Section - II
No - 533

INDEX TO VOLUME 102, FROM JANUARY TO JUNE, 1911

MINING AND SCIENTIFIC PRESS

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MINING AND SCIENTIFIC PRESS

"Science has no enemy save the ignorant."

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MINING AND SCIENTIFIC PRESS

ESTABLISHED MAY 24, 1860.

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EDITORIAL

Greeting!

It is pleasant from time to time to meet in person those whom you have long known by reputation or through correspondence; and in a similar way it is pleasant once a year to drop the editorial 'we' and talk directly to the large circle of friends that editorship of the *Mining and Scientific Press* gives to the fortunate one who sits in the editorial chair. Not that the chair itself is much, 'tis indeed but a rickety old thing that long since should have been sent to the shop, but it is well placed, in that next to it is another, into which from day to day drop for a few minutes, men from various parts of the world, each pausing to greet the editor and, yielding to quiet insistence, to give some bit of news or promise of an article; each in turn going on to some other quarter of the globe, there to take part in the active work of the profession. Gentlemen, this paper carries you my New Year's greetings and sincere good wishes. It also carries, I am sure, the thanks of many readers for that bit of news and for the article; though as to that, some promises evidently have been overlooked or there are many manuscripts lost in transit.

However, there are kindly recollections of your call in San Francisco and earnest hopes that you may again climb the steps and find your way down the hall to the chair that is waiting. The greatest reward that comes to an editor of the *Mining and Scientific Press* is the friendship of the men of his profession. Five years ago when Mr. T. A. Rickard purchased this paper he announced it as his ambition "to win the aid and to deserve the support of those who are engaged in mining, smelting, and the allied occupations, in the West first, and in the English-speaking world afterward." How well he succeeded is known to every mining engineer. When he went to London to establish *The Mining Magazine*, it was my privilege to fall heir, first as an associate of Mr. Courtenay De Kalb and later alone, to the many ties and connections that Mr. Rickard had woven between the editorship and the mining engineers, superintendents, and foremen who are the readers of this paper. With such a foundation, and the generous help of the many friends of the *Press*, it has been easy to do what an editor may to guide rather than control a paper. The last year has been no exception in the prosperity it has brought to the *Mining and Scientific Press*. The subscription list has grown at an almost embarrassing rate, advertising and reading pages have been added until today is issued the largest number of the *Press* ever published and the new year starts with every assurance of good business. These things seem to prove that Mr. Rickard was right when he announced his belief that "a paper which arouses the interest and stimulates the thought of technical men will receive such measure of support from them that those also who sell machinery will find it a remunerative vehicle for the offer of their merchandise."

American technical journals stand alone in the wealth of matter and illustration that they give their readers at low cost. It is an open secret that they are able to be thus lavish because of the support of the advertisers. For each regular issue of the *Mining and Scientific Press* the subscriber pays approximately six cents. That copy costs the publisher for paper, press-work, binding, and mailing, seven and a half cents; to which must be added the cost of news service, of illustrations, of editing, of composition, and of all office and incidental expenses. The reader pays materially less than cost for his technical journals; he accepts from the advertisers the remainder. Does it ever occur to you that such acceptance carries with it the obligation to give a respectful hearing to what the advertiser has to say, and to consider his wares on their merits? Every respectable publication is as careful in selection of advertisers as of contributors, and every paper, the *Press* among others, each year rejects offered business to protect its readers. The interests of reader, publisher, and advertiser are thoroughly interwoven. One can not be harmed without hurting all. Therefore, gentlemen, when you order machinery be fair and remember the advertiser.

I would not have you think that the advertiser controls the paper. He does not, and to be just to him, it is only most rarely that he attempts even to influence it. The *Mining and Scientific Press* is independent because it can afford to be, and when it can not, it will go out of business. It is published by the Dewey Publishing Company, of whose stock all shares, save a few in the hands of old employees, are owned by mining engineers. Mr. T. A. Rickard owns now, as he has for five years, a large controlling interest and he has every expectation of continuing to own it indefinitely.

In the routine of the office, 1910 was an interesting year. In May the paper celebrated its fiftieth birthday, emphasizing its position as the oldest mining journal in America. In July Mr. Courtenay De Kalb harkened to the call of the mine and left for Mexico to assume direction of the affairs of the Pacific Smelting & Mining Company, from which vantage point he still occasionally sends contributions to the editorial page. Mr. Thomas T. Read gave up his position in the Imperial Pei-Yang University at Tientsin, China, to become associate editor. He has since been visiting Korea, Manchuria, Siberia, France, Spain, and England, and is now about to take up active duties at San Francisco, to which he will bring a large first hand knowledge of those countries as well as enthusiasm and proved ability. In the interim between Mr. De Kalb's going and Mr. Read's coming, Mr. W. H. Storms has generously assisted in the editorial work, and in addition correspondents and contributors, to name whom would be but to list the active men of the profession, have helped to make the paper interesting and valuable.

Gentlemen, on my own behalf and on that of the stockholders of the company, I thank you one and all.

H. Foster Bain.

January 1, 1911.

EVEN our extra pages do not permit us to publish this week all the good things available and a number of articles and reviews arriving a little late have been regretfully held over for later issues.

COLORADO and its declining mineral output has been the subject of much recent comment. We are glad to present an authoritative analysis of the subject by so loyal a Coloradan as Mr. Theo. F. Van Wagenen. That there has been a decrease in production is clear, but that there is much of encouragement in the present situation is equally evident.

LACK OF WATER to continuously supply power to the mines in some portions of California during the past year has lowered the gold output. Many mines depend upon hydro-electricity and when the rain and snowfall are light, the mountain reservoirs empty early in the season. This is not because of light rain or snowfall so much as inadequate storage capacity. There has not been a year within the history of mining in the State when precipitation was not sufficiently great to have supplied all requirements had the reservoirs been large enough to retain the run-off. They never have been, however, and now nearly all the important water reservoirs, the canals, and the flumes, have passed

into possession of corporations whose interests often are only indirectly with mining.

GEOLOGISTS who attended the meeting of the International Geological Congress at Stockholm last fall returned delighted with Sweden and its people. We are glad to present to those who stayed at home, echoes at least of the affair, in the articles by Mr. James F. Kemp and Mr. H. V. Winchell. That by Mr. Winchell is but a part of an address that he delivered before the Minnesota Academy of Science.

COPPER has been the centre of interest in 1910 as in 1909. There has been much talk of mergers and of curtailment, but the review of the year by Mr. M. E. Appelbaum, president of the New York Metal Selling Company, as well as detailed statistics furnished by the Copper Producers' Association, shows that steady prices have been maintained mainly because consumption increased with production. This is as it should be.

PROGRESS in treatment of gold and silver ores is again reviewed for us by Mr. Alfred James, whose position in London and whose world-wide connections, enable him most effectually to annually sum up the year's achievements. Mr. James' letter has become an institution, and it would be difficult to measure its influence. This year we supplement it with a special review of improvements in cyanidation in America, written by one of the younger engineers who has accomplished things of importance, but who modestly forbids us to use his name.

LONDON'S importance in the mining market is indicated in the illuminating article by Mr. T. A. Rickard in this issue. The reason for its premier position lies in the fact that Great Britain's investments in other lands amount to about £3,000,000,000 (not dollars), from which a return of fully £150,000,000 is received annually. Metal mining, omitting coal and iron, contributes about £30,000,000 per annum to the British public, half of the amount being contributed by the gold mines. Despite all sorts of follies and extravagancies, the final result is remarkably good. Owing to the expansion of trade and the resultant accumulation of capital, it is safe to say that London is ready and prepared to finance sound mining enterprises, concerning which trustworthy information is furnished and on which reasonable terms are offered.

FIFTY YEARS AGO the *Mining and Scientific Press* began its second volume. Among other items in the issue of January 4, 1861, that read strangely now, was a note that "The news by last Pony from the Southern States is of gloomy aspect. South Carolina has virtually seceded from the Union." The germ of our modern review number was an estimate that "Forty-two million three hundred and twenty-six thousand dollars have been sent from the State during the year." A description of a "steam quartz mill" then being erected at Murphy's, in Calaveras county, California, states that the engine, "seventy horse-power, thirty-inch stroke, and fourteen-inch cylinder" was to be placed in the second story. It is comforting to know that the mill was "built of heavy timbers and with double floors." An editorial that might almost be clipped and re-used today voices the miners' protest against enactment of any mining law. A local paper is quoted: "We ask no mining laws, for those that have been enacted by the miners themselves, with the decisions of the courts upon them, constitute as excellent a code as can be wished for." There were evidently stand-patters then as now.

The Year in the West

"Prospect in the older districts," is the advice given by Mr. Stanly A. Easton in a recent interview, and it is sound advice. As he points out, the man who goes into a new district takes chances not only on finding ore but on a multitude of other things. In new territory a mining company must provide transportation, food supply, water, power, and all the accompaniments of a complex civilization. In the older districts these are provided and the engineer can devote his whole attention to finding and mining ore. Leadville has this year had another revival due to the discovery of hitherto unsuspected bodies of calamine. A periodic rejuvenation of Leadville, indeed, has come to be expected. In 1911, Cripple Creek is expected to gain greatly in output, and there are already many signs of a return to the activity of earlier years. Completion of the Argo or Newhouse tunnel in 1910 has given opportunity for re-opening old mines in Clear Creek and Gilpin counties, and in the opinion of certain acute observers the San Juan region has a golden future that will eclipse its silvered past. What is true in Colorado is equally marked elsewhere. The remaking of the copper districts of the Southwest that has characterized the last few years is as important as any discovery of new. Among the gold mines of the Sierra Nevada there is as large an interest and as hopeful a tone as at any time in years. Pioche, one of the oldest districts in Nevada, has this year made marked advance despite temporary difficulties over railway transportation detailed in our news columns recently. The recent consolidations of properties there make operations on a large scale possible. The rehabilitation of Republic district, Washington, was one of the achievements of the Northwest, and the fact that its ores contain gold, principally, relieves operators there of worry over the metal market. The Coeur d'Alene district, supplying one-third of the lead produced in the United States, had a year of normal output and extensive development at the big mines, and besides, there appeared a number of new producers. Of the new camps, National and Jarbidge attracted most attention; both are situated in northern Nevada, 75 to 80 miles from any railroad. National has yielded free-gold ore that proved a bonanza to its owners, and Jarbidge, whose début was more or less spectacular, has settled down to steady development, with prospects of proving to

be an important producer of good milling ore. One of the most encouraging features of the mining business of the last year in the United States was this quiet steady progress, unaccompanied by any speculative movement. Money supplied for development and equipment of properties was advanced with a view to probable returns from ore mined, rather than with thought of manipulating the price of shares. Funds were paid in cautiously, but proper and practical use was generally made of them. It was a year during which the tributer gained strong footing. Lessees and lessors alike recognize that the modern system of leasing, wherein supervision is exercised by the owner, results in profitable mining, without allowing the mine to get in bad condition, with undue depletion of ore reserves. The year was further characterized by evidence that miners, lessees, and operators were sticking to the old, well-explored districts rather than seeking mines in unexplored regions; and this faith in the old camps has been abundantly justified by the results. Every experienced mining engineer has lived to see men grow rich and prosperous who came into a camp at a time when he left it in disgust. In the rush for the new, do not neglect altogether the old.

A Rich Man's Mining Law

Law is for the convenience and protection of the people, not for mere perfection as an instrument. As a model of legal excellence the Mexican mining law has won well merited fame. We have taken occasion to expatiate on this fact in the past. It has much in it worthy of emulation, but it has defects which render it less a model for other countries than its ardent admirers would have us believe. Technically it is admirable; in practice it fails to stimulate the industry it was created to facilitate. To protect vested interests is not the chief value of a statute. Protection may become a mere wall, and thus set limits to development. This, in our opinion, is what the Mexican mining law has done. It is essentially a rich man's law and, in mining, the rich and the poor should be partners. We are not aware of any great successes attained by the development of virgin mineral resources that have not been the result of endeavor in the first instance by men who had all to gain and nothing to lose. Prospecting and initial development are essentially functions of the poor man, and the law that does not give the man of small means a chance distinctly limits the expansion of industry.

Mexico is a virgin land, to all intents and purposes. After more than three hundred years of successful mining, the country is just emerging from a condition where mine and bonanza were synonymous. The greater resources in copper, gold, lead, and other substances, are just beginning to be exploited, and the efforts of the men with more energy than funds are needed to redeem the country from dependence upon a single metal. Unfortunately the requirements of the law increase the risk of development to such an extent that in great areas known to be highly mineralized, where many producing mines should be opened, there are nothing but prospects, and but little hope of exploration. To acquire a mining claim it is necessary to make a denouncement, requiring the payment of fees, and the deposit of a sum of money sufficient to cover costs that will accrue by proceeding to title. In theory this is excellent; it necessitates serious purpose and fixed determination to do actual mining. In effect, however, it means that a mineral deposit must possess great superficial evidence of merit before anyone is justified in taking it up, and only a man with money can do it. The only chance for the poor dweller in the hills is to risk securing a petty payment for showing his discovery to some local capitalist or established company. The claim is then too often denounced for strategic purposes, or in the hope of winning a sum of money by promotion. This is further encouraged by that provision of the law which precludes regular mining operations until the patent to the claim has been issued. Theoretically it is sound reasoning to prevent an individual from injuring or depleting a deposit which pertains to the commonwealth until private rights shall have been fully established and confirmed, but the actual working of the law is to deter initiative. The interests of the people would be better subserved by giving the locator a reasonable time, at insignificant expense so far as fees are concerned, to explore the deposit and demonstrate the wisdom or folly of further effort and outlay. A more liberal law would convert a large population from a condition of hopeless serfs and poorly paid laborers into independent, self-respecting prospectors, and would cause the development of the mineral industry at a pace which would insure peace and prosperity. The recent disorders in Chihuahua, which have been falsely colored with the lurid hue of revolution by the yellow journals in the United States, could not have occurred had it been possible for the poor miners to seek their personal aggrandizement through prospecting the mineral districts of the Sierras instead of through relapse into the ancient customs of pillage and banditry.

In the United States the opportunity for the prospector has been widened to almost limitless license. Retardation of development has been fostered by making it so easy to hold a claim that the policy of the dog in the manger is practised in every camp, to its serious detriment. It is clear that a happy mean must lie somewhere between the laxity of the United States statute and the severity of the Mexican. It is right that a man should be compelled to proceed to patent within a reasonable period, but it is not good policy to compel him to take such action until he has had a fair chance to prove the utility of so doing.

It is rather singular to note that one effect of the stringency of the Mexican law has been to play directly into the hands of the foreigner, a purpose which was as far as possible from the wish of Señor Olegario Molina, the Secretario de Fomento, who drafted the existing statute. His effort to bring the foreigner under subjection to the Mexican courts was intended as a step in the direction of preserving Mexico for the Mexicans. In reality that meas-

ure, which was abandoned under the pressure of strong influences, would have produced but feeble effect as against the requirements which make the acquisition and exploration of mines impossible for the poor men who range the hills and find them. A better protection of the resources of Mexico for the Mexican would consist in giving at least a year to make good before larger capital than brawn and will and a little powder were required, and the result would be to immediately stimulate mining.

Opinions may easily differ as to the value of the new requirement for elaborate and costly monumenting. The Mexican mining claim, as now defined by masonry monuments, can be seen from afar, gleaming on the hillsides like buzzard-roosts. No man with eyes in his head need waste his time by locating a property only to find the ground covered by a previous but unsuspected claimant. Technically the protection is perfect on both sides; the monuments must be erected in accordance with the title maps; they must be approved by a licensed surveyor; and finally passed upon by an inspector. In spite of all this costly routine, possession in Mexico as elsewhere can only be made certain by court decree, for frequent errors will occur, either through negligence or intent. The large expense involved, which is quite beyond the reach of the poor prospector, would not be necessarily evil were it not an added burden in securing a title, and the right to mine, in advance of opportunity to develop the property. It would be warrantable after a man had proved that he had found something worthy of such monumental display. The greatest defect in the Mexican mining statute, we repeat, consists in its being a rich man's law instead of a law offering opportunity to all.

Gold Dredging Progress

Dredging attracted much attention in 1910 throughout the world. Money was supplied in London for several undertakings, notably the Oroville in Colombia and the Inambari in Peru. In Siberia the Orsk Goldfields is a company that is trying, despite many hindrances, to exploit a large tract of rich ground. In West Africa two dredging companies of importance may be mentioned, operating on the Ankobra and Offin rivers, respectively. Driftwood and bad climate have proved obstacles, but the gravel is rich enough to warrant further efforts to make money. In California the Oroville company has been a disappointing venture for the Britisher, and it is not surprising that the issue of Natomas bonds had to be taken by the underwriters. English capital is also being used for dredging in Burma, Servia, Guiana, and Tierra del Fuego. On the whole, the prejudice against alluvial mining has been overcome lately, chiefly by reason of the splendid output of the Lena Goldfields. At Nome, Dawson, and in California the year was one of marked achievement as shown by the reviews presented in the pages of this issue. Lack of space prevents publication at this time of interesting descriptions by Mr. C. W. Purington of a Siberia undertaking, by Mr. W. B. Winston of a new Burma dredge and other articles.

Metal Production

GOLD AND SILVER

By the courtesy of Mr. George E. Roberts, Director of the Mint, we are enabled to publish below preliminary estimates of gold and silver production in the United States in 1910. The figures for gold show a slight decrease, due mainly to the falling off in Alaska, with slight losses in Colorado and South Dakota. There were gains in Nevada and California. The latter State regained its old place at the head of the column, a result of the growth of the dredging industry. Among the silver-producing States, Montana maintained a slight lead over Utah, with Nevada ranking third. Production of gold and silver in other countries is summarized in articles in this issue, especially in that by Mr. Rickard.

GOLD AND SILVER PRODUCTION IN THE UNITED STATES

By the Director of the Mint

State or Territory.	Gold		Silver	
	Final, 1909. Value.	Preliminary, 1910. Value.	Final, 1909. Fine oz.	Preliminary, 1910. Fine oz.
Alabama	$29,200	$29,416	200	264
Alaska	20,339,600	16,987,990	198,600	126,480
Arizona	2,626,800	3,375,256	2,523,600	2,835,641
California	20,703,600	21,146,150	2,304,900	3,530,246
Colorado	21,846,600	20,408,641	8,846,300	8,747,777
Georgia	43,400	25,488	200	286
Idaho	1,344,200	992,930	6,755,900	6,686,016
Illinois	.....	.....	900	1,727
Michigan	.....	.....	217,600	268,642
Missouri	200	.....	15,200	32,900
Montana	3,750,100	3,465,364	12,034,500	11,519,059
Nevada	16,386,200	17,941,643	10,119,200	9,346,256
New Hampshire	.....	599	3,000	854
New Mexico	252,800	397,974	324,200	683,111
North Carolina	31,400	54,884	400	1,215
Oregon	829,000	631,173	69,600	62,848
Pennsylvania	6,200	2,419	.....	7,867
Philippine Is.	247,600	90,357	3,000	1,523
Porto Rico	600	1,013	.....	2
Kansas	.....	11,163	.....	4,113
South Carolina	7,400	31,566	.....	11
South Dakota	6,573,600	5,183,070	196,300	113,460
Tennessee	4,300	3,514	65,300	75,714
Texas	400	475	408,100	365,854
Utah	4,213,300	4,243,907	10,551,100	11,242,301
Virginia	4,000	558	6,400	34
Washington	429,000	711,359	75,200	176,816
Wyoming	3,900	3,990	1,800	1,363
Oklahoma	.....	15,090	.....	66,476
Miscellaneous	.....	299,225	.....	539,839
	$99,673,400	$96,055,214	54,721,500	56,438,695

COPPER

Preliminary figures of the production of copper in the United States in 1910 have been prepared by Mr. B. S. Butler, of the United States Geological Survey, and are published here through the courtesy of the Director, Mr. George Otis Smith. In these, and the figures for spelter and lead, which follow, the output for December, and in a few cases for November, has

been estimated. The output of blister and Lake copper was 1,079,000,000 lb., as against 1,092,951,624 in 1909. Figures published by the Copper Producers' Association for the first eleven months of 1910 indicate that the production of marketable copper by the regular refining plants from all sources, domestic and foreign, will amount to about 1,448,000,000 lb., as against 1,405,619,519 in 1909. According to the Bureau of Statistics, imports of pigs, bars, ingots, plates, and old copper for the first eleven months amounted to 255,237,942, and the copper content of ore, matte, and regulus imported amounted to 75,958,712 lb. If the imports for December were equal to the average monthly import for the first eleven months the amount of copper entering the United States for the year was about 338,000,000, as against 321,801,114 lb. in 1909. Estimates indicate that the exports of copper will exceed the exports for 1909, which amounted to 682,846,726 lb., and that they may be as much as 700,000,000. Domestic deliveries for the first eleven months of the year, as given by the Copper Producers' Association, indicate a consumption of copper in the United States exceeding that of any previous year and reaching, perhaps, 770,000,000, as compared with 688,565,243 lb. for 1909. Arizona again takes the lead among the copper-producing States with an output slightly above the production of 1909, which was 291,110,298 lb. The Bisbee district was the largest producer, with an output of approximately 145,000,000 lb. The production of Montana probably did not exceed 285,000,000 lb. for 1910, as compared with 314,858,291 lb. for 1909. The State will therefore rank second. Utah, ranking fourth, made a marked increase in production over 1909, which was 101,241,114 pounds.

LEAD

The statistics of production and consumption of refined lead have been prepared by Mr. C. E. Siebenthal, of the United States Geological Survey, and are based on returns from producers and records of imports and exports kept by the Bureau of Statistics. The total production of refined lead, desilverized and soft, from domestic and foreign ores in 1910 was approximately 469,682 short tons, worth at the average New York price $41,332,016, as compared to a production of 448,112 tons in 1909, and 396,433 tons in 1908. These figures do not include an estimated output of 13,948 tons of antimonial lead, as against 12,896 tons in 1909, and 13,629 tons in 1908. The total production of lead of domestic origin was 379,076 tons, as compared with 345,255 tons in 1909, an increase of about 10%. Of the total production, desilverized lead of domestic origin, exclusive of desilverized soft lead, is estimated at 217,166 tons, as against 194,034 tons in 1909, and desilverized lead of foreign origin comprised 90,606 tons, as compared to 102,857 tons in 1909. The production of soft lead from Mississippi Valley ores is estimated at 161,910 tons, as compared with 151,221 tons in 1909. The amount of lead available for consumption during 1910 may be estimated by adding to the stock of foreign lead in bonded warehouses at the beginning of the year, 17,405 short tons, the imports, 108,268 tons, and the domestic production, 379,076 tons, making a total supply of 504,749 tons. From this are to be subtracted the foreign lead exported in warehouse, 72,345 tons, the foreign lead exported in manufactures under drawback, estimated at 7653 tons, the deduction by liquidation, 7631 tons, and the stock in bonded warehouses at the close of the year (assumed to be the same as at the close of November), 32,446 tons, leaving as available for consumption 384,674 tons, which by comparison with 370,013 tons in 1909 seems to be about a normal decrease. The imports of lead in 1910 are estimated at 47,111 short tons of lead in ore, valued at $1,728,607; 57,472 tons of lead in base bullion, valued at $2,330,383; and 3685 tons of refined lead, valued at $208,172—a total of 108,268 tons, compared with 114,181 tons in 1909. Of the imports, over 83% came from Mexico.

SPELTER

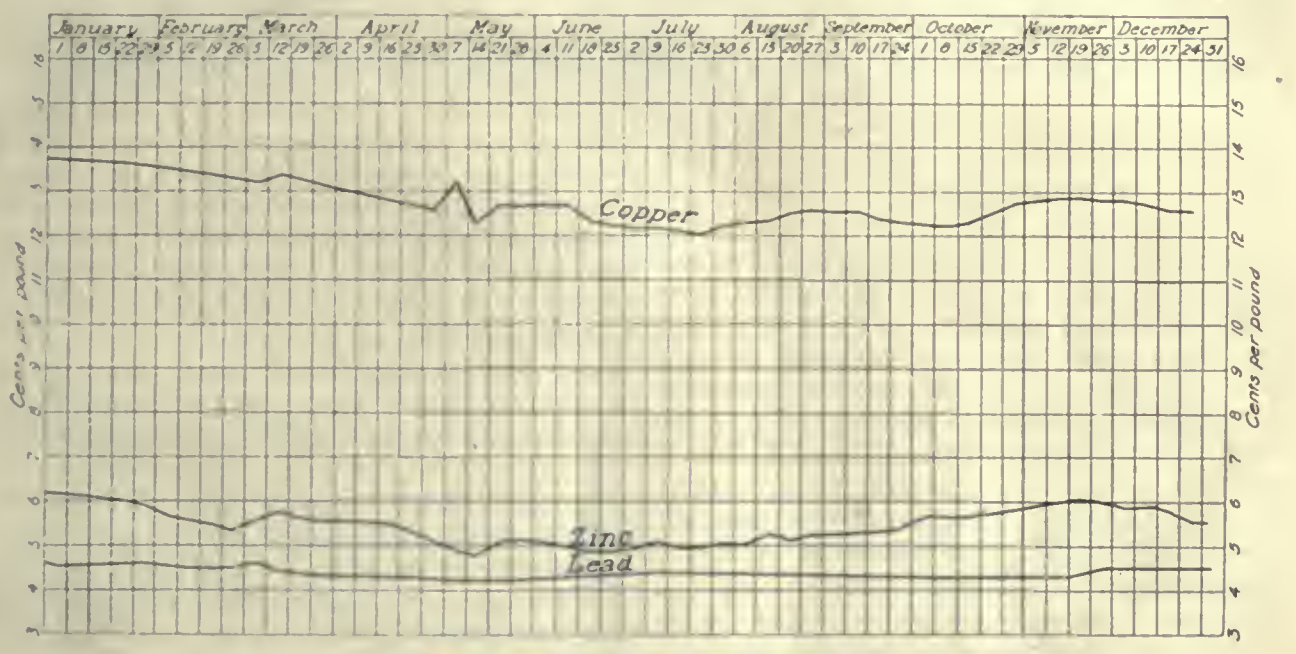
Statistics of production of zinc in 1910 are of unusual interest because of the new tariff, the open market, the closing of certain smelting plants, and the range in prices for the year. Mr. Siebenthal's figures, given below, show that domestic production broke all records, that imports decreased 25%, and exports quadrupled. The production of primary spelter from domestic ore in 1910 is estimated at 250,052 short tons and from foreign ore at 17,371 tons, a total of 267,423 tons, worth, at the average price, $28,881,684, as compared to a total of 255,760 tons in 1909, made up of 230,225 tons of domestic origin and 25,535 tons of foreign origin. The production of spelter from both domestic and foreign ores, apportioned according to the States in which the ores were smelted, was approximately as follows: Illinois, 73,373 tons in 1910 and 67,653 tons in 1909; Kansas, 105,659 tons in 1910 and 103,299 tons in 1909; Oklahoma, 34,762 tons in 1910 and 28,782 tons in 1909; all other States, 53,629 tons in 1910 and 56,026 tons in 1909. The total production of spelter is equivalent to the output of 61,700 average retorts operating continuously through the year, or about 70% of the maximum capacity of the smelting plants in operation for some part of 1910. The apparent domestic consumption of spelter in 1910 may be computed as follows: The sum of stock on hand at smelters at the beginning of the year, 11,167 tons, plus the imports, 3339 tons, and the production, 267,423 tons, gives the total available supply, 281,929 tons. From this are to be subtracted the exports of domestic spelter, 3953 tons; the exports of foreign spelter, 5029 tons; the exports under drawback, 2717 tons; and the stock on hand at smelters at the close of the year (to be exact, on hand December 15), 20,170 tons, a total of 31,869 tons, leaving a balance of 250,060 tons as the apparent domestic consumption, almost exactly the production from domestic ores. This calculation takes no account of the stocks of spelter held by dealers or consumers. On comparing the apparent consumption in 1910 with the 271,274 tons in 1909, the 215,401 tons in 1908, and the 228,524 tons in 1907, it is seen to be about normal, indicating that stocks other than those at smelters have at least not greatly increased during the year.

Metal Reviews

COPPER

By Mishia E. Appelbaum

The beginning of 1910 found copper on a 14c. delivery-30-days basis, for both electrolytic and Lake, and outside of slight rallies which occurred from time to time, the market sagged until it reached 12⅜c. In the second half of the year, due to persistent rumors that a curtailment policy had been agreed upon by the leading producers, the market recovered to almost 13c. and held firmly there until the latter part of November, when, due to heavy decline of securities as well as lack of buying, the market showed a slight reaction. In my last year's review I indicated that the domestic consumption would be approximately 70,000,000 lb. per month, and that we could also rely on Europe taking at least 50,000,000 lb. per month. Because of the excellent demand for copper all over Europe, the Europeans have at times taken much more than this quantity, and as a result the statistics at the end of the year, while still showing a large visible supply, nevertheless encourage hopes of gradual reduction of accumulated stocks. During the coming year several properties will enter the producing list and will swell the production of copper from 60,000,000 to 80,000,000 lb. To offset this, the American producers, and some of those of Europe, have agreed on a small curtailment so that the surplus will not show any increase, even though deliveries be as heavy as in 1910. Were it not for the uncertain outlook, due to the general pessimistic feeling prevalent among men who are well posted on the business situation, and to the fact that the railroads are not ordering equipment owing to the uncertainty as to whether they will be permitted to advance their freight rates, thus increasing revenues and thereby creating a ready market for new securities, the metal outlook would be most encouraging. The business situation, however, is hard to diagnose, and it is therefore difficult to make any prediction as to the probable course of prices during the year 1911, or to estimate probable consumption of copper. The American producers have, so far, kept prices at a low level, enabling the consumers with reasonable safety to carry small stocks, although the recent attempts in some quarters to create the impression that a large consolidation would take place, is to be regretted. The leading copper producers are represented by some of the most brilliant minds of this country, and I would not dare to voice my opinion against theirs, but it seems to me that a real cure for the unsatisfactory copper market, if one is necessary, is to permit the market to be governed by the law of supply and demand. When the surplus of copper will have been reduced to such condition that consumers will find it difficult to readily purchase at their own figures, the metal market will advance on its own accord, and when an advance takes place, based upon such reasons, it will be of a lasting nature, continuing at least, until such time as the business situation again creates an extraordinarily large surplus.



Metal Prices in 1910. New York Quotations.

SPELTER AND ZINC ORE

By R. G. Hall

The position of the spelter market at the close of 1910, as compared with that at the opening of the year, is a particularly strong one, although the ruling price is less, at the time this is written, than it was in January of this year. The average prices by months for the year are approximately as follows:

January	$5.90	to	$6.00
February	5.40	to	5.50
March	5.45	to	5.55
April	5.25	to	5.35
May	5.00	to	5.10
June	4.95	to	5.05
July	4.95	to	5.05
August	5.10	to	5.20
September	5.30	to	5.40
October	5.45	to	5.55
November	5.80	to	5.90
December	...		....

The high prices at the beginning of the year were the result of a sentimental advance following the passage of the tariff bill with its high duty of $0.01 per pound on zinc in ores. The lull in the steel business beginning early in 1910, and continuing throughout the year, caused a corresponding depression in the price of spelter, until a price of less than $0.05 was reached in June. Later in the year, as I pointed out at the time,* it became evident that the failure of the gasfields of Kansas must further curtail the smelting capacity of the country, so that a spelter demand of anything approaching normal would have to be supplied to some extent by importations. It happens, however, that such a normal demand is not in existence, as is shown by the operations of the steel concerns, and the greatly decreased consumption of the early winter leaves the market in a somewhat weakened condition, with no disposition on the part of smelters to sell metal at lower figures. The fact is, were it possible to take an accurate inventory of all the spelter in the country on January 1, 1911, it would be found much below normal, while the smelting capacity has, at the same time, been very much restricted. On the other hand, the position of the ore market is much simpler. After the drop in the prices of all four metals—copper, lead, zinc, and silver—during and following the panic of 1907, many of the larger mining properties of the Rocky Mountain States which had been producing zinc ore, either as a principal product or as a by-product, were obliged to suspend operations; and, consequently, zinc ore buyers, formerly supplied entirely from that source, were obliged to turn, in whole or in part at least, to the Joplin and Wisconsin field.

During 1906 and 1907 the number of smelters in the gas-belt had been largely increased, even to a point beyond the maximum spelter demand of the country. The condition of an industry dependent on the life of a gasfield for its own period of activity is a peculiar one, inasmuch as each concern drawing gas from a given locality where there are a number of other consumers must, of necessity, try to draw the fullest possible supply of fuel at all times. Once the gas in any locality is developed and pipe-lines laid, it becomes then, from one point of view, at least, a matter of time rather than the quantity consumed by any one industry. An idle plant in the gas-belt, while there is gas to be had, is consequently not to be thought of. The effects of this condition are plainly shown in the accompanying table. The base price given is on ore in bins at the mines, Joplin, and is taken from Zook's 'Car Report' of each week, a reliable authority.

The margin shown, based on a recovery of 1020 lb. of metal per ton of 60% ore, covers all expenses from bin to smelter, buying expenses, handling, freight, treatment cost, and freight on metal from gas-belt to St. Louis. The low base-prices are for undesirable ores, or those high in lime or lead. Were this table carried back into 1908 and 1909, the figures would be even more striking in showing reasons for the 'falling by the wayside' of some gas-belt operators. It is safe to say that with a smelting margin of less than $15 per ton, there will be very little new construction of zinc smelters undertaken.

Mining and Scientific Press, September 3, 1910.

Joplin Ore Prices and Margin, 1910

Week ending.	Basis 60%, From.	To.	Value of Spelter, 100 lb.	1020 lb.	Margin, From.	To.
January 1	$46.00	$49.00	$6.062	$61.83	$15.83	$12.83
February 5	40.00	45.00	5.531	56.41	16.41	11.41
March 5	43.00	45.00	5.60	57.12	14.12	12.12
April 2	40.00	43.00	5.4479	55.56	15.56	12.56
May 7	35.00	39.50	4.9083	50.06	15.06	10.56
June 4	40.00	43.50	5.0104	51.10	11.10	7.60
July 2	38.00	41.00	5.035	51.35	13.35	10.35
August 6	36.00	41.00	5.0188	51.19	15.19	10.19
September 3	40.00	43.50	5.2625	53.67	13.67	10.17
October 1	42.00	44.50	5.3875	54.95	12.95	10.45
November 5	44.00	46.50	5.8125	59.28	15.28	12.78
December 3	44.00	47.00	5.71	58.27	14.24	11.24

While the production of the Joplin and Wisconsin fields has, during the past year, remained nearly stationary, there has been a gradually increasing production from the Rocky Mountain States, and, at the same time, there are many new developments today in the latter region, which, while not yet resulting in production, will within the coming year come into the market with further supplies of ore. The most noticeable of these is perhaps the discovery of large bodies of carbonate of zinc in Leadville. A considerable amount of this material has already been marketed, largely to the oxide plants, but also some to the spelter producers. It is true that further development has failed to substantiate the rosy predictions of the press in the early days of the discovery. There does not seem to be an immediate prospect of such a large tonnage as would tend to upset the ore markets, but undoubtedly there will be a sufficient quantity mined to give a new lease of life to the great camp. The importations during the year were not of a significant amount. The relatively higher prices for metal prevailing in Europe, together with the lower freight rates given by the Mexican railroads to European exports than are given for shipments to this country, have diverted much Mexican ore to Europe. Some ore has also been brought in from British Columbia, but that has not been of large amount.

In the United States during the year, there has been practically no advance made in smelting methods. The prevailing practice continues to be the use of the small round retort, common in this country for many years. Improvements in roasting practice, rather than any change in methods, have improved the extraction to some extent. The prevailing type of roasting-furnace in the gas-belt continues to be the Zellweiger furnace, which, owing to its construction, is only available for use in the gasfields. Where acid is made as a by-product of roasting, the Hegler type of kiln is the only one in use today. In smelting in the gas-belt, almost the only type of furnace is the Hegeler blow-furnace of from 600 to 800 retorts. In the coalfields the use of the direct-fired Belgian furnace has been nearly discontinued, and only the producer-gas fired Hegeler and the regenerative, or Siemens types, are in use. Zinc smelting by electricity is not done in

any part of the United States today. Though some experiments have been made in this line, there seems to have been no progress. In Europe, however, much preliminary work is being carried on; and, while it is as yet of no great industrial importance, it is not improbable that the future may see some very interesting developments. In British Columbia the government has appropriated $50,000 for experiments in zinc smelting; and it is not unlikely that some method may be worked out which will eventually keep these ores at home. Much has been said of the establishment of a zinc-smelting plant in Mexico, but so far as known publicly, nothing has resulted. It is hardly probable that anything will come of it, for some time at least, owing to the present economic and industrial conditions of the republic.

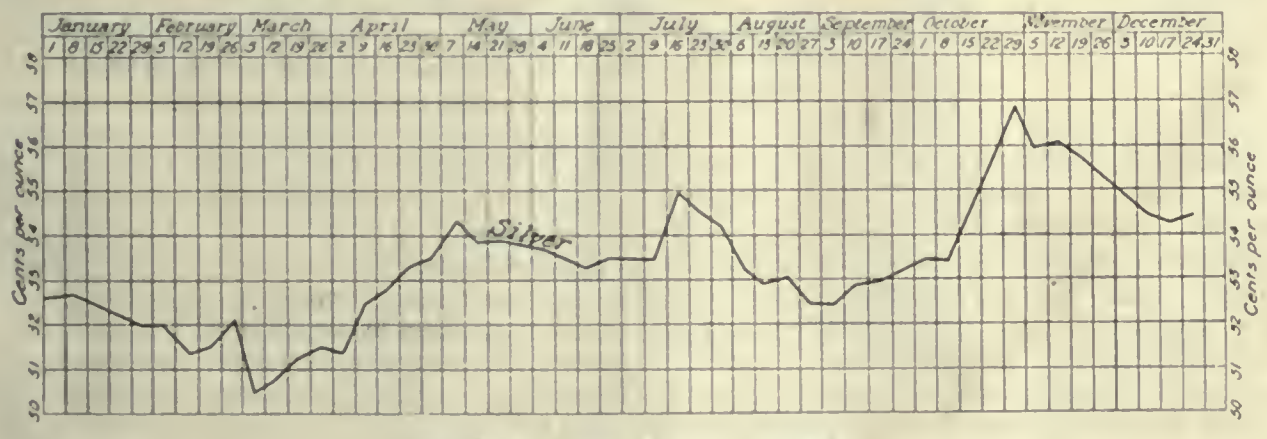
LEAD

By H. Foster Bain

Examination of the graph of metal prices for the year shows that for lead to be a nearly straight line. The range of quotations was from 4.70 in January to 4.28 in May. The average for July was 4.41 and for August, September, and October each, 4.40. Such remarkably uniform prices through a year when other metals have risen and fallen through a much wider range indicates that the lead industry is controlled to a degree not paralleled except in the matter of steel rails. No figures of production and consumption are published except the annual statement issued by the Government, and there is no way of knowing what stock of metal is on hand at any given time. Late in December it was announced by officials of the American Smelting & Refining Co., the dominant interest, that less than a week's supply was available. Apparently there have been good deliveries and no marked increase in production. The Coeur d'Alene district is known to have reached the turning point, British Columbia is not now competing heavily in the United States market, the Leadville output is falling, and neither Utah nor southern Idaho have increased production as was at one time hoped. Leadership in lead production is returning to the Mississippi Valley and in the great deposits of southeastern Missouri, particularly, is the largest known American lead reserve. Conditions have been good there in the year just closed and production has doubtless increased, though at Joplin, despite activity in zinc, the lead output was slightly less than in 1909. In Idaho and Missouri lead can be produced at about the same cost, approximately 3c. per pound, the accessory silver of the one district offsetting cheaper fuel and labor in the other. In Missouri there are large unprospected areas and one of the leading companies has been so successful in drilling for ore as to feel safe in cutting down materially on exploratory work. The Missouri ore is practically non-argentiferous and evidently as smelting becomes more prominent in the Mississippi Valley the copper furnaces of the West will be relied on more to smelt gold-silver ores. There is little encouragement for outsiders to invest in lead mining. Through ownership of smelters and mines, contracts with independent companies, and particularly through affiliation with the National Lead Co., the chief consumer, the Guggenheim interests dominate the situation. They pay the usual penalty of such success in having to face frequent charges of unfairness in buying and selling; such as, that prices of lead are not raised until after favored customers have been allowed to replenish stocks.

SILVER

Last year was marked by rapid and extreme changes in the price of silver, as is shown by the accompanying graph. The range was from 50½ early in March to 56¾ late in October. The close of the year found the price between 54 and 55c. per ounce, approximately two cents per ounce above that on January 1, 1910. As usual, the principal demand has been in the Far East, and prices have varied in obedience to the call of our Oriental neighbors. Just what factors have been at play is not altogether clear, but continued development of China and other Asiatic countries is sure to lead to increased demand for silver so long as it remains the accepted means of storing surplus wealth. In India the establishment of mutual savings banks is drawing into light a surprising amount of silver that evidently has been buried, and in time this may react against further purchases. For the present, however, China and India take the surplus with charming willingness. Mexico continues to be the chief producer. In the United States silver is more and more relegated to the position of a by-product. A rapidly increasing amount of the metal is being used in the arts.



Silver Prices in 1910. New York Quotations.

London Mining Market

By T. A. Rickard

Introductory.—The year now near its close has been one of agreeable interest and prosperity to those engaged in business at this great mining-financial centre. We have had three manifestations of acute speculative excitement in connection with rubber, oil, and gold. Copper and tin have held attention at intervals. No acute collapse in public confidence needs to be recorded, and while failures have alternated with successes, no fiasco of devastating character has to be chronicled. We have much for which to be thankful. War has wrought no havoc to the financial market. Politics may have diverted interest at home, in South Africa, in Australia, and in America, but the results have established rather than weakened confidence. Revolutions in countries of political instability have aroused occasional anxiety, but did no great harm to mining operations. The worst was the three-cornered fight in Nicaragua. The Mexican revolt proved abortive, while those in Brazil and Uruguay cannot be said to have offered any check to activity in mineral exploration.

In Great Britain the general prosperity has created a solid base for financial resourcefulness. Trade has veritably boomed. Statistics for the eleven months exhibit the following contrast:

11 months.	Exports.	Imports.
1908.....	£419,297,046	£536,364,602
1909.....	426,320,091	563,990,656
1910.....	487,065,186	609,359,309

The value of exports for the year is likely to reach £530,000,000, which will be 48% higher than in 1900. Even after allowing 5% for an advance in the price of commodities, it is apparent that the volume of export trade has risen by fully 45% during the decade, while the population has increased 11%. During the interval imports have increased from £460,000,000 to £666,000,000 per annum. At the present time this country is estimated to receive not less than £300,000,000 annually, half as interest on capital invested abroad and the other half from freights, insurance, brokerage, tourist expenditure, and other services for which goods are not given in payment. Naturally, this has stimulated speculation. In the first nine months of 1910 new issues absorbed capital to the extent of £216,000,000, which is £24,000,000 higher than the previous best record. Of the total nearly £100,000,000 went to foreign countries. During the year about £150,000,000 was invested abroad in various ways, private and corporate.

Rubber and Oil.—In the spring the rise in the price of rubber, due to an increased demand in the face of a restricted supply, caused excited speculation both in the commodity and in the shares of companies formed to exploit plantations in various parts of the world, notably the Malay peninsula, the East Indies, and Madagascar. Rubber rose to 12s. per pound. It has now fallen to half that price. And with the fall has come a diversion of the interest taken by promoters in that field of finance. For the present the rubber market has been played to its limit, but as the speculative energy was based on sound economic facts, it has not been followed by the wreckage that results from irrational inflation.

While rubber was still to the fore, an oil boom was started. This also was based on good reasons, for the increased use of fuel oil in motor-engines, both on sea and on shore, has called for an increased production, especially from British territory, hitherto not explored for this mineral. In consequence, Trinidad, West Africa, and Burma have asked for capital. The gushers in the Caucasus and California have attracted operators to those regions, while the Pacific coast of South America, from Ecuador to Chile, has been the scene of oil exploration. Capital has been liberally furnished from London, and, despite the usual proportion of over-capitalization, it is believed that much of this financial energy will prove remunerative, being based on economic conditions and directed, in the main, by competent men.

Before summer waned the oil and rubber excitements had subsided, the share market being glutted with issues in those commodities. Then, in June, came the most spectacular, but also the least serious, event of the year. It was announced in the daily press that a mountain of gold ore had been found on Bitter creek, near Stewart, in British Columbia. A rush of adventurers ensued and one or two silly efforts were made to turn the incident to account by forming companies on mere options. These failed, for the bubble was quickly pricked. It would appear that the episode was encouraged by the railway companies now building to that part of North America, and it was fostered by an irresponsible press eager for sensations but quite ignorant of mining. However, Stewart did no harm. In these days of rapid communication the real facts concerning a mineral discovery are easily obtained. Fraud is difficult.

Tin and Copper.—In August the rise in tin helped the starting of new companies to exploit a promising region in Northern Nigeria, especially in the Bauchi district. The country is elevated and healthy, so that efficiency of labor is possible. Results are now being obtained, but it will be difficult to translate them into dividends on account of excessive capitalization. Some interest has also been taken in tin mining in Bolivia, China, and the Straits Settlements.

Copper, both metal and shares, was the subject of speculation in the early portion of the year. The shares of the new disseminated-copper mining companies in America were bought in London, but the obvious danger of over-production led to hasty sales later in the year. The optimistic promises of those controlling the big low-grade mines in Utah, Nevada, and Arizona pointed to a large output of cheap copper, and had the effect of defeating the effort to invite buyers of shares. Among unpleasant episodes it is necessary to mention the Great Fitzroy, Great Cobar, and Granby Consolidated, all of which suffered a severe check. On the other hand, the year has seen a decided improvement in the position of the Siberian group: Spassky, Atbasar, and Kyshtim. The story of great expectations from Central Africa

has not yet been told, but there are signs of increasing anxiety as to the outcome of the big enterprise controlled by the Tanganyika Concessions. In Peru the Cerro de Pasco, after spending $23,000,000, is still a massive experiment, but it has attracted no English money. Rio Tinto, however, is a standard investment, which dominates the London copper market. At Huelva the announcement of a decreased production, ostensibly to strengthen the metal market, has provoked a smile. In America the amalgamation of the Utah Copper and the Nevada Consolidated was important, and it is likely to be followed shortly by an equally interesting event, namely, the consolidation of the numerous holdings of the Calumet & Hecla.

Transvaal.—Despite the attractions of oil and rubber, of tin and copper, the hunger for gold remains undiminished and the adventurous spirit of the British speculator continues to find satisfaction in the vicissitudes of gold mining. As before, the Transvaal is much the most important of the gold-producing countries, although the rate of expansion is being rapidly retarded. The following figures tell the tale:

MONTHLY RECORD IN OUNCES OF FINE GOLD

1909-10.	Rand district.	Outside districts.	Total Transvaal.
November	576,768	20,997	597,765
December	583,209	21,778	604,987
January	579,743	21,625	601,368
February	550,422	25,200	575,622
March	581,899	25,220	607,119
April	594,339	24,706	619,045
May	606,720	27,446	634,170
June	598,339	26,842	625,181
July	610,664	28,050	638,714
August	623,129	26,140	649,269
September	621,311	25,588	646,899
October	627,445	25,702	653,147
November	617,905	24,686	642,591

Year.	Gold.	Dividends.
1884	£10,096	.....
1885	6,010	.....
1886	34,710	.....
1887	169,401	£12,976
1888	967,416	112,802
1889	1,490,568	432,541
1890	1,869,645	254,551
1891	2,924,305	334,698
1892	4,541,071	901,470
1893	5,480,498	955,358
1894	7,667,152	1,532,284
1895	8,569,555	2,046,852
1896	8,603,821	1,513,682
1897	11,653,725	2,707,181
1898	16,240,630	4,864,973
*1899	15,452,025	3,109,041
*1900	1,481,442	.....
*1901	1,096,051	415,813
*1902	7,301,501	2,121,126
1903	12,628,057	3,362,237
1904	16,028,883	3,928,487
1905	20,854,440	4,857,539
1906	24,618,704	5,736,161
1907	27,410,210	7,091,612
1908	29,986,469	8,751,282
1909	30,925,788	9,504,621
1910	32,000,000	9,875,000
Total	£300,040,310	£74,421,919

*The war period lasted from 1899 to 1902.

This year the output of gold is bigger than in 1909 by about 265,000 ounces or £1,125,925, which is a gain only slightly bigger than for the year preceding. More might have been expected, for several new properties have been started and more machinery, both men and mills, has been at work. But it is fairly apparent that the gold mining industry of the Rand has about reached its zenith of productiveness. Lower costs are not likely to gain on poorer yields, new mines barely balance the exhaustion of the old ones, and increased technical skill only just holds its own as against deeper workings and the difficulties incidental to enlarged excavations underground. Throughout the year the scarcity of labor has threatened to cripple operations, and although this factor has actually affected only a few mines, it has been a constant cloud on the speculative horizon. Statistics show an increase in the supply, but it has not sufficed for the demand, and the efficiency is lower, owing to the migratory character of the Kaffirs.

LABOR STATISTICS

This table gives the number of laborers employed on all the mines of the Transvaal, as well as those on the gold mines only. In 1906 there were 53,000 Chinese at work on the Rand, the last of these being repatriated in January, 1910.

Month. 1909.	Kaffirs on all mines.	Chinese.	Total laborers on gold mines only.
October	166,133	3,199	151,276
November	167,403	3,197	152,245
December	172,077	1,910	155,931
1910.			
January	179,393	1,903	162,570
February	189,155	....	169,771
March	199,549	....	178,345
April	206,680	....	183,814
May	205,709	....	183,964
June	204,898	....	183,431
July	201,672	....	181,514
August	199,944	....	180,831
September	199,644	....	182,200
October	196,699	....	180,103
November	194,756	....	178,027

Several mining companies have ascribed their decreased returns to the lack of laborers, and it is plain that the disappointment in stope-drills has accentuated a critical position. The attempts to economize labor by employment of machine-drills have proved unsatisfactory, although the last has not been said on this subject. Efforts to recruit natives have been widespread. The only prospect for solving the labor difficulty lies in the cessation of work in unprofitable or only barely profitable mines. A more favorable feature of the year is the strong fiscal position of the big consolidations, such as the Crown Mines, Rand Mines, East Rand, Randfontein, and Modderfontein. These enormous properties, consisting of large areas of ore-bearing ground, afford an example of a thing heretofore rare, namely, 'investment' in mines. Such large enterprises, with immense reserves of low-grade gold ore, under experienced management, operating under conditions no longer new, afford a minimum of risk. In so far as they do so they kill speculation, and it is one of the complaints of brokers that the Rand has ceased to offer

opportunities for making money as in days gone-by. It remains to add that 1910 has seen a peaceful invasion of the Rand by American metallurgists and an opportunity generously given for a fair trial with methods and machines already successful in the United States.

In Rhodesia no great progress has been made as regards production, although the last quarter of the year exhibits a quickening pace.

PRODUCTION OF GOLD IN RHODESIA

Month.	1908.	1909.	1910.
January	£199,388	£204,666	£227,511
February	191,635	192,497	203,888
March	200,615	202,157	228,385
April	212,935	222,700	228,213
May	223,867	225,032	224,888
June	224,920	217,600	214,709
July	228,151	225,234	195,233
August	230,792	228,296	191,423
September	204,262	213,249	178,950
October	205,466	222,653	234,928
November	196,668	236,307	240,573
December	217,316	233,397	*240,000
Totals	£2,526,007	£2,623,788	£2,608,701

*Estimated.

In the absence of figures for the production in December, no accurate estimate for the year can be made owing to the extreme variability of output at individual mines, but it is apparent that the total for 1910 will be slightly less than in 1909.

As in the past, the companies operating in Rhodesia have had extreme variations of fortune; unlike the Rand, the northern territory gives the gambler ample opportunity, for what with good cables heralding rich finds and bad cables announcing sudden impoverishment, the holders of Rhodesian shares have had plenty of food for excitement. Fluctuations in quotations have been tremendous, as is shown by the accompanying table:

HIGHEST AND LOWEST QUOTATIONS FOR RHODESIAN SHARES DURING 1910

	Highest.			Lowest.		
	£	s.	d.	£	s.	d.
Eldorado	8	3	9	2	18	9
Enterprise	3	18	9	2	3	9
Giant	5	8	9	3	8	9
Globe & Phoenix	3	0	0	1	6	3
Jumbo	1	5	0	0	11	3
Selukwe	1	5	0	0	3	0
Surprise	3	15	0	0	6	3
Wanderer	0	11	6	0	3	3

The Globe & Phoenix, the Giant, and the Eldorado are the largest producers. The first was non-productive for several months owing to repairs in the shaft and remodeling of the mill, but continues to yield high-grade ore down to its seventeenth level. But the most important event in Rhodesia is the uncovering of a big deposit of gold-bearing agglomerate on the Shamva claims in the Abercorn district. Already 25 to 30 million tons of ore expected to yield a profit of 10 to 12 shillings per ton is said to be assured, and actual reserves exceeding 1,000,000 tons of 5 dwt. ore have been proved. This should become one of the big gold mines of the world.

West Africa has felt the lack of labor, as well as other obstacles to profitable operations. The output of gold is considerably less than in 1909, despite the application of ample capital and increased technical skill.

PRODUCTION OF GOLD IN WEST AFRICA

	1910.		1909.		1908.	
Month.	Oz.	Value, £	Oz.	Value, £	Oz.	Value, £
Jan.	17,357	70,699	22,817	91,112	24,844	98,808
Feb.	16,976	68,469	21,403	86,210	25,354	101,813
March	17,627	71,954	23,186	93,556	26,726	106,243
April	16,363	67,069	21,491	88,071	25,108	100,353
May	16,590	68,355	25,104	100,056	24,227	97,091
June	17,194	70,988	17,340	70,561	23,360	92,737
July	15,564	58,551	17,331	70,523	24,587	97,829
Aug.	13,921	57,713	17,766	71,614	25,195	100,629
Sept.	11,497	47,746	18,125	72,963	25,123	99,689
Oct.	13,341	55,046	15,957	65,813	23,781	94,674
Nov.	14,021	57,658	17,882	73,824	24,437	98,214
Dec.	14,500*	59,600*	17,570	71,332	24,624	98,262
Total.	184,951*	753,848	235,972	955,635	297,366	1,186,342

*Estimated.

Undoubtedly London is disappointed in the Gold Coast; it does not yield the only fruit by which mining is gauged: dividends. Brief periods of speculative bidding for shares on the news that big firms were buying interests or providing working capital have been followed by longer intervals of lifeless depression. Eleven years of effort and promise have fructified in a paltry output of gold and two dividend-paying companies, whose working costs are 33 and 47 shillings per ton, respectively, as against an average of 17½s. on the Rand. Various reasons are given to explain this poverty of achievement: the climate, the poor food, the scarcity of native labor, and the expense of a white staff, the members of which require frequent chances to recuperate a vitality lowered by tropical conditions. These obstacles are not imaginary, and until they are overcome in part, at least, no noteworthy growth of industry is at all probable. However, these facts are becoming understood and organized effort is being made to overcome the worst of them.

Australasia.—Leaving Africa we turn to Australasia, which has been so liberally irrigated by British capital during the last twenty years. The most vivid episode was the Bullfinch excitement in October and November. This arose from the finding of rich ore in a mine situated near Southern Cross, a West Australian district that participated vainly in the boom of an earlier decade. Southern Cross or Yilgarn was one of the earliest localities exploited in Western Australia, being discovered in 1887, seven years before Coolgardie and Kalgoorlie. The new find was used as the basis for the Bullfinch Proprietary, itself an overcapitalized affair and followed by a series of issues of crescendo absurdity. An entire absence of reports by independent engineers formed a disagreeable feature of this speculative splutter, and the rapid collapse of the incipient boom left an impression that the public has gained slightly in its ability to diagnose good business from bad. The Mount Maroomba flutter in the Northern Territory was a fiasco, and the discoveries at Tanami have proved unimportant. These were two 'excitements' that gave rise to the hope of new mining districts. The accompanying statistics show

that Western Australia has been losing ground steadily, owing to the exhaustion of the big mines. In 1910, however, for the first time in many years, three promising new developments can be chronicled: at Bullfinch, as already mentioned, at Youanme, and at Meekatharra. The big mines at Kalgoorlie are on the decline, and recurrent disputes over dwindling reserves only serve to warn the public that their glory has departed.

PRODUCTION OF GOLD IN WESTERN AUSTRALIA

Month. 1910.	Export. Oz.	Mint. Oz.	Total. Oz.	Total. £
January	34,327	97,960	132,267	551,917
February	35,169	87,947	123,116	522,959
March	26,515	100,479	126,994	539,433
April	30,240	107,524	137,764	585,181
May	29,244	100,165	129,409	549,696
June	35,294	97,207	132,501	562,825
July	31,986	101,132	133,118	565,445
August	36,028	100,590	136,618	580,313
September ...	34,787	110,131	144,918	615,569
October	21,911	101,183	123,094	522,867
November ...	27,280	99,341	126,621	537,489
*December	30,000	100,000	130,000	553,400
Total	372,781	1,203,659	1,576,420	6,697,094

*Estimated.

AUSTRALASIAN GOLD PRODUCTION

	1908.	1909.	1910.
Queensland	£1,960,766	£1,916,468	£1,510,000*
New South Wales.	954,854	869,546	833,000*
New Zealand	2,004,925	2,006,910	2,005,000*
West Australia ..	6,779,763	6,696,112	6,697,000*
Victoria	2,872,990	2,897,340	1,927,500†

*Estimated. †For 9 months only.

In Victoria, once the most productive gold region in the world and later famous for its deep mines, the British public now takes scanty interest, for the 'deep lead' companies, which represent the last effort to enlist English capital, are defunct. Final obsequies were performed during the past year. That gloomy chapter is closed. On the whole London's participation in Victorian mining has been a succession of failures. The best mines were never offered in England. However, domestic capital, chiefly from Melbourne, has been profitably employed, particularly at Ballarat and Bendigo. The latter, famous for its saddle-reefs, has had a revival due to the finding of rich ore on the Sheepshead reef, one of the anticlinal axes parallel to the main 'lines of reef.' The new discoveries are at a relatively shallow horizon and may stimulate lateral, as against vertical, prospecting. Dredging has proved successful in Victoria on a small scale at several localities, but lately trouble has been made by the farmers, as in other districts where river-beds are being uptorn in the course of systematic digging for gold.

New South Wales looms large in the eyes of the London financier by reason of Broken Hill, the mines of which district belong geographically to New South Wales, but industrially to South Australia. On the Barrier range, synonymous with Broken Hill, the application of the flotation processes has given fresh life to the exploitation not only of the large reserves of low-grade ore in the mines, but to the treatment of the big heaps of tailing, the refuse from former milling operations. The output of concentrate, averaging 47% zinc, will be about 430,000 tons for the year, which represents about one-fifth of the total world production of spelter. The higher price of the metal has helped to augment profits and to justify the formation of companies to beneficiate the old tailing, which, as now treated, averages about 20% zinc, 8½% lead, and 10 oz. silver. The lead and zinc concentrates are shipped mainly to Germany, thus provoking Australian jealousy of the European markets and inciting talk of an export duty. The Great Cobar copper mine was the victim of a metallurgical blunder which almost wrecked the enterprise. However, as the mine contains plenty of ore and the plant has been re-organized, the shareholders are hopeful. But it has been a severe trial.

In Queensland the year has been darkened by the Great Fitzroy fiasco, due to an error in sampling and to a mistaken application of water concentration. On the other hand, the Mount Elliott and the New Einasleigh are two copper enterprises that give promise of substantial returns. At Charters Towers the deeper workings on the Brilliant and Day Dawn lodes continue to give excellent results. But the Mount Morgan is still the chief pride of Queensland. Up to November 30, 1910, this mine had yielded (since 1886) no less than £16,507,000, of which £1,335,000 was due to copper and the rest derived from gold. During the year the completion of the railway to the Many Peaks mine has afforded a needed supply of basic flux, suitable for admixture with the pyrite smelted at the old mine.

In Tasmania the Mount Lyell, which now includes the North Lyell, has done fairly well, the output of the two mines yielding a satisfactory smelting mixture. An interesting recent change is the shipment of the blister copper to Port Kembla, in New South Wales, instead of Baltimore. British capital is not interested in Mount Bischoff, the great tin mine, which has recently received increased technical aid, but it is responsible for the Briseis, a 'deep lead' near Derby from which much was expected at one time. The copper discoveries at Mount Dundas and Mount Read have been financed in Australia, but the Tasmania, an old gold mine near Launceston, has been the subject of a reconstruction, which was barely effected when good ore was found on the 1370-ft. level. If this English company has any luck the effect will be to encourage speculation in Tasmania; if not, then otherwise, for a good deal of money is involved.

New Zealand has been prominent on account of the anxiety over the Waihi, the quotation for which has fallen from £9½ to £5¾ on 500,000 shares. It has been known locally for two years that the lowest level showed impoverishment, especially on the Martha lode, and the efforts to escape the unpleasant fact have only augmented the fears of English shareholders. In September it was announced that the decline in the grade of the ore necessitated a decreased output from £18,500 to £17,000 per week, indicating diminished dividends from 18s. per share for 1909 to 16s. per share for 1910. On the other hand, the adjoining mine, the Grand Junction, has

been doing so well as to justify an enlargement of the mill. Elsewhere in New Zealand the Progress and Blackwater mines at Reefton are owned in London; of these two, the Blackwater is doing well. At the Talisman, near Karangahake, the excessive water has been overcome by new pumps, and recent discoveries on the lowest level are encouraging.

India.—Gold mining is mainly confined to the Kolar goldfield, and the six companies at work are practically controlled by John Taylor & Sons, an old and conservative firm of engineers. The past year has been uneventful, the uneventfulness of quiet prosperity. The four big mines, the Mysore, Nundydroog, Champion Reef, and Ooregum, represent a total capitalization of £1,208,772, having a market value of £5,719,485, on which an average dividend of 11.3% is paid annually. This is gold mining at its best.

GOLD OUTPUT OF KOLAR DISTRICT

Month.	1909.	1910.
January	£173,555	£174,314
February	153,542	170,725
March	170,106	176,231
April	170,578	175,539
May	172,156	175,387
June	171,585	174,923
July	172,552	175,523
August	173,318	175,356
September	173,279	175,687
October	173,496	175,719
November	176,027	175,604
December	203,703	200,000
Total	£2,083,901	£2,125,008

It is apparent that the output of the gold has been fully maintained during the year. The developments at the Mysore, Nundydroog, and Ooregum have been consistently good; the Champion Reef has been in poor ground for two years, and the profits have been seriously reduced, but the grade of the ore discovered during the year has gradually improved and the position is now more hopeful. As regards other gold-mining districts in India, Dharwar has proved a disappointment, and Anantapur continues to hold out hopes for profitable operations.

Canada came unpleasantly to the front during the Stewart fiasco, but since then the Porcupine district has attracted merited attention, following by tentative participation in development. Cobalt has been in evidence through the La Rose, Nipissing and one or two other silver-mining companies, but only to a slight degree. Oil shale in New Brunswick, coal in Ontario, dredging in British Columbia have engaged private enterprise, but on the whole Canadian mining has not been prominent. The liquidation of the Le Roi Mining Co. closes an unhappy chapter; on the other hand, the better results from the Le Roi No. 2 have done credit to Rossland.

Mexico has held a place of importance both in London and Paris. The shares of the El Oro group, especially Dos Estrellas, Mexico Mines, and Carmen, have been boosted by our French friends. The Esperanza has received several setbacks, owing to decreasing profits, but the old El Oro mine itself has done well, with illusive promise of betterment in depth. The year began with the flotation of the Santa Gertrudis, at Pachuca, the purchaser being the Camp Bird company, famous as the owner of a rich mine in Colorado. Another later issue was the Santa Gertrudis South. Improved returns from the Mazapil Copper Co. in Zacatecas have pleased the shareholders and done credit to technical management. The old Palmarejo is doing better. Purchase of the Buena Tierra, at Santa Eulalia, and the formation of the Santa Rosa company mark the continued financial activity of the Exploration Company, so long honorably connected with mining in Mexico. The oil development along the Gulf coast and the ensuing fight between the Standard Oil and Pearson groups provoked comment in London, but the interest has not been expressed in terms of money. It is likely, however, that the coming year may see more active participation. Moreover, several metal mines are known to be under option and may become the basis of new companies shortly.

South America has made no large demands upon London, at least as regards mining. The Poderosa copper mine, in Chile, has given anxiety, but is now yielding high-grade ore. The Braden Copper Co. sold some of its bonds in London; they were freely taken, this enterprise being considered perfectly sound. The Ferrobamba in Peru was about to be exploited by an English group when an enterprising American, A. C. Burrage, suddenly made an offer, probably in the interest of the Amalgamated Copper Co. In Argentina the Famatina has made a new start under happier auspices. In Brazil the St. John del Rey and the Ouro Preto are old companies, which continue to peg along successfully, while in the north the Brazilian Goldfields and other newer concerns are exploring a region that may prove important as a source of gold.

Siberia has loomed big this year by reason of the excellent results obtained from the Spassky, Kyshtim, and Atbasar mines, all of which are controlled in London. Some American capital also is involved in the Kyshtim. But the largest British interest is undoubtedly in the Lenskoie, a Russian company controlled by the Lena Goldfields, an English corporation, which has paid £112,221 in dividends on an issued capital of £1,122,210. The production of gold by the Lenskoie for the last fiscal year, ending October 1910, was worth £1,600,000, of which £600,000 is estimated to be profit. Apart from the magnificence of the yield, the technical man will be astounded to learn that the average working cost is 24s. or $6 per cubic yard. Even an Alaskan miner will wonder at the excessive cost, for the Lenskoie is a drift mine in frozen ground, bedrock being 100 ft. deep. New ventures are in preparation and more English capital is likely to be found for Siberia in the near future, despite the unsympathetic attitude of the Russian Government and the red tape of the Mining Department, both of which are serious obstacles to successful exploitation.

Zinc Production in Australia

By Edward Walker

After years of experimental work, the vast zinc resources of Broken Hill are now being successfully beneficiated, so that the output from the district is approximately one-fifth of the entire production of the world. Twenty years ago Broken Hill was a large producer of the lead and silver derived from oxidized ore. When at depth the carbonates and oxides gave way to sulphides, it was found that zinc was also present and thereafter it soon formed an important constituent of the ore. The two sulphides were so intimately mixed that jigs failed to extract more than one-fifth of the lead, and modern table concentration was a thing unknown. Another fact that stood in the way of mechanical concentration was the high specific gravity of the gangue, especially of the garnet and rhodonite. The efforts of metallurgists were therefore devoted to the discovery of leaching and smelting methods. A vast number of different processes were tried, of which perhaps the Ashcroft and the Fry-Everitt received the greatest amount of attention. The former was a leaching process, the zinc being deposited electrolytically; and the latter was a smelting process, using a soda compound for the production of a liquid slag. The former failed because of its cost and because of the zinc being produced in a spongy and easily oxidizable form, and the latter because all the zinc and much of the silver were irrecoverably lost in the slag. Eventually the various companies decided to go back to mechanical concentration, the efficiency of the jigs was greatly improved, and tables were introduced. In this way the extraction of lead and silver was increased, but still the tailing contained most of the zinc, much of the silver, and some lead; and the silver-lead-zinc slime was also a waste product. Both tailing and slime were stacked or impounded for future treatment. Efforts were made to deal with the problem by means of magnetic separation, but no satisfactory results were obtained.

About ten years ago the selective action of oil for sulphide particles and the agglomeration of such particles into a frothy scum claimed the attention of a number of scientists at Broken Hill and elsewhere. The principles upon which all these various processes are founded have been known for a great many more years than is commonly supposed. I need not go into the matter here, for I gave a history of the subject in *The Mining Magazine* for September 1909. The Elmores were the first to devise a continuous process and to make it work in practice, and their first application depended on the power of oil to lift and float away all the sulphide. This required so much oil and such a big plant that it became obvious that it could have few practical applications. At about the same time Cattermole experimented with oil, acid, and air-bubbles; his patents and those of Sulman, Picard, and Ballot form the subject-matter of a second process. It was adopted at the Central mine at Broken Hill belong-

Minerals Separation Plant at the Sulphide Corporation's Central Mine, Broken Hill, Australia.

ing to the Sulphide Corporation, and is now operated by the Minerals Separation company. Another process, devised by Potter and improved by Delprat, uses no oil but floats the sulphides by immersion of the ore in hot acid solution. This has been used at the Broken Hill Proprietary. Later came the second Elmore invention known as the vacuum process; then the De Bavay process, which depends for its floating power on surface tension chiefly; and recently the Murex process, in which magnetic material is added to the pulp together with oil and sulphate of alumina and the agglomerated magnetic material and sulphides extracted by an electro-magnet. These various types of flotation processes came to the aid of metallurgists at Broken Hill. By such means the zinc sulphide contained in the tailing was separated from the heavy gangue. The concentrate thus produced contained varying amounts of lead, often sufficient to penalize it when sold to the zinc smelters, so it had to be given another dressing on tables to make separate zinc and lead products.

The production of zinc concentrate by flotation at Broken Hill dates from 1903, when the Delprat process was started by the Broken Hill Proprietary, and the Minerals Separation process by the Sulphide Corporation. The Potter process, which was similar to Delprat's and is now incorporated with it, was tried by the Zinc Corporation, which was organized by Bewick, Moreing & Co. in 1903 to work the dumps belonging to the Block 10, British Broken Hill, and Broken Hill South Silver Mining companies. When it failed, the Minerals Separation process was tried, also unsuccessfully, and eventually the Corporation adopted the Elmore vacuum process. Subsequently the De Bavay company started, and last year it was expanded into Amalgamated Zinc (De Bavay's). This company owns some of the dumps at the Broken Hill South; it is treating current tailing from North Broken Hill, and since March last the current tailing from Broken Hill South.

As regards the Minerals Separation, this company is working dumps purchased from the Sulphide Corporation and is treating the current tailing of the Central mine on a royalty; these dumps are nearly exhausted, but the current tailing amounts to 5000 tons per week. Of other mines at Broken Hill, the South Blocks is accumulating zinc tailing for future treatment, Block 14 is trying the Murex process, and Block 10 recently erected an Elmore plant for treating the current tailing, but found it unsuitable for the purpose. Broken Hill South Silver sold some dump to the Zinc Corporation and some to Amalgamated Zinc (De Bavay's); until March last the current tailing was sold to the former and since then to the latter.

As regards the output of zinc concentrate, the total has risen from 57,602 tons in 1904 to 375,906 tons in 1909. The output for 1910 will probably be about 430,000, averaging 47% zinc, of which 120,000 tons will come from the Sulphide Corporation dump owned and worked by the Minerals Separation company, 70,000 tons from the Sulphide Corporation's current tailing, 87,500 tons will be produced by the Zinc Corporation, and 95,000 tons by Amalgamated Zinc (De Bavay's). As the Sulphide Corporation dump is nearly exhausted, it is probable that the total output in future years will never again be as high.

Another important point to remember is that the dump material still to be worked by the other companies is of lower grade than those portions already beneficiated, for in starting the various plants the better portions of the dumps were usually worked first. The average of the material now treated is 20% zinc, 6½% lead, and 10 oz. silver, but there must be many parts of the dumps where the zinc content is not greater than 12%. The average cost of treatment is 8s. per ton, which at present prices is the net value of material assaying 11% zinc, 5% lead, and 7 oz. silver, so that much of the remaining dumps will yield only a small margin of profit. As regards the future price of zinc, we may assume that, as the Broken Hill output, which is the chief factor, will not increase, the present price will not recede. It is not certain how the European producers, some of whom have been obliged to suspend operations owing to their ore being of less value and regularity in content than the Broken Hill concentrate, will be affected by this slackening of the Australian supply. They may be able to reenter the market and so prevent any great increase in the price of zinc.

I have so far sketched the method of treating the zinc tailing and have shown that it is now being utilized to the utmost. There still remains the problem of the silver-lead-zinc slime, and several workers are endeavoring to reach a solution from different points of view. This slime is high in lead and zinc, and contains much gangue, being similar in constitution to the ore. It is not amenable to concentration by tables and even if treated by a flotation process, the concentrate derived from it would be unsuitable for either the lead smelter or the zinc distiller owing to the lead and zinc contents being almost equal. During the early part of this year announcements were made that E. J. Horwood of the Broken Hill Proprietary had succeeded in adapting the sulphatizing roast to this slime in order to coat the galena with sulphate, which is not amenable to the flotation action. After the roast, the slime is sent to the flotation plant, where the blende rises and floats away, leaving the sulphatized lead behind. The success of this process on a practical scale depends on the accuracy with which the temperature of the furnace can be maintained. The process has not yet been perfected. In the meantime the Minerals Separation company has devoted much time to a consideration of another scheme; and their engineers are in favor of treating the whole of the discard of the lead concentrators, without dividing it into zinc tailing, barren tailing, and slime. They consider that any slight loss due to the lower average zinc content will be more than compensated by the greatly increased output. The result of this 'total' treatment will be watched with interest. By adopting this system the Sulphide Corporation, using the Minerals Separation process, has the only mill

in the world that takes a mixed lead-zinc ore and turns out a high-grade lead concentrate and a high-grade zinc concentrate in one continuous operation, and at the same time sends to the dump tailing from which practically all the lead, zinc, and silver have been extracted.

It should be noted that the metallurgy of zinc has altered radically during the last few years. The German firms who buy this zinc concentrate are not so desirous nowadays of having a minimum lead content. Formerly zinc sulphide ores or concentrate having a large percentage of lead were not in demand and were heavily penalized. Zinc metallurgy has undergone changes recently. For instance, the retorts are now made by the hydraulic press and are capable of withstanding reactions quite unsuited to the old porous retort. Many improvements have also been made in the condensers, where the volatilized zinc is caught. The result of these various improvements has been that lead is not the bogy to the zinc distiller that it used to be. In the case of Broken Hill zinc concentrate the lead content has become a necessity to the zinc distiller, for it is of value in collecting the silver present in both zinc and lead sulphides. The new metallurgy provides for the collection of as much lead and silver in the zinc-retort residue as possible, and this residue, instead of being thrown away, is now treated in the lead furnace for the recovery of the lead and silver. The buyers of Broken Hill zinc concentrate during recent years have modified their terms of purchase as regards the lead content. They now penalize any zinc concentrate containing less than 5% lead: from 5 to 8% they pay nothing for the lead; and for anything above 8%, they make an allowance. There is, however, no advantage to the seller in having any more than 5% lead, for every 1% zinc content is worth more than 1% lead, seeing that the prices of the metals favor zinc. Another interesting point is that the payment for the silver in the zinc concentrate is at the rate of one shilling per ounce over a minimum, which is generally about 5 oz., and in the lead concentrate the rate is 2s. per ounce of silver. It is clear that the terms of contract make it advantageous to the seller to get as much lead and silver into the lead concentrate as possible, as long as the lead in the zinc concentrate is not allowed to fall below 5%. This alteration in the terms of purchase receives the attention of sellers, who have to judge which is the most profitable way of treating the zinc tailing. It is clear that the Minerals Separation company had the point in view when deciding to adopt the 'total' treatment mentioned above. This leads me to another question of vital importance to Broken Hill. At the present time the mines are absolutely at the mercy of the German smelters in the matter of zinc concentrate, just as years ago they were under the thumb of English and German buyers of lead ores and bullion. It is not surprising to hear that the mines, under the leadership of G. D. Delprat, the manager of the Proprietary, are agitating for a protective export duty, to encourage the local smelting of the zinc concentrate.

The industry is unfortunately still under the shadow of litigation, which becomes more embittered and more complicated as time passes. More lawsuits are threatened. The action brought by the owners of the Elmore patents against the Minerals Separation company has passed through all its stages in England, resulting favorably to Minerals Separation, and is shortly to be repeated in Australia, in the form of an action by the owners of the Australian Elmore patents against the Sulphide Corporation, which uses the Minerals Separation process. Another lawsuit is being started by the Potter Sulphide Ore Treatment company against the Sulphide Corporation, which will thus be attacked from both sides, the Elmore alleging infringement of the selective action of oil in a flowing pulp and the Potter company claiming the sole right to hot acid solutions. I also understand that the Minerals Separation company is commencing actions in England against the Zinc Corporation and in Australia against the Amalgamated Zinc (De Bavay's) company. The position is further befogged by the Zinc Corporation adopting the Minerals Separation process in the extension of plant now in process of erection, and by the Amalgamated Zinc having an option on the Potter process. Another lawsuit more recently announced is one by the Elmore company against German buyers of Broken Hill zinc concentrate. The German Patent Office granted a patent to the Elmores covering the use of the selective action of oil in a freely flowing pump. Other inventors have not, for one reason and another, obtained in Germany the exact equivalents of their British and Australian patents. Consequently the Elmores claim to hold a master patent in Germany and they contend that they have the right to collect a royalty on all concentrate smelted in Germany produced by any method using oil in a freely flowing pulp. They argue, for instance, that the zinc concentrate obtained by the Minerals Separation process is produced by such a method. It is a ticklish question, and it is not for me to discuss it.

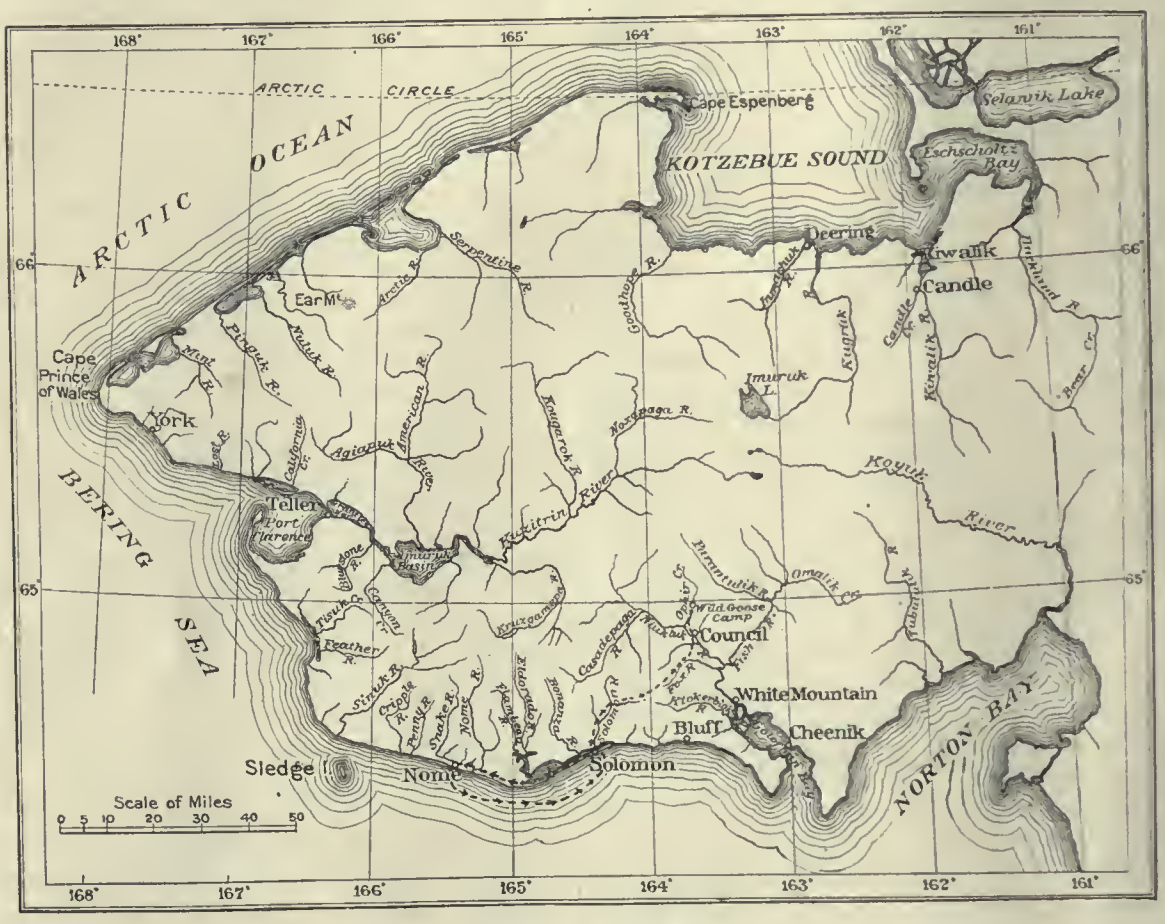
It has always been a wonder to me that the principle of flotation has never found application in America. The chief objection urged by American engineers appears to be that the older plant was expensive to construct, and that the cost of oil, acid, and power was high. I would here mention that the expense of construction and the cost of working have been greatly lowered, and the mechanical efficiency has been notably increased. Most of the processes use very small quantities of oil and acid. For instance, the Minerals Separation plant to handle 6000 tons per month costs about £5000, and when employing oil obtained from the local eucalyptus tree requires only 3 pence or 6 cents worth of oil per ton of ore, and with some ores no acid at all is required. Now that the flotation principle has been proved to be of so great a service at Broken Hill and has secured a lasting position in concentration, American engineers will no doubt once more examine its merits. This article is expressly written in the hope that they will do justice to one of the great triumphs of metallurgy.

Nome Dredges in 1910

By T. M. Gibson

The season of 1910 at Nome was in many ways a most important one. While the output amounted to about $500,000 less than in 1909, being estimated at this time of writing, late in October, at $3,567,608, it may be predicted that the yield was lower than it will be for many years. The reason for the expected increase lies in the number of dredges erected and started on Seward Peninsula this season. Not only, however, were an unusual number of boats launched, but plans for the same sort of activity in 1911 are already being made. At least five new dredges are expected next spring. Two will be made this season, as both the machine and ground are fully up to expectations.

The Plein Mining & Dredging Co. completed the construction of a dredge on Otter creek, a tributary of Nome river, in the early part of September. Mr. Plein, the manager, planned in October to run till November 1. Actually he kept the dredge going till November 26. More permanent frost was found than they anticipated, but the gold tenor of the gravel handled has been above expectations, and on the whole the men concerned are so well pleased with the showing made that they contemplate building another dredge next season. Their dredge has a 3½-ft. open-connected bucket line, revolving screen, and pan stacker. It is driven by steam power, and crude oil is burned for fuel. It has compound con-



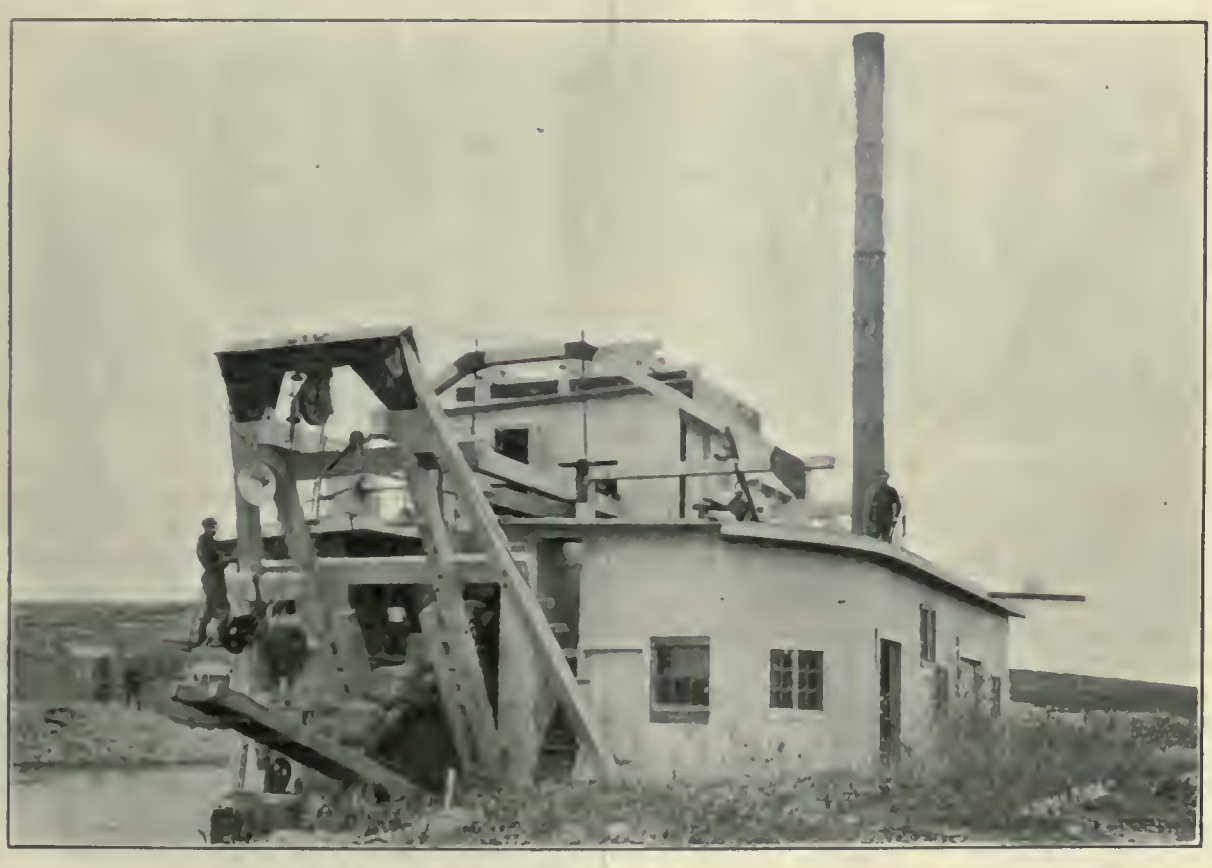
Seward Peninsula.

placed on Solomon river, one on Cripple, one on Sinrock, and one on Kougarok.

Of the dredges constructed this season, the Sionx-Alaska Mining Company's boat built on Moss gulch, a tributary of Nome river, was the first to begin operation, and had a sixty-day run. The dredge has a 2½-ft. open-connected bucket line, revolving screen, and belt stacker. It is driven by gasoline power. A 50-hp. engine drives the bucket line, screen, winches, and stacker, and a 35-hp. engine drives the pump. It was designed by the Northern Construction Co. and built at the Union Iron Works, San Francisco. The company was financed in South Dakota, H. G. Solem of Baltic being president, H. O. Smith of Dell Rapids being treasurer, and Collin Murray of Nome and Seattle, manager. Mr. Murray states that they are well satisfied with the showing

densing engines, and a water-tube boiler. It has no spuds, and digs on head lines entirely. They had the misfortune to break one of the low-pressure columns at the beginning of operations, and it could not be repaired until certain parts were shipped here from San Francisco. These were not received until the last boat, so that they have operated on less power than was designed for the dredge, and as a consequence have been unable to work up to the normal capacity. The machine was designed to dig 2000 cu. yd. per day, but in its crippled condition could only wash an average of 1300 cu. yd., and the men in charge have been compelled to adjust the digging apparatus to the washing capacity. The broken cylinder will be repaired before the season opens next spring, and long-continued prosperity is anticipated for this enterprise. The dredge was

Arctic Gold Dredging Co.'s Dredge, Saunders Creek, Nome District.
(Built by Union Iron Works.)



Flodin Gold Mining Co.'s Dredge No. 1, September 21, 1910, Nome District.
(Built by Risdon Iron Works.)

built by the Risdon Iron Works of San Francisco, and installed under the able supervision of Gerald Hutton, the Alaska representative of this firm.

The Arctic Gold Dredging Co. has installed a dredge during the past season on Saunders creek, about ten miles east of Nome. It was designed by W. W. Johnson and built at the Union Iron Works of San Francisco. It has a 2½-ft. open-connected bucket line, revolving screen, and belt stacker. It is driven by gasoline engines, having a 50-hp. en-

gine which drives the bucket line, winches, screen, and stacker, and a 35-hp. engine to run the pump. There is also a small boiler which is used to supply a steam-heating plant. By placing light housing over the stacker and over the bucket line down to the water-level, and a return steam-pipe on each side of the bucket and stacker ladders, the operators are able to prevent ice from forming on the belt and bucket lines, when the temperature is much below freezing point. By the use of this plant, they hope to be able to run considerably later in the fall than the weather conditions would otherwise permit. This company has its headquarters in Wichita, Kansas, and was financed by Kansas and Nebraska capitalists. The dredge was shipped here last spring to be installed on Arctic creek, a tributary of Cripple river, 15 miles west of Nome, but a more careful examination of the area upon which it was to be installed convinced Frank Middaugh, the manager, that the ground was not as well suited for dredging as had been supposed. He immediately secured several claims on Saunders and Grass creeks, and changed the destination of the machinery from the mouth of Cripple river to the mouth of Hastings creek, into which Saunders creek flows. By exerting the utmost energy, he had his dredge built and running by the end of the first week in September. He closed on October 15 to catch the last boat out. Upon being interviewed, he said all were well pleased with the showing made this season. In the five weeks the dredge had been operated, enough had been made above operating expenses to cover the cost of freighting the plant to the ground and building it, and the owners look forward to a long and successful career. A. E. Helm of Wichita, Kansas, is president, and F. E. Braucht secretary-treasurer of the company.

Another dredge is being installed on Saunders creek by the Saunders Dredging Co., of which Andy Anderson of Nome is the president and manager, and J. J. Cole treasurer. The dredge has a 3½-ft. close-connected bucket line, revolving screen, and belt stacker. It is driven by gasoline engines and is equipped with one 80-hp., one 25-hp., and one 10-hp. Metz & Weiss engine. It was designed and built by The Bucyrus Co., and was shipped here to be installed on the Casadepaga river, but the company became involved in financial difficulties, and was unable to proceed with the enterprise. A new company was then organized among local capitalists, and the dredge machinery purchased from the Casadepaga company, and it is now being rapidly erected on lower Saunders creek. It will be ready to operate by the time the frost is out of the ground in the spring, and, as it is well known to have a large area of rich ground in which to work, there is no doubt of its success.

Sivertsen & Johnson, who made such a signal success last season operating a small gasoline-driven dredge, on Solomon river, have this season installed a new one in the same area. This dredge has a 2½-ft. open-connected bucket line, revolving screen, and pan stacker. It is driven by steam power, and coal is used for fuel. It was completed in the early part of September, and has had about a six weeks' run up to the time of writing. It has operated in ground from eight to twelve feet deep, with a rough limestone bedrock, and has averaged about 1500 cu. yd. per day. The exact amount of the output has not been obtainable for publication, but it is well known that this area contains some of the richest gold-bearing ground on the Solomon river, and it is certain that the clean-ups amounted to many thousands of dollars per week. The dredge was built by the Risdon Iron Works, and installed by Gerald Hutton.

The Flodin Mining & Dredging Co. of Chicago has built a dredge of the same size and design as the Sivertsen & Johnson dredge, near the mouth of Big Hurrah creek, on the Solomon river. This dredge, the Plein dredge near Nome, and the Sivertsen & Johnson dredge were under construction at the same time and were launched on the same day. They are all of the standard Risdon type, with some modifications to meet local conditions. The work of assembling the machinery and constructing each of these dredges was under the supervision of Gerald Hutton, and this energetic engineer has shown marked ability in accomplishing a big task, under many difficulties, to the entire satisfaction of all concerned. This dredge is credited with having mined $60,000 in the six weeks it has operated, and while I cannot vouch for the truth of this statement, it is working in a rich area, and an output of $10,000 per week from a dredge handling an average of 1500 cu. yd. per day should not cause surprise. Claes Flodin of Chicago is president and manager of the company, and Benjamin Flodin is secretary.

On the upper Solomon river near the confluence of the East Fork and Solomon, another dredge has been constructed this season. It was built by The Bucyrus Co. for the Solomon Dredging Co. which was financed at San Francisco, and is managed by Frank I. Reid of Nome. P. R. Parker, Pacific Coast engineer for The Bucyrus Co., was in charge of its construction. This is said to be one of the best constructed and equipped dredging machines yet built in the North. Its hull is 80 by 45 ft. and 7 ft. deep. It is equipped with a 150-hp. Mosher water-tube boiler, and crude oil is used for fuel. Its main engine is a Ball 90-hp. compound condensing engine, arranged to run tandem. This drives the bucket line, screen, and stacker. The pumps are driven by a 60-hp. compound condensing engine. The bucket line contains 62 close-connected buckets of 3½-ft. capacity, and at normal speed, 20 of these are delivered per minute. The screen is of the revolving type, 60 inches in diameter and 25 ft. long. The perforations are graduated from ⅜ to 1½ inches. An 8-in. centrifugal pump delivers water to the screen sprayer, and a 4-in. auxiliary pump sprays the buckets as they dump into the hopper, and supplies additional water to the gold-saving tables. Its tailing conveyer is of the belt type, usual to Bucyrus machines. It is lighted by a 6-kw. dynamo carrying 100 lamps, and is equipped with a steam-heating plant to prevent the stacker and bucket line from freezing as the cold weather comes on in the fall. Owing to delays in delivery of material, and to the substantial manner in which this

dredge has been built, it has required practically the whole season to assemble and complete the dredge. It was finished and began operations October 14, and is now in full swing. Mr. Reid informed me that he hoped to get in a thirty-day run before the cold weather compelled him to close for the winter.

The Alaska Gold Dredging Co., which built two dredges in the Council district last year, has this year erected another on Willow creek, a tributary of the Casadepaga river. It is a 2½-ft. open-connected dredge, driven by two gasoline engines of 40 and 25 hp. respectively. It has a revolving screen and belt stacker. It was completed late in September and was run long enough to prove its efficiency in handling the rich Willow creek gravel. This is the fourth dredge built on Seward Peninsula through the efforts of the old pioneer, Jerry Wilson, who is president and manager of the Alaska Gold Dredging Co., and, while it is not definitely known that he will do so, it will not surprise the old-timers here if he should bring another with him next spring. Kimball & Saupe have constructed a small dredge on Melsing creek, near Council city, during the past season, and have had a successful run of nearly 60 days, handling about 1000 cu. yd. per day. Melsing creek is a type of many streams on Seward Peninsula which offer big returns on a comparatively small investment in a dredging enterprise. The gold-bearing gravels are from 5 to 15 ft. deep, lying for the most part on decomposed schist, or else on shattered and broken limestone, or, in some cases, on a false bedding of sandy silt or clay. There are no large boulders and the gravel is for the most part well washed, and comparatively free from clay or sticky material. The gold is coarse and easily saved, and the tenor is from 40c. to $1.50 per cu. yd. The banks of these streams are frequently in the grip of permanent frost, and are not dredgeable, but the beds of the streams over which the water flows are almost invariably thawed, especially if the stream carries a considerable volume of water. Many of these streams have been worked by the pick and shovel method, but as the miners can make only wages, and sometimes not even that, most of the stream beds in this class still remain to be turned to profitable account by other methods. There are innumerable opportunities here for the investment of from $15,000 to $50,000 in enterprises that, if intelligently managed, will give profitable returns on the investment. This class of property is not held at high prices, and in many cases the owners would be glad to put up a large tract of ground as an offset against a small but substantial dredge, and divide the profits over working costs.

Wild Goose M. & T. Co.'s Dredge. Began Operations September 26, 1910.
(Built by Yuba Construction Co.)

Among the many dredges installed on the Peninsula this season, none is more substantial or better equipped for work than the one built for the Wild Goose Mining & Trading Co. on upper Ophir creek, in the Council district. It was built by the Yuba Construction Co. of Marysville, California, and embodies all of the best features of this company's standard designs, together with such additions and improvements as could be suggested by C. H. Munro, manager for the Wild Goose company, who is himself not only an expert dredge superintendent but a constructing engineer of ability. His experience in this district has thoroughly equipped him to handle the

problems which local conditions present. The dredge has a close-connected bucket line, carrying 58 buckets with a capacity of 3½ cu. ft. each. The hull is 75 by 37½ ft. and 6 ft. deep. It has a revolving screen 60 in. diam., 25 ft. long. The perforations are graduated from ⅜ to 1 inch. The tailing is handled by a Robins conveying belt of the best quality. The power is supplied by a standard gasoline engine of 125 hp. Water is furnished by a 10-in. centrifugal pump having a rated capacity of 2800 gallons per minute. The port spud is of Washington fir, while the digging spud is of angle steel and weighs four and one-half tons. A steam-heating plant maintains a comfortable temperature aboard the boat, and steam lines on the stacker ladder prevent ice from forming on the belt when the chilly winds begin to be felt in the fall. The boat is lighted throughout by electricity, generated by a dynamo aboard ship. No expense has been spared to make this dredge a perfect digging machine and first-class gold saver. Its capacity is 2000 cu. yd. per day. The Wild Goose company owns a number of contiguous claims on upper Ophir creek, and it is certain that this dredge will add its full quota to the general output for many years to come. It was finished in the early part of October, and was run about ten days with entire satisfaction to all. Owing to the high cost of cordwood and the excessive freight charges on coal and crude oil delivered to Ophir creek, Mr. Munro chose a gasoline engine as the most economical power developer under the prevailing conditions. The Blue Goose company's dredge, the pioneer dredge of Ophir creek, under the capable management of Gilbert Russell, has had a fairly successful season, though much delayed in the early part of the summer by the winter frost. Its capacity is about 1000 cu. yd. per day. It is driven by steam power. Wood is used for fuel and costs $10 per cord. It requires an operating force of nine men. Its gross output this season was $55,000, of which about one-half is profit.

The small dredge on No. 24 Ophir owned by Charles Kimball has run steadily all summer, and Mr. Kimball reports a very profitable season.

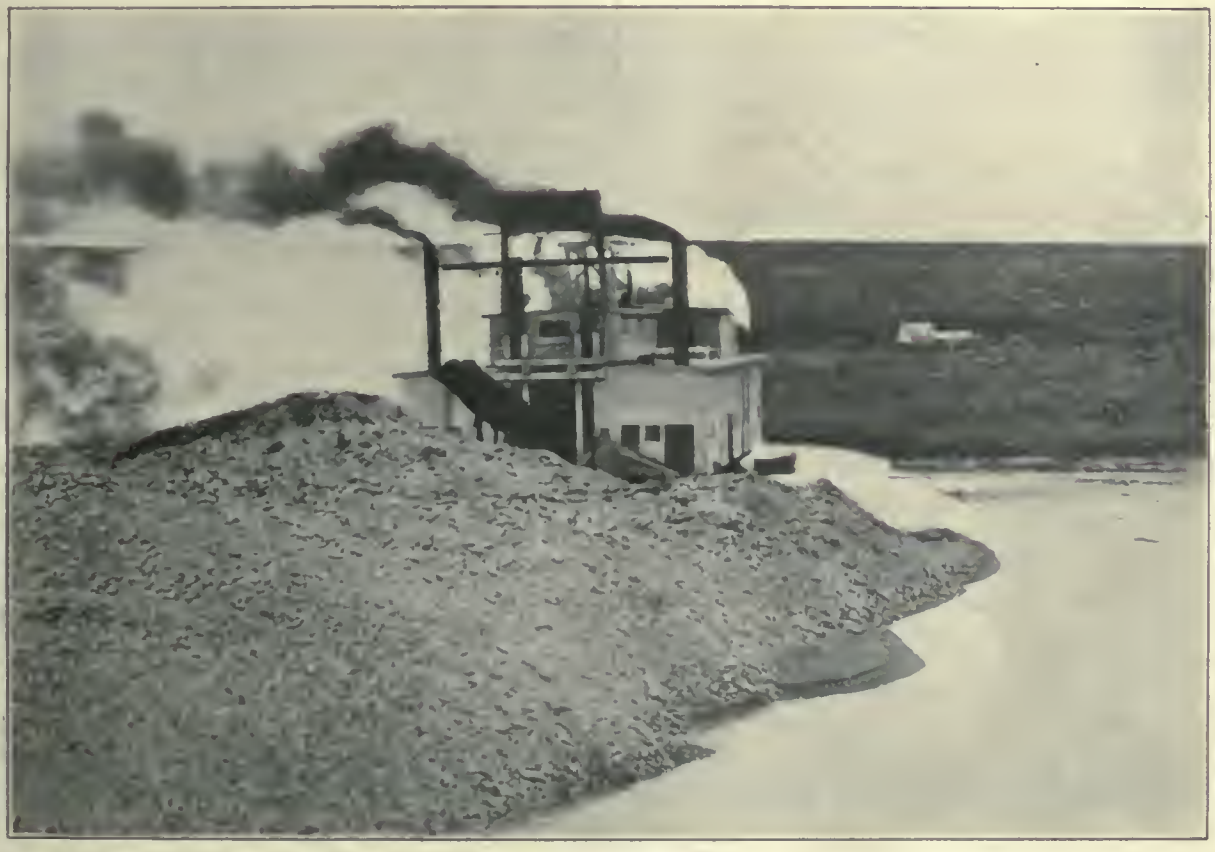
The Alaska Gold Dredging Co.'s two dredges on Gold Bottom and Warm creeks near Council have had to face extraordinary difficulties this season, and have not met with as much success as was anticipated. These two dredges were built at the confluence of Gold Bottom and Warm creeks and were but a short distance apart, when closed last season. During the winter an ice sheet formed over a large area in the beds of the streams about and in the vicinity of the dredges, and by continued overflow and constant accumulation, a bed of ice many feet thick was formed. The season opened late and the weather continued chilly and inclement until midsummer, and while this ice mantle slowly melted away, it kept the warm air from reaching the frozen gravel underneath, and was a serious obstacle for the larger part of the season. The formation of such an ice sheet over this area is unusual and was entirely unexpected. It may not occur again for many years. I am informed that the yardage handled this season was about half what was expected, though the output was encouraging, all things considered.

The Three Friends dredge and the Pearson dredge on Solomon river, both of which have made a splendid showing in the past, were much delayed by the late season this year. The Three Friends dredge shipped in a new Bucyrus bucket line on the first fleet of boats, and the Pearson dredge shipped a modern water-tube boiler. Ice along the shore prevented the ships from landing this machinery at Solomon for many days after they reached the roadstead off Nome. The Pearson dredge was finally made ready to start on June 23, eighteen days later than it started last year, and the Three Friends did not get under way until July 6, thus giving about a 100-day season. These two dredges, although under entirely different ownership, have operated for the last three seasons near each other, handling river gravel and the top foot or so of bedrock, and working at depths ranging between eight and fifteen feet. They are driven by steam power, and burn coal for fuel. Coal costs $20 per ton laid down by the railroad, to which must be added about $1 per ton for wagon haul to the boats. The Pearson dredge is a 5-ft. open-connected machine of the Risdon type, and handles an average of 2000 cu. yd. per day, with an average fuel consumption of 4½ tons of coal. It is equipped with compound condensing engines and water-tube boiler.* The Three Friends dredge is a 5-ft. close-connected machine of the Bucyrus type, patterned after the best models of six years ago in all features, except the power. It has ordinary flue boilers, and plain slide-valve engines, exhausting into the open air. Its fuel consumption averages 14½ tons of coal per day, and though it has a record of handling 3000 cu. yd. per day for a 120-day run three years ago, it has averaged only about 2000 cu. yd. per day during the last two seasons. When this dredge was built in 1905 it was the intention of the company to install electric power on the boat in 1906, but litigation over water rights and other causes have prevented them from carrying out their plans, and they have operated from year to year with the old make-shift boiler and engine. A. J. Condee, the present manager, states that they have had an excessive fuel cost of over $20,000 per annum for five years. To save this loss and to supply power for two more dredges which they are now planning to build, the company will, next year, erect an electric plant on the beach near the mouth of Solomon river. The electricity will be generated by steam power, and crude oil will be used for fuel. Crude oil can be delivered into a tank on the beach at a cost not to exceed $2 per barrel, which is equivalent to coal at $7 per ton. The electric plant as now planned, will cost $70,000 when ready to run, but it is the intention to supply power to other

*Later advices state that this dredge continued in operation till November 13 and took out $15,000 this year after most of the other dredges had stopped. Last year the Pearson, or Nome-Montana-New Mexico dredge, stopped October 27. The operating season in 1910 was the longest since dredging began on the Seward Peninsula.

dredges on Solomon river, if suitable contracts can be made, and in this case additional units will be placed in the power-house to meet the requirements. Mr. Condee says he can supply electric power at a cost of $7.50 per horse-power per month, whereas at the present time those most favorably situated and best equipped are paying about $30 for the same power. It speaks well for Solomon river as a dredging area that it will bear such excessive and wasteful charges and yet pay dividends to the operators. There are now six dredges on the Solomon river, five of which have steam power, and one gasoline. At least two more dredges will be installed in this area in the near future, and they are to be designed larger than any now in the field. Taking the average power consumption at 100 hp. for each machine, and the average saving as outlined above at $23.50 per horse-power per month, or $2350 for each dredge, by uniting their forces, and erecting a central power-plant, these companies can pay for such a plant, together with the cost of changing to motors on the boats, in two seasons, from money which is now being absolutely wasted as far as the dredging industry is concerned.

The Wonder Creek dredge, near Nome, is still at work and has had a season of a little more than four months. It is digging in ground about fifty feet deep, and a mantle of frost at the surface is not a serious hindrance. Consequently, operations can be begun here earlier in the spring than at dredges in shallow ground. The *Mining and Scientific Press* in its issue of July 9, 1910, under the head of 'Special Correspondence' from Alaska, is made to say that this dredge and the Bourbon dredge have installed thawing plants with which the ground can be thawed to a depth of 60 ft., at a cost of 8c. per cu. yd. of material handled, and that the two dredges are handling nearly 6000 cu. yd. per day. I wish to correct this statement, as it appears ridiculous to those who are familiar with the handling of frozen ground, and with the conditions under which these dredges operate. Neither of these dredges is equipped with a thawing plant, nor has there yet been devised any method by which ground may be economically thawed to a depth of 60 ft., nor is there any method known by which frozen ground at any depth may be thawed at as low a cost as 8c. per cubic yard. With coal at $20 per ton and crude oil at $3 per barrel, it is safe to say that no frozen ground has yet been thawed in this district at a less cost than 50c. per cubic yard.



Three Friends Dredge.

(Built by Western Engineering & Construction Co. Complete Equipment Furnished by The Bucyrus Co.)

It is quite possible that with an economical boiler of about 120 hp., mounted so it could be easily and cheaply moved, burning crude oil and supplying a battery of 100 points, a gravel bed from 8 to 12 ft. deep could be thawed at a cost of 25c. per cubic yard in the vicinity of Nome. In such a case a carpet of tundra from 2 to 6 or 7 ft. thick overlying the gravel would not be detrimental, but rather advantageous, as it would serve to prevent surface radiation and consequent loss of heat. The extra length of points required would not make them much more difficult to drive, as a steaming point sinks readily by its own weight in the tundra surface, and the driving head would be within easy reach when the point hit the gravel. This surface layer need not be thawed, but could be undermined by the dredge, and then broken down in blocks of considerable size, and floated and

rolled back into the pond. There are a few frozen areas on Seward Peninsula where the required conditions as above described are found, and there may yet be successful efforts made to dredge them. So far, however, all dredging has been, and is being, done in thawed ground, though a rib of frost is sometimes found and must be cut through. In such a case the wear on bucket lips and pins is severe and dredge masters will grapple with it only when absolutely necessary.

The Wonder dredge has averaged about 2000 cu. yd. per day, and though I do not know the amount of the clean-up, I understand it has been highly satisfactory. The Dexter creek dredge mentioned as being under construction in the special correspondence to which I have above referred, has its existence only in the imagination of the writer, as no such dredge is being built, nor has it ever been started. The Bourbon creek dredge, the control of which passed into the hands of Col. Stuart-Weatherly, last winter, has had its usual season of bad luck this summer. The Colonel was fortunate in securing the services of Frank N. Wood, who made such an enviable record on the Three Friends dredge during its first five years of operation, to act as his superintendent. After a thorough overhauling, Mr. Wood got the big machine under way about July 20. By the most watchful attention he has managed to keep it digging nearly all of the time until he laid it up for the winter, about October 1. It has not been a success and it may never start again until it has been rebuilt into a better dredge and placed upon ground suited for dredging and containing sufficient gold to give reasonable returns. I am reliably informed that a run of 17,000 cu. yd. averaged only 4c. per yard, and another run representing about twice this yardage returned 12c. per yard. These values are entirely too low to pay to work in this district. This dredge is situated near the mouth of Bourbon creek, almost on the edge of tide-water. The valley in which the creek flows is a shallow depression in the tundra and the stream is small, not even affording water to float the dredge in dry weather. There has been but little re-concentration due to the creek, and the gold found there is only such as may be found anywhere over thousands of acres of the tundra plain in the immediate vicinity of Nome. Colonel Stuart-Weatherly frankly says that the drill records made by his grantors were utterly unreliable, that he has been deceived, and is much disappointed. It is another exemplification of the danger of trusting to the trader to tell you the age of his horse. One must look at his teeth and be able to judge for himself.

Away back in the early days of Nome's history, E. E. Powell, then of Portland, but more lately of New York, came here with a small gasoline engine, a chain of buckets, each of which resembled an ordinary water pail, bolted to a sprocket chain, a few sprocket wheels, bolts, belting, and a wagon-load of timber. Bourbon creek, being near town and not overcrowded with miners, offered an inviting locality for Mr. Powell's experiment. Being a keen trader, he was soon in possession of one or two claims, and in a short time had erected a sort of vest-pocket dredge on wheels. He and another man worked the machine from the time it was finished until the end of the season, and his tailing pile was so much bigger than two men could have shoveled in the same time, that, taken together with his exceptional conversational powers, he easily impressed the owners of claims up the stream with the important part machinery was going to play in the future prosperity of the camp, and particularly in low-grade gravels like Bourbon creek, and that he was well equipped to handle just such ground. He secured control of several claims along the creek and the following season came in with two more of these small aggregations of machinery. These were erected at points higher up the stream and he began to feel that Bourbon creek was his particular cabbage patch. With this idea in mind he organized the Anvil Hydraulic & Drainage Co. and proposed to dig a drain ditch from sea-level at the mouth of Bourbon creek to the foot of Anvil mountain some three miles away. To accomplish this, it was necessary to get control of a block of ground from the foothills to the sea. He laid his scheme before the claim owners in his most persuasive manner, and before long he had the route for his drain pretty well secured; some of the claim owners had stock, some had 'gold bonds' issued by his company, bearing 8% interest, and some had money, but Mr. Powell had the ground. The following year he came in with a much more pretentious machine. It was big enough at the base to put a kind of pilot-house on it as a second story without danger of becoming topheavy. He installed this machine a short distance from the mouth of the creek and began to dig his proposed drain, which was to be fifty or more feet deep through two miles of its length. His last machine was so far superior to the others, that he abandoned them as instruments that had outlived their usefulness, and they stand today where he left them as monuments of his enterprise. About this time he became intimately associated with William Tecumseh Perkins, who had had considerable training as a promoter under the tutelage of John Rosene of the Northeast Siberia company and Northwest Development Co. It was not long before Mr. Perkins and Mr. Powell had formulated a plan for a big company flotation which seems to have been eminently successful. Mr. Powell's connections had been in the West, but Mr. Perkins was in touch with the East. The Nome Mining Co. was formed to lease the holdings of the Anvil Hydraulic & Drainage Co. and the opportunities for profit-taking were painted in such beautiful colors that they readily placed enough Nome Mining Co. stock to enable them to build an electric-power plant at a cost of $150,000, and a dredge at a cost of $97,500, and to enable Mr. Powell and Mr. Perkins to each have his own automobile. Pursuant to the plan originally made, the Nome Mining Co. was given a lease for a term of years on the Bourbon creek holdings of the Anvil Hydraulic & Drainage Co. at a royalty of 25% of the gross output, and an option to purchase at $1,750,000. The construction of the Nome Mining Co. dredge, commonly called

the Bourbon dredge and power plant, was begun in the summer of 1907 and completed in the summer of 1908. The dredge was built by contract, and the design was drawn by the contractor. There was neither a technical engineer nor a practical dredgeman to draw the specifications, nor inspect the machine as the work progressed. The result was what might have been expected, a mass of heavy machinery without balance or a proper regard for the interdependence of its various parts, and it has given trouble from the start. More than $65,000 has since been expended in changes, additions, and improvements, but it is still only a makeshift affair. Mr. Powell, although abandoning his big drain ditch scheme on the birth of the Nome Mining Co., has not been identified with the active management of the latter company since the dredge and power plant were completed. The Eastern stockholders were given the privilege of subscribing for considerably more than half of the shares issued by the company, and they have been in control. After two years of unsuccessful effort under two different managers, and the expenditure the first year of $25,000, and the second year of $40,000, in changes and improvements on the dredge, the Nome Mining Co. last winter sold to Colonel Lionel Stuart-Weatherly 54% of its stock for $200,000, of which $65,000 was paid in cash and the remaining $135,000 was to be paid from a percentage of the gross output within a fixed period. The Colonel was elected president of the company and given entire control. From remarks made by the Colonel during the latter part of the season about having been 'fleeced' and 'bunkoed,' it is presumed he will sever his connection with the enterprise in the near future. The Colonel has other and extensive holdings here, however, and is by no means discouraged.

The Gold Beach Dredging Co., which last year installed a 5-ft. open-connected dredge near the mouth of Dry creek on the outskirts of Nome, has come to grief. This concern was promoted by one Roy Braucht with headquarters at Fremont, Nebraska. It was capitalized at $1,000,000, and a prospectus containing most extravagant statements was published and circulated. A sufficient amount of stock was sold to enable them to buy a dredge, which had been built by I. B. Hammond of Portland for a company in Oregon, but which had never been started, owing to insurmountable difficulties encountered by the company. It was dismantled by the Gold Beach Dredging Co. and shipped to Nome in the spring of 1909. The company leased claim No. 14 Below on Dry creek, agreeing to pay 25% of the gross output as royalty to the owner. The dredge was built and ready to run by September 20. Up to this time no effort whatever had been made by the dredge company to prospect the ground and it was relying upon general rumor as to the gold tenor of the gravel and its suitability for dredging purposes. Getting the dredge under way, they soon discovered that with the exception of a narrow, tortuous course under the bed of the stream, the ground was permanently frozen and dredging impossible. Nothing daunted, however, they closed the gates in their dam and flooded five or six acres to a depth of six or more feet, under the fond delusion that the water would draw the frost from the ground. They laid the dredge up for the winter, went out on the last boat, called a meeting of the stockholders, and after a glowing report on the success of the enterprise, the directors proceeded to declare a 10% dividend. Immediately following this enthusiastic gathering, Gold Beach stock was again offered to the public at 30c. on the dollar, and boosted, as sales were made, until it reached 65 or 70c. The advertised purpose of this issue was to secure funds to buy another dredge, and many Nebraska, Iowa, and Kansas people jumped at the chance to get in on an investment away under par that had paid 10% the first year of its existence and promised a magnificent increase in the immediate future. As the funds came in an order was placed for a 3½-ft. dredge. The company did not then, nor does it now, own an acre of mining ground in Alaska, nor did those in control know where they would place the dredge when they got it here. In the meantime, this sleek young promoter, R. Braucht, was selling blocks of his personal stock, at a little under the market, whenever opportunity offered, and this finally led to his undoing. He had bargained with a banker in Iowa to take 40,000 shares of his stock for a lump sum of $20,000, and when he made the final plunge on the new dredge, he reckoned confidently on this $20,000 being available for his use, if the funds in the company's treasury were insufficient to meet all demands. Another one of the insiders, learning of this transaction, visited the banker and offered to deliver a similar number of the company's shares for $17,000. The banker, as usual, being on the alert to make a thousand or so, promptly accepted the offer and the stock was delivered. When the time agreed upon for the conclusion of the deal with Mr. Braucht had arrived and the banker was called upon, he gleefully told Mr. Braucht of the lucky deal he had made, and that the proposed deal with him must be declared off. The $17,000 was diverted into other channels, and Mr. Braucht was compelled to start for Alaska with his new dredge held for the freight charges, though he consoled himself with the thought that he was bringing with him the best automobile that had ever been shipped to Nome, in which he would daily ride out three blocks from the centre of town to watch his Dry creek dredge turn out the money from the area he had so wisely flooded last fall. He had no doubt he would soon have money from this source to pay freight bills and install his new machine, when he found some place to put it. The frost was not drawn, however, nor could he make a success of drawing it with steam points. After much effort and a failure to meet current obligations, he was compelled to abandon the attempt, and the owner of the ground gave him notice to take his machine off the claim, as his lease was forfeited. Being unable to redeem his new dredge from the transportation company, he has turned it over to the Saunders Dredging Co., which was organized by local people to work on Saunders creek.

Colorado Mineral Production

By Theo. F. Van Wagenen

Colorado mining men, as well as all who have the welfare of the State at heart, have been much exercised during the latter part of 1910 over the reported decline of its mining industry. The Denver papers during November published the statement that the annual production of the mines had decreased in value from fifty to thirty millions in the last nine years—a loss of 40%—and gave Franklin Guiterman of the A. S. & R. Co. as their authority. The matter was then taken up by the Colorado Scientific Society, and the Colorado Chapter of the American Mining Congress, both accepting the figures attributed to Mr. Guiterman, which, in fact, have neither been repudiated nor amended by that gentleman. The year closed, therefore, somewhat gloomily among the real estate people in the valley

Mineral Districts of Colorado.

cities, for in spite of the evident prosperity among the farmers, stockmen, and manufacturers, it is recognized that any serious or progressive falling off in the value of the output of the mines, unless soon checked by new discoveries, will surely injure their business. Up to date I have seen no detailed verification of the depressing figures given out by Mr. Guiterman, nor any attempt to discuss the elements of the situation. It seems fitting, therefore, to take the matter up in this review. There is nothing to be gained by concealing the facts, and there may be a decided advantage in facing them. Hence the two following tables representing the metallic output of the mines of Colorado for the last fourteen years have been prepared. The figures have been carefully abstracted from the 'Mineral Industry', except those of 1909, which are the advance estimates of the U. S. Geological Survey. To a considerable extent they confirm the statement attributed to Mr. Guiterman, but not some of the inferences that have been drawn from them. The decrease

TABLE I

VALUE OF MINERAL PRODUCTION 1897 TO 1909

	1897.	1898.	1899.	1900.	1901.	1902.	1903.	1904.	1905.	1906.	1907.	1908.	1909.
Au	$19,579,637	$23,534,531	$26,508,675	$28,762,036	$27,693,500	$28,468,700	$22,540,100	$24,463,332	$25,023,973	$23,210,629	$20,897,600	$22,871,000	$22,321,745
Ag	12,722,227	13,692,615	13,771,731	12,488,775	11,062,680	8,308,280	7,014,708	7,985,028	6,945,581	8,185,276	7,587,000	5,429,400	4,721,786
Cu	971,135	1,199,056	1,769,395	1,267,183	6,227,525	4,250,306	3,894,867	4,278,372	5,111,570	5,756,658	5,180,856	2,413,152	1,576,835
Pb	3,043,000	4,287,124	6,170,765	7,770,196	1,268,264	1,983,940	1,030,920	1,203,456	1,457,749	1,433,460	2,799,699	1,840,592	2,674,964
Zn	.....	.....	.....	.....	.....	.....	91,032	488,637	778,682	3,956,632	3,077,086	2,339,190	2,177,418
Fe	.....	.....	.....	.....	.....	.....	.....	429,856	398,700	22,525	.....	.....	.....
Mn	.....	.....	.....	.....	865,959	908,098	649,727	348,132	.....	97,000	251,207	123,407	.....
W	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	715,031	126,281	400,000
U and V.	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	102,500	162,000	.....
Bi	.....	.....	.....	.....	25,488	.....	.....	.....	314	4,187	12,500	6,600	.....
	$36,315,999	$42,713,326	$48,220,566	$50,288,190	$47,143,416	$43,919,324	$35,221,354	$39,196,813	$39,716,569	$42,666,367	$40,623,479	$35,311,622	$33,872,631

in value of output from the product of the year 1900 to that of 1909 is under 33% instead of nearly 40%. However, it will have to be admitted that the correct figure is quite bad enough, unless some mitigating or compensating circumstances can be shown. This I will endeavor to do, with what success the reader can decide.

Table I deals wholly with money values, while Table II is entirely a matter of weights. The one will supplement the other. The first displays the fact that during the fourteen years under consideration the output has fluctuated in value very remarkably at times. If, for instance, we compare the figures of 1909 with those of 1897, the difference is only about 7%. And when it is noted that during the earlier period the miner was selling his silver for 59.8c. per fine ounce as against 51.5c. during the later (a difference of 14%), it will be evident where the trouble was. Again, if the business of 1903 is compared with that of 1900, it will appear that in the three years following the latter date the annual output fell off 30%, or nearly as much as in the nine-year period on which Mr. Guiterman's figures were based. But comparisons of this kind yield little comfort. The total output has declined heavily in value, no matter from what angle it is viewed. A study of the figures of Table II is necessary in order to see just where the trouble has been.

TABLE II

PRODUCTION OF METALS BY WEIGHT

	Gold,	Silver,		Copper,		Lead,		Zinc,	
	ounces.	Price, cents.	ounces.	Price, cents.	pounds.	Price, cents.	tons.	Price, cents.	tons.
1896	719,264	...	22,500,000	...	.....	..	54,705	..	.....
1897	947,249	59.8	21,278,202	10.3	9,437,663	3.6	42,500	..	.....
1898	1,138,584	58.2	23,502,601	11.3	10,870,869	3.8	56,708	..	.....
1899	1,282,471	59.6	23,114,688	16.7	10,614,252	4.5	69,024	..	.....
1900	1,391,486	61.4	20,336,712	16.2	7,826,949	4.4	82,137	..	.....
1901	1,339,673	58.9	18,437,800	16.1	7,872,529	4.3	74,056	..	.....
1902	1,377,175	52.2	15,676,000	11.6	8,463,938	4.1	51,833	..	.....
1903	1,070,376	53.6	12,990,200	13.2	7,809,920	4.2	43,276	5.4	877
1904	1,180,147	57.2	14,331,600	12.8	9,401,913	4.3	49,290	5.1	4,906
1905	1,243,401	60.4	12,942,800	15.6	9,854,174	4.8	57,856	5.9	6,599
1906	1,109,452	66.8	12,447,400	19.3	9,565,000	5.7	52,992	6.2	31,908
1907	1,010,921	65.3	11,494,500	20.0	13,344,118	5.3	47,332	5.96	25,814
1908	1,103,530	52.9	10,161,318	13.2	13,896,689	4.2	26,707	4.7	24,885
1909	1,079,909	51.5	9,168,516	13.0	12,129,500	4.3	31,104	5.5	19,794
Average	1,142,402		16,313,024		10,083,655		52,823		16,397

Gold.—The average annual output of the 14-year period under consideration has been 1,142,402 fine ounces, that of 1909 being 1,079,909. Here is a decline of but a little more than 5% in the period, and the figures of 1903 and 1907 are both less than those of 1909. As Cripple Creek is the main standby of the State in the matter of gold production, it will be natural to look there for an explanation of the decrease. It is known that the production at Cripple Creek has varied much on account of water difficulties, especially during the last four years. The camp, none the less, makes a fine showing in the face of this difficulty. Now that the deep drainage tunnel has at last reached the ore-bearing formation, all such troubles may be dismissed for the next ten years or more. The figures for 1910 are already known to show a considerable improvement upon those of 1909, and it seems probable that the record for 1911 will approach that of the best year of the great camp. Any worry over the gold output is unnecessary.

Silver.—Here the conditions and prospects are very different, and by no means encouraging. It will have to be admitted at once that the outlook for the white metal in Colorado is bad. The production of 1909 was below the average of the 14-year period by more than 45%, and while the improved value of the metal now current promises to result in greater value of the product during 1910 and 1911, yet a return to the tonnage figures of 1898, or anything like them, cannot fairly be expected. In 1906, when silver was worth nearly 67c. per ounce, as against nearly 60c. in 1897-9, the output was declining. The fact is that the silver production is closely connected with the lead product, and to a large extent with that of the oxidized lead minerals. The known resources in the latter have become extensively exhausted, and no explored and developed district in the State promises any notable revival in the yield of that class of mineral. Unless some surprises are awaiting the operators in the new western slope mineral belt which is slowly but surely being developed, it will probably have to be admitted that Colorado has passed her prime as a silver-producing region.

Copper.—Here operators are justified in feeling much encouraged. The copper output for 1909 was well in advance of the average of the 14-year period tabulated, in spite of the low price of the commodity. There are no indications yet that the State will develop mines of the red metal comparable to those of Arizona, Montana, Utah, or Nevada; but there is every probability that the product will never again fall below the average of the table. This is because of the stability of the industry in the two great fissure-vein localities of the State, Gilpin and Clear Creek counties in the Front Range, and the San Juan mountains in the southwest. In these parts Colorado stands on edge, so to speak, and deep mining, with iron and copper pyrite as the principal minerals, has become established. The first two counties named have been steady and re-

liable producers for the last fifty years, and the other district for more than thirty.

Lead.—In this item the decline has been serious since 1900, and looking around among the known districts of the State it is not possible to find warrant for hope of return to the figures of the past. The known oxidized orebodies of Leadville, Red Cliff, Kokomo, White Pine, Creede, Monarch, and Alma are practically gone, and no new localities of a similar nature have been discovered. Colorado will always be a considerable producer of the metal from its silver fissure-vein districts, such as Georgetown, Montezuma, Breckenridge, Lake City, Silverton, and Ouray, but from them it comes in comparatively small quantities, and the amount varies directly with the price of silver. There are still some chances of new discoveries at Leadville. The limits of that wonderful camp are not yet entirely known. When the long-contemplated Malta drainage tunnel is undertaken (as it ultimately will be), there are several large areas that are not unlikely to be found to contain extensive bodies of carbonates. In that great region of contorted and altered sedimentaries at the head of the White river, which has been neglected for so many years by the prospector, there is much promise for the discovery of argentiferous lead ores. And there is still another region of the same kind (geologically) in the extreme northwestern part of the State. All this new territory is being made accessible by the building of the Moffat road, now at Steamboat Springs, a branch from which will surely, sooner or later, be pushed to Meeker.

Zinc.—The figures indicate the beginning of a very important branch of our mining industry. It is already well known that the production of 1910 will be well in advance of that of the previous year, while the prospects for 1911 are particularly bright.

Other Metals.—Colorado is a variable producer of tungsten, manganese, uranium, vanadium, and bismuth. The outlook for tungsten is particularly good. It is probable that manganese production has seen its best days, at least until some new discoveries are made by prospectors. The output of the rare metals may be expected to be spasmodic, but there are indications that the State's resources in uranium and vanadium are fairly large, and will cut quite a figure when the western mineral belt becomes better known. Taken all together, there is no call for any feeling of depression over the condition of the mining industry in Colorado. There are enormous known bodies of low-grade sulphide ore at Leadville, Red Cliff, Kokomo, Robinson, and elsewhere, that cannot at present be handled economically by the smelters, because of the scarcity of silicious ores to work with them, and this scarcity has resulted mainly from the expansion of the milling industry at Cripple Creek. If new resources in dry ores are not soon discovered in the State, or made available from adjoining or nearby localities, it is not unlikely that the A. S. & R. Co. will begin a serious study of the problem of developing a method of ore reduction not so much dependent upon heat and fusion as that now in vogue.

Eleventh International Geological Congress

By James F. Kemp

The plan of an International Geological Congress had its inception in the American Association for the Advancement of Science and took form in the appointment of a committee at the Buffalo meeting in 1876. Subsequent correspondence brought a sympathetic response from those countries that are especially interested in the science and led to the first session in Paris, in connection with the Exposition of 1878. It was a simple affair compared with the congresses of later days, and was chiefly taken up with papers and discussions. French was selected as the official language and the organization was perfected and made permanent. The second meeting was held in Bologna in 1881, and since then there have followed in order, Berlin, 1885; London, 1888; Washington, 1891; St. Petersburg, 1894; Geneva, 1897; Paris a second time, so as to coincide with the exposition of 1900; Vienna, 1903; Mexico, 1906; and finally the eleventh session, held at Stockholm, Sweden, in August of 1910.

Beginning more particularly with the Washington congress, excursions to places of especial scientific interest became a feature, and as time passed the preparations for the excursions grew more elaborate. Guide books of increasing merit were written and visiting geologists were enabled to see in the most intelligent way the country where the session was held. Governmental aid has been extended when this was possible, and expenses of travel have been kept within reasonable limits. In Mexico and lately in Sweden excursions were planned so as to be of particular interest to the mining fraternity. In 1906 the delegates had the opportunity of visiting, for example, Pachuca, Guanajuato, Zacatecas, Parral, Concepcion del Oro, Mazapil, the Esperanzas coal basin, and the Ebano oilfield. The past summer there were eight excursions before the congress, and eight after it, two of which were specially planned for the iron mining regions of Sweden.

In the earlier sessions the Congress took up a number of matters of interest to all the participants. For example, a standard series of colors for geological maps was discussed before and at the Berlin congress of 1885. A report was submitted and a series proposed. Americans were soon after given a sample of the ones chosen, because they were used on the geological map of the United States prepared by C. H. Hitchcock and printed in the *Trans.* of the Amer. Inst. of Min. Eng., Vol. XV, 465, 1887. As soon as one studies Mr. Hitchcock's map it is clear that the two browns selected for the Cambrian and Devonian systems are too nearly alike. The United States Geological Survey therefore, after careful consideration, adopted a different set from that of the Congress, as is duly set forth in the Tenth Annual Report, p. 71. Practically this set continues in use. At one of the earlier congresses the preparation of a geological map of Europe was authorized. The map has been

appearing in parts and is now almost completed. It affords a fine portrayal of the European continent on a fairly large scale and is of invalnable aid to teachers.

For the Mexican Congress in 1906, a map of North America was prepared by the joint action of the Canadian, American, and Mexican surveys. The map was edited in Washington and printed in Baltimore. It is a beautiful example of modern cartography. While Canada and Mexico are fully colored, unsightly white areas were left upon the American portion in the Great Basin region, leaving a most unfortunate impression upon an observer. One involuntarily feels that after years and years of work and vast expenditure, American geologists knew less about their country than the Canadians do of Canada, or the Mexicans of Mexico. And yet as compared with Canada, the area is no greater, the accessibility is much superior, and the workers are far more numerous. In early Congresses the endeavor was made to correlate geological names, except of course for the smaller divisions, but this plan has never been successful beyond the Periods. So far as the pre-Cambrian rocks are concerned, we are in the worst confusion of all. Much discussion was held upon this topic in Sweden—but the only term of general application for both sides of the Atlantic is pre-Cambrian. Aside from this, parallelisms only can be suggested. Of course, as the pre-Cambrian rocks lack fossils, there are in them no such accurate means of comparison as in the later strata.

The congress in Mexico gave special attention to papers on ore deposits, and some interesting ones resulted. The Stockholm congress attacked a problem of the first magnitude under this head. It was the 'Iron Ore Reserves of the World', under which title, and by the co-operation of geologists in all parts of the world, an important two-volume work was prepared, with a large atlas of maps. In no other book of reference can so complete and authoritative descriptions of the world's resources in iron ores be found. Since Sweden is an important producer of iron ore, excursions were planned so that the delegates might see its mines, and especially the new developments in Lapland. There are now two districts which are active. The older one is at Gellivare. It has been shipping for many years from the port of Lulea, 123 miles distant, at the northern end of the Gulf of Bothnia. Navigation is closed, however, from November to May. Gellivare is situated 52 miles north of the polar circle. The mines at this place are distributed over a large ridge, and are based upon enormous bodies of magnetite in a gray syenitic gneiss. Many dikes of red granite and syenite penetrate them. The ores are associated with masses of hornblende and other basic minerals, collectively called *skarn*. The general consensus of opinion is that ores and *skarn* are basic segregations in a deep-seated eruptive. The open cuts are huge and profoundly impressed the visitors. Sixty miles farther north from Gellivare is Kiruna, where within the last ten or twelve years an important industry has been established. A great sheet of magnetite, generally high in phosphorus, runs along the crest of a ridge for two miles or more. It then drops beneath a lake and reappears two miles to the north at Luossavara. The ore averages 150 ft. thick, but where now worked is 500 to 600 ft. across on the horizontal. It dips at 60° to the east, and lies between a trachyte-porphyry foot-wall and a rhyolite-porphyry hanging. The ore is now shown to be later than the foot and older than the hanging and is believed to be, as the result of the last work, a lava sheet of nearly pure magnetite. It is extraordinarily rich. The shipments range from 65 to 68% iron. During the current year 2,300,000 tons will be produced, of which 300,000 go to Philadelphia. Mining has been begun in a smaller way upon Luossavara and also upon another hill lying three miles or so to the east called Tuollavara. From Kiruna the standard-gauge railway has been extended northwest 113 miles to Narvik, a port on the Norwegian coast which is a deep-water harbor, upon a fjord and open all the year round. Narvik has fine docks, ore-pockets, shoots, and shipping facilities of the most approved Lake Superior type. Ships can be loaded with the same despatch as at Duluth, Two Harbors, Ashland, or Escanabe. The ore goes chiefly to German and Belgian furnaces, for which its high phosphorus makes it especially desirable. The high percentage in iron raises the low percentages of the local minette ores. The visitors were again profoundly impressed with what they saw at Kiruna and Narvik and could not fail to express in the most emphatic way their admiration for the results accomplished under the vigorous management of Hjalmar Lundbohm, long a valued friend of many of us in America.

The sessions of the congress opened in Stockholm August 17 and continued one week, with many enjoyable entertainments from King, Crown Prince, and local committees. The prominent scientific subjects specially discussed, besides the topic of iron ores, were the changes in climate since the Glacial period; the first appearance of the Cambrian fauna; the recent results of Polar exploration, and the problems of the pre-Cambrian. There was a section devoted to economic geology, and there was probably the strongest gathering of workers in ore deposits ever collected, but the iron ore discussion overshadowed other matters. Following the congress a large party assembled to visit the iron and zinc mines of southern Sweden. The party was so large, in fact, as to be unwieldy for underground trips, but the Swedish committee did everything in its power to make them successful. The visitors saw the old-time workings and the modern improvements, and were deeply interested in the many evidences of careful and efficient management. They had the novel experience of being entertained at a banquet in a huge underground chamber, all of which had been excavated by fire and water with no explosives, two or more centuries ago. All the excursions terminated during the first week in September, and with many pleasant recollections of the eleventh congress, the six or seven hundred members returned to their homes.

New Klondike Dredge

By Guy A. R. Lewington

I am indebted to J. W. Boyle, president and manager of the Canadian Klondike Mining Co., of Dawson, for the following description of Canadian No. 2, the largest gold dredge operating in the world. It is safe to say that a record has been established in the construction of this dredge. The contract was placed with the Marion Steam Shovel Co., of Marion, Ohio, on January 21, 1910. All patterns were made, the machinery manufactured, and the last shipment forwarded from Marion on July 20. Construction of the framework of the hull was commenced August 4 and the dredge finished, with the exception of the digging line, stacker, and spuds, was floated on or about October 20. On November 5 the dredge was complete, and at once started to work. On November 15 this boat was successfully digging on bedrock, continuing to the end of the season, which is usually about November 25. The lumber was procured at Vancouver, B. C., and the dredge was constructed on the Boyle concession on the Klondike river, one mile below the mouth of Bear creek. The building of the hull and installation of all machinery was accomplished under direction of Howard Brenner, engineer for the Marion Steam Shovel Co. The dredge is electrically driven, with a continuous line of buckets, each of approximately 16 cu. ft. capacity, and will dig to a depth of 45 ft. below the surface of the water. The hull is built of selected British Columbia fir, reinforced throughout with steel plates and castings, and is 130 ft. long, 49 ft. wide, and 12 ft. deep, with an overhanging deck 3 ft. wide on each side, making the deck 55 ft. wide. There are four trusses, each over 20 ft. in height, running fore and aft, two through the centre of the boat, on either side of the well-hole, and one at each side. The two middle trusses have truss-chords 20 by 22 in., built up of 3½-in. fir, with 2¾-in. truss-rods, the chords abutting on the spud-casing timbers at the stern, and on the gantry timbers at the bow. There are two solid 10-in. bulkheads extending through the centre of the boat, forming the sides of the well-hole; two solid 6-in. bulkheads, midway between these and the sides, and two solid 6-in. bulkheads along the sides, all drift-bolted together with 22-in. drifts, bolted solidly through the post of the bents which are built up of 10 by 10 in. timbers. There are five cross-saddle trusses, two of which carry and distribute the weight of the main drive. The entire well-hole, bow, and both sides of the boat, for a distance of 40 ft. aft, are sheated with $^{5}/_{16}$-in. steel plate extending to the deck and turning back 18 in. under the bottom. The bottom plate extends entirely around the boat, and heavy steel plates $^{5}/_{16}$ in. thick and 2 ft. high extend entirely along the sides of the boat to the stern, which is sheathed with $^{5}/_{16}$-in. steel plates extending to the deck. The housing is of British Columbia fir, tongue and grooved, and is double sheathed on either side of the studding, leaving a 6-in. air space, one side being lined with heavy building paper. This method of housing has been determined as the most efficient in protecting the interior from the very cold weather of early spring and late fall. The total amount of lumber used in construction and housing is approximately 435,000 ft. Heavy steel castings are bolted to the stern, and countersunk into the timbers of the spud casings, and two large jaw-shaped steel castings are bolted to the steel traps extending 20 ft. along the upper truss-chords, giving protection to the hull and superstructure against the pressure and strain of the spuds. Heavy car-springs in the upper castings absorb the shock caused by the boat surging while in heavy digging. Along the top chords of the main saddle-trusses are tracks which carry hand-operated traveling cranes of 20 tons' capacity, which are at sufficient height to handle all of the main-drive machinery, and which travel the full width of the boat and overreach the roof about 2 ft. on each side. The bow and stern gantry caps are steel and are well fortified with heavy angles. The bow-swinging lines lead through a single sheave especially designed, which balances on raised bearings having a counterbalance and a swinging fair lead which travel with the line. These sheaves, like all castings throughout the dredge, are of open-hearth steel. The bucket-ladder is of the plate-girder type, 10 ft. deep, with a steel sluiceway along the top which catches the spill of the buckets and returns it to the pond through ports in the side of the ladder behind the lower tumbler, thus allowing the buckets to again pick it up. A compartment in the ladder, extending its entire length, is provided for steam-heating which keeps the ladder free from ice. The bucket-line comprises 71 close-connected buckets, which are cast in a single piece of high-carbon steel, with a manganese-steel lip 14 in. deep and 2¼ in. thick. The bucket bushings are of the full-circle type. The ladder-hoist is fitted with a separate motor of 200 hp., with automatic brakes, permitting the ladder to be handled in every way through the use of the motor-controller. The drum of the ladder-hoist is 48 in. diam. and is arranged for two hoisting lines. The winch machinery is of heavy construction, having 8 drums—4 for the side lines, 2 for the spuds, and 2 for general purposes. These are fitted with expanding band-frictions with check-belts, and arranged with reduction gears, giving two speeds in addition to the variation of the controller.

The main drive has self-aligning bearings throughout, with brass bushings. The upper tumbler-shaft is of hollow-bore nickel-steel 25 in. diam. with 18-in. bearings. The intermediate shafts are single, resting on bearings cast integral with the main-drive foundations. The foundations for the various parts of the main-drive bearings, the ladder-hanger shaft, and the main-drive motor, consist of heavy steel castings so constructed as to fit around the heavy gantry timbers, all of which are bolted together, forming a solid single foundation for the whole, thus rendering it impossible for any part to get out of alignment. The screen, or trommel, is of the straight type, 50 ft. long, and 9 ft. 9 in. diam., driven by a single-drive roller directly under the upper end.

while two small guide rollers, on either side, centre the screen on the driving roller: the lower end rests on rollers, one on each side. The perforated portion of the screen is 40 ft. in length. Especially designed wearing plates, placed in the bottom of the distributing trough, regulate the even distribution of the fine material to the tables. There is a single bank of sluice-tables extending along either side at right angles to the screen, and delivering into a sluice-box that empties into the pond at the rear end of the boat, giving, all told, a gold-saving area of slightly over 2000 sq. ft. The tables are fitted with especially designed steel riffles.

The 'save-all' is new in design, being built with a view to catching all that is possible of the drip from the returning buckets: it has deflecting plates over a cast-steel grizzly, and the whole is protected from the down-coming buckets by a set of 80-lb. steel rails. The save-all sluice is placed 2 ft. above the deck and empties into a long steel sluice which returns to the well-hole 15 ft. forward. The stacker is of the solid plate-girder type, built in box shape, entirely enclosed and so designed that the stacker-belt returns inside of the enclosure directly over a steam-heated chamber running its full length. The stacker is fully protected with a painted canvas hood. The two spuds are of steel, of the same size, 36 by 54 in., and 65 ft. long, fitted with rounded cast-steel points 15 ft. long. They are of the box-section type, with all angles on the inside. The pumps are high-pressure centrifugal, Morris make, and comprise one 14-in., driven by a 150-hp. motor, one 12-in., driven by a 75-hp. motor, and one 4-in., driven by a 30-hp. motor; all are direct connected.

All gears on the main drive, and all high-speed gears, have cut teeth. All bearings of the ladder and stacker rollers are especially designed and fitted with packing glands. The bearings of the lower tumbler are of new design, being double bushed with bronze bushings and rings, which take the end-thrust and are provided with packing glands which prevent grit or moisture entering. The ladder-hoisting tackle consists of two sets of blocks, with 6 sheaves each, attached to a 10-in. shaft, from which the ladder is suspended by two chains with cast-steel links 7 in. diam. and 5 ft. long. Each chain consists of five links and weighs 6080 lb. The entire weight of machinery and hull is approximately 950 tons. All sheaves for running lines are necessarily large and made of high-carbon steel. The bow and ladder-hoist sheaves are 48 in. diam. The dredge is steam-heated, a 50-hp. boiler furnishing steam for heating the plant, and hot water for flushing down the digging-ladder and stacker, and for keeping the sheaves free from ice. The winch-room is situated directly over the digging-ladder and is so arranged that the winchman, from his position at the controllers, has a clear view of the digging line, bow and shore sheaves, main drive, and spuds. The controllers and starters for all motors are in the winch-room and under the direct control of the winchman. There is also a system of electric-bell signals from all parts of the boat to the winch-room. All motors are direct-connected, there being no belts, and all drives are fitted with an especially designed safety-clutch used only by the Marion Steam Shovel Company.

The electric equipment was supplied by the General Electric Co. The motors in use were expressly designed and constructed for this dredge. They are

Dredge No. 2 Canadian Klondike M. Co., Near Dawson, Y. T.
(Built by Marion Steam Shovel Co.)

direct-connected to the 2300-volt transmission line, there being no transformers aboard except a small one used for the lighting circuit. The transportation difficulties encountered were many. The White Pass Railroad Co., in conjunction with its fleet of river steamers from White Horse to Dawson, delivered all the machinery from Skagway to Dawson in excellent condition. The great size and weight of many pieces of the machinery necessitated special transportation facilities, which were promptly provided; this speaks much for the development of transportation facilities in the Yukon basin. The moving of all this machinery from the docks of the White Pass Co., at Dawson, to a point seven miles up the Klondike valley was handled by local teamsters. The delivery of the heavy parts made it necessary practically to reconstruct all bridges along the road, straighten, and in many places re-gravel, the road, in order to prevent the wagons from breaking through. Twenty-six horses, hitched four abreast, except the wheelers, were necessary to move the spuds, which weighed 27 tons each, without the point (points weigh 5 tons). Each spud was placed on two especially constructed trucks, one being at each end. The digging-ladder, which came in three pieces, also required the same number of horses. The freight was all delivered so that little or no delay was caused by non-arrival of essential parts a most happy condition of affairs, although an absolutely necessary one to quick construction. Mr. Brenner found no difficulty in securing all the labor, both skilled and common, that he needed, from among the men of the country. The Canadian Klondike Mining Co. has also provided a complete machine-shop so that all ordinary repairs can be made on the ground. The property belonging to the Canadian Klondike Mining Co. is what is generally known as the Boyle concession, and is one of the ideal areas of dredging ground in the Far North. The greater part of it is not frozen, and it has a supply of water from the Klondike river which never entirely freezes, so that by the use of artificial means, dredging may be carried on from early in April to about November 25, or fully two and a half months longer than conditions will permit on any of the other properties now being dredged.

This company also has a 7-ft. Marion dredge on its property, which has been working successfully for the past five years and is in excellent condition, and still good for many years' work. It was the success of this dredge that proved to the company the great advantage to be derived from the installation of a very much larger dredge, and this has resulted in the building of Canadian No. 2, the success of which will no doubt be watched closely by all who are interested in dredging.

Hornsilver and silver chloride are one and the same thing. There can be no distinction between the condition of the mineral, whether occurring in dust-like particles or in solid masses. It is the composition of the mineral that determines, not its physical condition.

Gold Mining in California in 1910

By William H. Storms

Notwithstanding the general business depression of the past year, gold-quartz mining in California has given unmistakable evidence of a revival, which appears to have extended throughout the entire length of the State. Many old properties are being re-opened and new ventures started, which in most instances give good promise of success. The onward trend of events has been published in these columns weekly, as they occurred, and a review of the past year's happenings shows a great improvement in conditions over those of the previous year.

Little of general interest has been done in gold mining in the extreme southern end of the State, in San Diego, Imperial, Orange, Riverside, and Los Angeles counties, although there are gold mines in each of these, and some that are excellent. What is most needed there is new capital, new energy, and competent experienced management. For lack of them, these southern counties have suffered seriously. Within the past three months there have been reports of resumption of operations on the Golden Cross group of mines, at Hedges, 20 miles northwest of Fort Yuma, but nothing of importance has been done thus far. These are among the largest mines in the State and are equipped with 140 stamps. There are gold mines scattered throughout this southern region, particularly in the desert, but they are mostly operated, when at all, on a small scale, owing to their situation many miles from water, fuel, or convenient means of transportation. The re-opening of the Needles smelter under management of the U. S. S. R. & M. Co., has stimulated mining throughout southern California and Arizona, and is sure to be of still larger influence. In San Bernardino, Inyo, and Kern counties, the greater portion of which is desert territory, the usual amount of development has been in progress, and ore shipments have been made from numerous small mines, particularly of copper-gold ores in eastern San Bernardino, and of zinc-lead in Inyo county. Mining for borate minerals in and near the East Calico hills, has been continued with satisfactory results, some new ground having been developed. Indications are that the borate deposits are extensive, though of lower grade than that formerly mined in the famous colemanite deposit at Borate. High-grade gold-silver ore has been shipped in carload lots from the Coso range, and prospecting has been unusually vigorous during the year in both the Coso and Panamint ranges. At Randsburg, in Kern county, a district discovered in 1894, and where all expectation of finding anything new of importance had been abandoned, a fortuitous discovery was made the past summer, when a heavy rainstorm caused the outcrop of a vein to be exposed in a trail near the Butte mine over which thousands of miners had traveled for years. The ore was rich, and shafts were promptly sunk along its

course for several thousand feet and a new lease of life given the mines of Butte hill. There has also been some renewed activity in the Piute mountains of Kern county, where mines of gold and silver have been operated in a more or less desultory manner for half a century, and new equipment has gone into that district. Tungsten ores are also reported discovered in that vicinity.

In Mariposa county there have been some encouraging developments, particularly in the vicinity of Hornitos, where new mines are in operation and some old ones have been resuscitated. The region about Big Oak Flat and Groveland, near the Mariposa-Tuolumne county line, has also attracted considerable attention, and development is proceeding there, it is said, with satisfactory results.

On the Mother Lode there has been a noticeable revival of interest, extending from the northern part of El Dorado county to Mariposa county on the south. In the latter county, little of consequence has been done on the great Lode, the larger part of which is covered by two large estates, those of the Mariposa Mining & Commercial Co. (Fremont Grant) south of the Merced river, and that of the

Mines on Deer Creek, Nevada City.

Merced company (formerly the Cook Estate) near Coulterville. However, in Tuolumne county there has been unusual progress. The Republican, at Jacksonville, has renewed operations, and efforts to reopen other mines in that vicinity are being made. The Eagle-Shawmut mine, one of the largest mines in the State, near Chinese, has been practically idle for several months, owing to lack of power. This has long been one of the influences retarding mining in Tuolumne county. Each summer season for years past, there has been a shortage of water, owing to lack of sufficient storage capacity in the mountain-reservoirs. It would seem that this condition would have been improved before this, but each succeeding summer finds the same unfortunate condition. Mines are obliged to suspend operations, and great damage, in some cases, results to the underground workings. Rich ore has been found in the App and Heslep mines at Quartz, and new development is in progress in that vicinity. Prospecting for river gravels has also been given renewed attention in this county, notably near Chinese, Columbia, and in the Stanislaus canyon. A rich find was reported a few weeks ago in the Tarantula mine on the Mother Lode, west of Tuttletown, and the Toledo mine, west of it, is being reopened after many years of idleness. The Dutch mine, near Quartz, after being idle for some time, is again in operation. On the East Lode, at Soulsbyville, the Bagdad-Chase company has succeeded, it is said, in again placing the old Soulsby mine on a paying basis. This famous property made a production of over $6,000,000 from a small vein in early days. This company also owns a large group of mines south of Ludlow, in San Bernardino county, and operations are to be resumed there, after a long idleness. Near the

Zeila Mill, Jackson.

town of Tuolumne there has been vigorous prospecting work done in various mines, and good ore found. The old, long-abandoned Buchanan mine, several miles southeast of Tuolumne, is to be reopened. At this place is an excellent opportunity for mining at great depth by means of adits, as the outcrop of the Buchanan mine is 2300 ft. above the canyon of the Tuolumne river, which crosses by the lode, a mile south of the mine. The Black Oak mine, near Soulsbyville, has been the scene of renewed operations during the year, and some new prospects are being developed east of Sonora, not far from the old Bellevue mine.

In Calaveras county, numerous old and new properties have been receiving the attention of investors,

Empire Mine and Mill, Grass Valley.

both on the Mother Lode and on the East Lode, particularly on the latter near West Point. Near Mokelumne Hill, too, development and new equipment have contributed to the general activity. One recently inaugurated enterprise is that to dredge the tailing accumulated in Chile gulch from the operation of numerous great hydraulic mines in past years. There are millions of cubic yards of this material filling the gulch from depths of 20 to 100 ft. for several miles. The channel gravel originally was rich, or much of it was, and it is not unlikely that this débris may contain gold to a profitable

extent, if mined with a dredge. It seems unlikely, however, that a dredge can be floated in a pool of water, after the manner of the dredges operating in the valleys, owing to the comparatively heavy grade of the gulch and the character of the material to be handled, which will make it difficult to maintain a pond sufficiently deep to float the boat. At and near Angels the old mines are mostly in operation, with a renewal of life in Smith's Flat area, west of Angels. The Gold Cliff, Lightner, and Angels mines are operating steadily, and the Lightner is being re-opened by a new shaft now being sunk. Prospecting is in progress along the line of the Lode, both north and south of Angels.

Amador county is showing decided signs of prosperity and gives promise of continuing to be a large, and probably a greater, gold producer for many years to come. Here are the deepest gold mines in America. The Kennedy, over 3500 ft. deep, the Argonaut, over 3300 ft., and South and Central Eureka, each nearly 3000 ft., are all in full operation, with developments which assure many more years of profitable existence. The Bunker Hill mine, half a mile north of Amador City, and the Fremont Consolidated, half a mile farther north, are both deep mines, and operating to the fullest capacity of their equipment. These are the great active mines of the county, but, in addition to them, are the Kennedy Extension, formerly the Muldoon mine, adjoining the Argonaut; the Lincoln, at Sutter creek; the Alpine, at Plymouth, and several smaller mines south of Jackson, where development is being urged with all possible speed, and with excellent prospects for becoming great mines. The Original Amador mine, at Amador City, is one of the latest properties to be re-opened and fully equipped with hoisting and milling machinery. It is said to be a successful enterprise. It certainly has an excellent piece of ground and a good equipment. In eastern Amador some prospecting is being done on the East Lode, but mining is less active there than in former years. In the low foothill region, near Ione, some successful mining for gold and copper is reported.

In El Dorado county more than usual activity has characterized the year. El Dorado has produced millions of dollars in gold, mostly from ores of unusual richness, and there a few of the oldest mines in California are still being operated. Some of the cheapest quartz mining in the State has been done in this county, where gold ore has been mined and milled for less than 60c. per ton, but under exceptionally favorable conditions, of course. Work has been resumed on numerous abandoned mines in various parts of the county, and it is expected some of these ventures will develop into permanent and profitable enterprises. Recent examinations of some idle property in the county will probably result in the resumption of operations.

In Placer county, although there are profitable quartz mines, the industry is more particularly concerned in the drift-mining operations on the ancient river channels of the Forest Hill and Iowa Hill divides, and others occurring nearer the Sierra Nevada. In this branch of mining, in Placer county, there still remains a large and almost unknown field, particularly that portion lying northeasterly from the east end of the Forest Hill divide. There are many encouraging prospects there which remain undeveloped for lack of capital. Moreover, the channel system is little known, and opportunities for legitimate investment are still numerous, and these will, in time, undoubtedly be taken up.

Nevada county has continued to contribute its annual gold output. The deep mines of Grass Valley, and those near Nevada City, have been operated uninterruptedly, and some old properties, long idle, have been reopened, newly equipped, and there is no present evidence that mining will not be successfully continued in Nevada county for many years. At the North Star mines, near Grass Valley, the metallurgical branch has been given an unusual amount of attention during the past few years, and an elaborate plant provided for the treatment of the ores. The Empire mine, at Grass Valley, has built a cyanidation annex to the stamp-mill which has been designed along the lines suggested by the successful experience at the North Star mill. The Champion-Providence mines, near Nevada City, have been involved in litigation for some time past, but this is about settled, and operations will be resumed with new energy. This company has a large area of undeveloped, but undoubtedly valuable ground. In the eastern part of Nevada county, in Meadow Lake district, the usual amount of experimenting has been done, but this interesting district seems always to lack that fortunate combination—capital and experience.

Sierra county has shown more activity the past year than in many previous years. The success of the Tightner mine has stimulated prospecting, and many new properties are being developed in a small way as well as old mines re-opened, among these latter the Sierra Buttes, which in early days was one of the famous producers of the State. Across the river in Plumas county, the Plumas Eureka has also been re-opened, and there has been a general renewal of mining interest thereabout. The mines of Lassen county have done little the past year, the plant at the Hayden Hill having been burned. It is now being rebuilt. In Modoc county, in the extreme northeast corner of the State, a new district, near Fort Bidwell, is being opened. Some of the numerous properties there are likely to become producers within the coming year. The most important of these, thus far, is that owned by the Fort Bidwell Con. M. Co., which recently placed a mill on its property. In Siskiyou and Trinity counties gravel mining has been the attractive feature, although development of quatz mining has not been neglected.

It will be observed from this necessarily brief résumé of the situation, that the gold-mining industry in California has been progressive and not retrograde, as in some instances elsewhere. This is also evidenced by the fact that the gold production of the State for 1910 will be found to approximate $21,000,000, of which amount the dredges, the drift, and hydraulic mines produced about $7,000,000.

Swedish Mines and Mining

By Horace V. Winchell

Archean Geology.—For the student of the Archean there is a splendid field in Sweden, and to the economic geologist, Sweden is one of the most interesting countries on the face of the globe. Its great age as a centre of mining, the magnitude of its deposits, and their unusual types, provide material for innumerable *wunderbars* of the Teuton, and challenge the utmost exaggeration of the Yankee to suggest their equal in his own land. Historically, mining operations here are lost in the mists of antiquity. Methods and machinery had established vogues and patterns 350 years ago, in the days when Agricola, the Nestor of mining, published his classic treatise. Indeed, some of the machinery pictured by him in 1556 still finds its counterpart in Swedish iron and copper mines, steadily doing duty side by side with electric hoists or smelting plants of the most modern design.

Although Paleozoic and Mesozoic strata are found in Sweden, yet the larger portion is covered by the Archean rocks: gneisses, schists, intruded rhyolite, and porphyries. These eruptives have been in many instances profoundly altered, and the ancient ore deposits, which they were instrumental in producing, have undergone a varied and unusual history. The Swedish Archean consists of three petrographically and geologically different groups of rocks. These have long been named: the gneiss group, the porphyry-'hälleflintgneiss' group, and the granite group. Recently this terminology has been modified by the exchange of the term hälleflintgneiss for leptite, the latter having been proposed in 1875 as a collective name for the same rocks. The porphyry-leptite group, as the new designation also runs, includes fine-grained gneisses, schists of many types, especially certain dense green rocks called in Sweden hälleflinta, limestone, dolomite, argillaceous schist, quartzite, and conglomerate, together with porphyry and porphyroid rocks to a large extent. Many of the rocks of this group bear traces of having once been formed at the surface as lavas, tuffs, tuffites, or normal sediments. The latter, however, are only subordinately represented in the Archean. The leptites themselves, which form by far the greatest part of this group, are closely related to the other rocks and seem to be metamorphosed rocks of volcanic origin: lavas, tuffs, or tuffites. Consequently the 'porphyry-leptite group' corresponds very well to the designation supererustal rocks, which has newly been proposed by the eminent explorer of the Fennoscandian Archean, J. J. Sederholm. Supererustal rocks also form a great part of the gneiss group, but the high degree of metamorphism, which characterizes the gneisses, mostly conceals their primary petrographic character and geological relations so as to make their origin in many cases doubtful. The gneiss group includes also gneiss-granites. By this term Swedish petrographers understand granites strongly affected by regional metamorphism such as crushed, foliated, or granulated granites; often with a clearly marked secondary parallel structure. The third is the granite group. This embraces all the numerous types of granites, in which the Swedish Archean is so rich. Great areas of Sweden consist of these rocks. Together with the gneiss-granites they certainly make up much more than 50% of the Archean. The contacts show that the granite magmas have cut all the other rocks and must, therefore, be considered the youngest. They are real plutonic eruptives. Together with the gneiss-granites, and the gabbros and diorites which appear in smaller quantities, the granites may be said to form the infraerustal rocks of the Archean, in accordance with the Sederholm nomenclature.

Mines at Utö.—What is known as the porphyry-leptite group of rocks is associated with iron ores in central Sweden and also near Stockholm, extending along the coast to the islands Utö, Ormö, Namdö, and Runmarö. The rocks are hälleflintas, leptites, mica schists, porphyry, epidote or amphibole-bearing green schists, calcareous schists, limestones, and iron ores. They are all bedded, often regularly and with alternations, which makes them closely resemble stratigraphical complexes. Their structures are, however, wholly crystalline and the bedding planes are now always nearly vertical. The iron ore at Utö is the type known as *randig blodsten*, or quartz-banded hematite similar to Minnesota jaspilite. The quartz is gray or reddish, and the iron ore is hematite with more or less magnetite. Beds of amphibolitic rocks accompany the ore and thin green layers alternate with the iron ore strata. The mines in Utö were worked as early as the beginning of the seventeenth century, and operations continued down to 1879. From 1711 to 1878 the output was 2,070,900 tons of iron ore. The total production is estimated at 2,500,000 tons. The ore was not of high grade, containing before concentration but little over 40% of iron. The Nyköping mine was worked to a depth of about 650 ft., and the Finn mine about 500. Two famous lithia pegmatite dikes cut across the folded iron orebody of Nyköping. Here the element lithium was first detected by Arvedson, a pupil of Berzelius, in 1818. These dikes are among the most important known natural resources of lithia.

Adjacent to the iron-bearing zone of Utö is a mighty series of limestone and hälleflinta. The limestone is finely crystalline and alternates with the hälleflinta in bands from only a few centimetres to several metres in thickness. Where intensely folded and crystallized the hälleflintas resemble amphibole schists: and, indeed, the bedded complex is bordered on the east by a thick layer of green amphibolitic rock containing thin limestone layers. This green rock resembles the green 'skarn' or gangue rock of the iron mines farther north. Associated with these rocks is a greenish gray bedded leptitic hälleflinta which likewise contains a few thin beds of limestone. Then comes the regular bedded leptite, containing layers of nearly massive porphyritic rocks, which are undoubtedly altered lava beds and tuffs. The leptite is sometimes quartzitic and almost itself a quartzite. It is composed of quartz, feldspars, bio-

tite, and muscovite, and may be recrystallized volcanic ash, or mud. It is even occasionally coal bearing, and is mingled with limestones. The iron ore is perhaps a chemical sediment. There were silver mines also at Utö. Native silver occurs mingled with epigenetic sulphides of copper, iron, lead, and zinc. The mines are not now operated and were never important.

Upsala and Vicinity.—In the central portion of Sweden is the university town of Upsala. If Stockholm is the Venice of the North, Upsala is surely the Boston of the Arctic. Here for hundreds of years has been a centre of learning and culture. Here lived and wrote Sweden's greatest scientist, Carl von Linnaeous; and his house, with all of his natural history collections, is still preserved on the old farm, a couple of miles outside of the city. Not far from Upsala are Dannemora, Sala, Krylbo, Karrgrüfvan, Norberg, Hagge, Ludvika, Grängesberg, Persberg, Ammeberg, and Falun.

Dannemora.—Like many other Swedish iron mines, Dannemora was first worked for precious metals. The date of its discovery is approximately fixed by a deed of gift dated 1481 by which Sten Sture, the Elder, conveys to the Archbishop of Upsala and his successors one-fourth of the silver mountain in the parish "which was discovered a few years" before. When Gustav Vasa secularized the church lands, the mine reverted to the Crown, and was first leased to Joachim Piper, a burgher of Stralsund, in 1532. Iron ore was still only a subordinate product mentioned along with "sulphur, vitriol, antimony, lead, tin, copper, silver, and gold." By 1545 iron ore production had become important, under a lease from the Crown. Later, in the seventeenth century, the works and mines passed into the possession of private owners. Gunpowder for breaking the ore was first tried at Dannemora in 1728; and in 1727 a wonderful "fire and air engine" was set up for raising the water. In 1805 a steam-engine of Watt's construction, the first in Sweden, was installed.

The rocks at Dannemora are crystalline schists with intrusive granites. There are also other intrusive dikes. The Dannemora ore district is chiefly occupied by hälleflinta, the porphyritic having the greatest extent. This almost encloses the limestone and other varieties or phases of the formation. This so-called 'porphyritic hälleflinta' consists of a dark-colored, microcrystalline, fine-grained, quartz-feldspar rock with a rich admixture of a sericitic mineral of secondary origin. Chemically, it is an acid quartz-porphyry. Many variations in color, texture, and geological relations occur in this field; and north of lake Grufsjön it passes into granulite or leptite. The ores are enclosed in a limestone mass, which has a length of about 3000 metres and a maximum width of about 450. Composed exclusively of magnetite, the ore has a characteristically fine-grained structure, often as compact as steel. It occurs associated with skarn or gangue (called *bräcka*) and more or less mingled with limestone. The iron present varies from 20 to 65%. The more important ore deposits belong to a number of complexes, some of which contain several parallel ore layers. In each complex there occur several independent ore-stocks, separated by limestone or *bräcka*. Such ore-stocks may be connected with other ore-stocks in the direction of the pitch or toward the depth. They are usually nearly vertical. Their horizontal extension in the line of strike may reach 200 to 300 metres and their thickness 30 to 40. The mines of the central field have been opened from the surface on several orebodies of great thickness, partly separated by gangue and branching toward the north. On the south this extensive ore formation is almost entirely cut off by a system of parallel chlorite leaders, which form the southern wall of the Hjulvind mine, and somewhat resemble a fault. These chlorite bands or 'sköls' were probably originally diorite dikes which acted as a dam in cutting off the ore injection or the solutions by which it was formed. Quantities of sulphides, chiefly zincblende, have been introduced metasomatically at a later period, impregnating both the ore and the later granite intrusions.

Långban.—The mines of Långban have produced small amounts of argentiferous galena and sphalerite, and considerable quantities of manganese and iron ores. Here, as elsewhere in central Sweden, the ore-bearing formation is a crystalline schist. It consists here chiefly of granulite and dolomite. Closely associated is a gneissic granite. Two varieties of younger intrusive granite dikes occur, and various still later diorite and diabase dikes. Pure dolomite bears such a constant relation to the ore or sköl formations that it is concluded that the ore-depositing agencies had a marked effect also upon the dolomite, which is characteristically banded by lime magnesia silicates, except adjacent to the ore and sköl. The ores occur in stockworks, usually containing both iron and manganese. There appears to be a tendency to scatter and diminish in importance at moderate depth. The deepest workings are about 200 metres. The gangue of the iron ore-shoots is called skarn and is of varied color and mineral composition, containing gray-green malacolite, brown and black garnets, and ferruginous quartz. There are also unimportant deposits of sulphide ores of copper, iron, lead, and zinc. Many sköl layers or bands bound the ore and extend through the adjacent rocks. In some instances these sköls are squeezed and altered greenstone dikes that seem to have been present before the ore was deposited, and to have formed a boundary to it or determined its extent. In other cases they are more or less micaceous and represent transformed granulite or leptite. Still other occurrences resemble very old shear-zones or fault-planes whose filling has been transformed into crystalline rock material. Later fracturing has occurred, and the cracks have been filled with calcite and other secondary minerals.

In this same neighborhood are also the mines of Norberg, Flogberg, and Persberg. The principal features of interest are the skarn ores and the calcareous ores, the former of which are hornblendic magnetites and the latter serpentinous and amphiboliferous limestones which are found intermixed

with small patches and lenses of the skarn ore.

Persberg.—This is one of the oldest mining fields in Värmlands Bergslag. Mining dates back to the thirteenth century; and the first mining privileges were granted by King Erie the Pomeranian in 1413. The Bergmaster's report for 1637 states that "the whole mountain is nothing but ore, and of mighty richness, and can be smelted without flux," from which it can be seen that the art of writing mining prospectuses based largely upon the imagination did not originate in the United States. The total output of the Persberg mines is estimated at less than 4,000,000 tons. Fifty years ago the annual production was about 50,000 tons. At the present time it is about 30,000 tons. The ore is of excellent quality and has contributed largely to the reputation of Swedish iron in the world's market. The best grade of ore contains 55% Fe, 0.001 to 0.004% P; the second grade 45% Fe and 0.005 to 0.01% P. The sulphur content varies from 0.012 to 0.025%. The deepest workings are now about 1000 ft. Machine-drilling was first started in Sweden at Persberg about 1864. These mines were well described by Linnaeous about 1746. Powder for blasting was introduced about 1720. The skarn ores are believed by Sjögren to owe their origin to the metamorphic influence of greenstones upon limestones. There are, however, considerable ore deposits which are, so far as can be seen, without any immediate limestone association. The granite eruptives may also in some instances have been active mineralizing agents. Granulite or leptite is abundant, cut by skarn zones, which contain the ores.

Sala.—The history of the Sala lead and silver mine extends over four centuries. The ore deposits seem to have been discovered early in the sixteenth century, being mentioned in a document dated September 1, 1510. The palmy days of this district were in the early half of the sixteenth century, when it furnished an important part of the public revenue. By 1571, mining operations were difficult on account of water. Kings Carl IX and Gustavus Adolphus both tried their hands at it; but for fifty years little progress only was made. The grade of the ore declined with greater depth, but renewed exploration in the upper levels discovered more ore once in the latter part of the seventeenth century and again a hundred years later. At present an effort is being made to utilize the zinc ores that were left in the mine by former operators. The total production of silver of the Sala mine is estimated at about 400 tons, of which about one-half was produced in the sixteenth century. Sjögren states that from an economic point of view the mine was run at a loss for three and a half centuries. It was kept going only by means of special privileges from the Crown. The fact was noted at an early date that the ores declined in richness toward the deep. This phenomenon, which is not peculiar to Sweden, is commonly ascribed to secondary enrichment from the surface downward; but Sjögren, to whom we are indebted for a description of many of these mines, and who went with our party as guide, philosopher, and friend, does not accept that theory. Here again the crystalline schists or basal complex of hälleflinta and limestone, cut by granite and porphyrite intrusions and by later diabase dikes, form the country. The carbonate rocks are most closely connected with the ores. Galena is found chiefly in the limestones and only to a very subordinate extent in the hälleflinta. Copper ores occur in the limestone; while small iron mines in the district are connected with the hälleflinta. This latter rock here presents an extremely varied formation whose only common character is the felsitic texture of the ground-mass. It is dark, or light gray, or brownish, and is sometimes striped or banded. A few varieties have a purely granitic or quartz-porphyritic constitution; in general, however, the percentages of alkali are lower than in the quartz and felsitic porphyrites, and the constitution corresponds rather to that of the dacites and quartz-porphyries, with which rocks the hälleflinta also shows points of agreement in the quantity of ferromagnesian silicates. On the whole, the rock in its composition stands closest to the intermediate eruptives.

Grängesberg.—The Grängesberg iron ores occur in the usual formation of gneissic rocks, called granulites, hälleflinta gneisses, or leptites. Included in this formation are also amphibolitic or dioritic greenstones, skarn rocks, crystalline limestones, and iron ores. Later granitic and diabasic eruptives are also present. The ores are (a) apatitic; (b) quartzose hematites; (c) skarn ores; and (d) calcareous ores. The two last as well as the first are non-manganiferous, non-titaniferous magnetites. The iron content varies from 55 to 65%; and the phosphorus from 0.1 to 8%. Thus the mineral apatite sometimes amounts to more than 40% of the ore.

Falun copper mine is historically one of the most remarkable mines in the world. Worked without interruption for the past 650 years, it had, down to the end of the nineteenth century, produced more copper than any other mine on the globe. From 1630 on, complete records of its production are extant. According to these the total output in that time amounts to nearly 300,000 tons, or 600,000,000 lb. of copper. From the commencement of mining operations to the present time its output has been estimated at 500,000 tons of copper, 1 ton of gold, and 15 tons of silver, valued at about $250,000,000. For the sake of comparison it may be noted that in these days of monumental performances the total estimated output of the Falun mine in 650 years is about equal to three years' production of the mines of Butte. The ore was formerly richer, and the possibility of secondary enrichment is again suggested. At present the mine is worked for pyrite, which is used in the sulphite-pulp digesters belonging to the company which operates the mine. This corporation, although one of the oldest in existence, is one of the most progressive and profitable concerns in Sweden. The date of its actual foundation is not known; but it is supposed to be about the year 1225. There is in existence a deed dated 1288 conveying certain shares of stock; and a charter of the company, given by King Magnus of Sweden and Norway, is dated February 24, 1347, at that time

ratifying and confirming the company's rights and privileges which are mentioned as "very old." The company, whose full address is Stora Kopperbergs Bergslags Aktiebolag, Falun, Sweden, began to make or produce copper about the year 1225, sawed-lumber in the year 1689, iron in 1735, gold and silver in 1790, bessemer steel in 1871, open-hearth steel in 1878, electric steel in 1904, soda (sulphate) pulp in 1895, sulphite pulp in 1900, paper in 1900, and bismuth in 1904. It owns vast forests, 200 iron mines, and water-falls estimated to be capable of yielding 150,000 hp. It makes the specially soft charcoal wrought-iron for which Sweden is famous. Its annual production is, pig iron, 75,000 to 100,000 tons; bessemer ingots, 70,000; open-hearth ingots, 26,000; charcoal iron blooms, 4000; rolled and hammered iron and steel, 75,000 to 100,000. It uses 450,000 cubic metres of charcoal per annum, making 150,000 cubic metres in its own kilns.

The Falun mine, called 'The Country's Treasury' by Gustavus Adolphus, is 1200 ft. deep and has about 18 miles of underground workings. The bottom of the mine is now full of water, and many of the old workings are inaccessible. During the first 400 years of its history the ore was broken by burning wood against it. Gunpowder was first used in 1729. The ore was raised by means of windlasses worked by hand or horse-power, and the ropes were made of ox-hides, 200 to 300 hides being required for a single rope. The country rock at Falun belongs to the crystalline series represented here by gray gneiss and granulite or leptite. The gneiss is locally a quartzite which is the true ore-bearing rock, and to it belong also the other copper ores of this and adjacent districts. It contains amphibole and, as accessory minerals, cordierite and its alteration products, falunite, andalusite, and magnetite. There is also considerable white saccharoidal limestone. Composite basic dikes also occur, cutting both ore and country-rock. The ore of the Falun mine is pyrite occurring in various modes, more or less associated with sulphides of lead and zinc. In the upper levels the ore was considerably enriched, and probably contained the higher grade copper sulphides. Occurring in stocks of bluntly conical form with the point downward the former interior of the orebodies is now seldom seen. They consisted largely of nearly pure pyrite with a slight percentage of copper. There was also a quartzose mixture of copper pyrite and pyrite containing fragments of quartzite and limestone. There is here also a considerable development of skarn at the contact of quartzite and granulite. It consists of a dark green mass of radiate and sometimes garnetiferous amphibole. Then there are sköls more or less closely connected with the pyrite stocks and surrounding them or separating them from the other rocks. They consist partly of amphibole, biotite, and cordierite, and partly of their hydrated derivatives, chlorite, talc, and falunite. There are also secondary garnets and magnetite octahedrons and later sulphides. The sköls sometimes have a thickness of 10 to 15 metres, and again they thin out rapidly. They grow smaller in depth and have in general a development proportional to the extent of the ore mineralization. The richest ores the mine ever produced came from the upper zones of the sköls. The 'hard ores' lie immediately in the quartzite without being enclosed by sköls or leaders, and pass by insensible gradations into the rock itself. All the ores appear to come to an end at the maximum depth of 250 to 280 metres. Gold occurs associated with galenobismutite, in small quartz veins. Some selenium has also been found associated with trap dikes which contain amphibole in a felsitic groundmass of quartz and plagioclase. The gold ore was the richest at the depth of from 40 to 100 metres. Workable gold ores have not been found below 200 metres. The surface of the pyrite and neighboring limestone in some places retains the grooving and striations of the glacial period. It is interesting to note that there has been barely perceptible oxidation and solution in the five thousand or more years that have elapsed since Jack Frost here made his mark.

WORK OF GEOLOGICAL SURVEYS IN THE MISSISSIPPI VALLEY

Several changes in personnel of State Surveys occurred in 1910. H. A. Buehler has been appointed Director of the Missouri Survey. R. C. Allen has succeeded A. C. Lane as State Geologist of Michigan. Edward Barratt was elected to succeed W. S. Blatchley, who has been State Geologist of Indiana for sixteen consecutive years. The new Geological Survey of Tennessee has been placed in charge of George H. Ashley, formerly of the U. S. Geological Survey. In Wisconsin, W. O. Hotchkiss is now State Geologist. The Tennessee Survey has already issued timely bulletins relating to the geology and to the economic deposits of the State. It has among its duties a study also of the drainage problems, forestry, distribution of soils, and development of water-power. Co-operation has been established with many Federal bureaus, notably the Department of Agriculture and the Geological Survey. The former co-operates in the study of soils, public-road building, and drainage investigations; the latter, in topographic and geologic surveys, and particularly in oil studies. Work in Michigan and Wisconsin, to some extent, has been concentrated on iron and copper in the Lakes region. In Illinois, co-operative geological studies with the U. S. Geological Survey have been continued in the coalfields in northern Illinois at La Salle, in the central part of the State near Springfield, and in the southern fields of Williamson, Franklin, and Jackson counties. The general geology and mining problems of the lead and zinc region have been taken up on a thorough scale by State and Federal surveys. A study of the Illinois oilfields has required increased attention, particularly in connection with the new field at Sandoval and with scattered drilling outside of developed territory. In Missouri, in addition to the continuation of the studies of lead and zinc, an important resurvey of the coalfields has been in progress in co-operation with the U. S. Geological Survey.

A B C of Empire Drilling—I

By J. P. Hutchins and N. C. Stines

*The purpose of this article is to give details essential to the efficient manipulation of a particular type of drill as used in the sampling of alluvial ground. Incidentally other information bearing upon this branch of mining is offered. The drill to be described is the Empire hand-drill. There are other hand-drills, but they do not have the same complete outfit as the Empire. For the purpose of comparison we refer the reader to an article entitled 'The A B C of Keystone Drilling' by J. P. Hutchins, published in *The Engineering and Mining Journal* of December 14, 21, and 28, 1907. It affords a comparison between drilling by hand and by power, respectively. After several years of experience in the use of this and other hand-drills with and without rotated pipe, suggestions are offered in the hope that they may prove useful to our fellow engineers. The Empire hand-drill is characterized by the employment of a rotating pipe, strong enough to withstand severe strain and to permit of threads being cut on it: it is therefore not an ordinary 'casing' which merely encases the hole formed by the drill.

Set-up of Drill and Rotation by Hand.

Object of Sampling.—The object of sampling an alluvial deposit is to ascertain its tenor, volume, or extent, and physical characteristics. The physical characteristics include depth, degree of induration, size, occurrence, and proportion of sand, medium and big boulders, distribution and characteristics of clay, and of buried timber, occurrence of frost, annual or perennial, characteristics and tenor of overburden and bedrock, contour of bedrock, occurrence and proportion of sand, depth to water-level, and distribution of valuable contents.

Samples may be obtained by open-cutting, drilling, or shaft-sinking, and in each case the valuable content washed from the sample by panning, rocking, or sluicing. One or all of these operations may be required in getting the data necessary.

Kinds of Deposits.—For convenience of consideration in this article, alluvial deposits may be divided into two classes according to the method by which they are worked—by open-cutting or by 'drifting.' The first includes hydraulicking and dredging. The second includes many varieties of underground mining having for its object the extraction of one or more rich strata of gravel through shafts, inclines, or tunnels. All other kinds of placer mining are classed under open-cutting. Inasmuch as it is usually only necessary to prospect the lower stratum for drift gravel mining, it is often possible to apply such methods as have for their object getting data concerning it only. But it is necessary to sample the total gravel section for open-cutting, for all the material must be handled in the course of exploitation.

Drilling may be done by electric, gasoline, or steam-power drills, or by those operated by hand alone, or by hand assisted by horse-power.

The immediate object of this paper is to describe fully (1) the obtaining of the sample with the Empire hand-drill, (2) recovering the valuable content from the sample, and (3) ascertaining its value.

History of the Hand-Drill.—This device with rotated pipe seems to have been evolved fifty years ago in two places: in America for drilling water wells, and in the Dutch East Indies (where it was known as the Banka drill) in testing for tin. This type of drill was not used in prospecting for gold until about five years ago, when it was applied in America. Until then it had been used where labor was cheap and no serious attempts had been made to economize in this respect, but as soon as it was introduced into North America, where labor is expen-

Changing Tools.

[*We are requested by the authors to say that while this article is devoted to a detailed description of a particular drill, it was not written with the purpose of furthering the sale of any drill, but with the sole desire to give useful technical information through the medium of the *Mining and Scientific Press*.—Editor.]

sive, many improvements were made. These improvements with numerous refinements of construction and operation, changed the drill from a very primitive machine to a complete sampling outfit, requiring not only less labor, but less time, and able to overcome difficult conditions, such as frozen ground, and capable of taking more accurate samples.

Briefly the drill consists of a pipe, a platform, rotating and driving devices; boring, drilling, pumping, and pulling tools; all for penetrating to and into bedrock, for obtaining and treating the sample, and for pulling the pipe from the hole. In a few words the operation is as follows:

The pipe, having a toothed cutting-shoe on the bottom, and a platform on the top, is placed in an erect position at the spot where the sample is to be taken. Some of the crew steady the pipe, while others stand on the platform and with a battering-ram drive the pipe into the ground until it will stand without help. The rotating device is then attached, and a combination drilling and pumping tool screwed to rods, is used as churn drill, the pipe being rotated simultaneously. While it is thus kept loose in the ground, it is sunk (1) by the weight of the pipe, (2) by the weight of the platform attached to the top of the pipe, (3) by the weight of the drill-men who stand on the platform, (4) by the weight of the rod and tool that the drill-men operate inside the pipe while standing on the platform, (5) by the jarring effect of the tool striking on the bottom of the hole. The weight of the crew standing on the apparatus sinks the rotated pipe into the ground; it causes a core to accumulate and the churning crushes and forces this core into the pump.

When filled, the pump is removed from the pipe and its contents emptied. The pump is again lowered into the pipe and the operation repeated. The contents are washed and the estimated weight and characteristics of the gold noted. These operations are repeated, lengths of pipe and drill-rod being added as required, until bedrock is reached. The pipe while being rotated is pulled from the hole by leverage. The apparatus is moved to another spot and another hole started as before. The drill acts like a combined core-drill and churn-drill, for the toothed shoe cuts a core and the drilling and pumping tool performs the work of a churn-drill and also pumps.

It should be kept in mind, while reading what follows, that the pipe, whether being sunk into or pulled from the ground, is always kept loose by rotation. This is one of the unique features of this and the Banka drill, and it is due to this circumstance that the sinking of the pipe into the ground and pulling of it from the ground are accomplished so easily. It is hard to sink and pull pipe when it is not being rotated. In placer drilling, all power churn-drills both sink and pull pipe by impact. This is the hardest work they have to do, and it puts a severe strain on the apparatus.

The full operation of ascertaining the average gold content, the volume or extent of the gravel, and its physical characteristics, will be described as follows: (1) obtaining the sample; (2) treating the sample; (3) amalgamating, parting, and weighing the gold; (4) ascertaining and recording the physical characteristics in the field; (5) calculating the value of each sample and the average gold content, volume of the whole deposit, and recording the field notes.

Obtaining the Sample.—The area to be sampled is surveyed and the points at which samples are to be taken are laid out in lines, staked, and numbered. The points, where the drilling is first done, are such as are supposed to give, preliminarily, a maximum of information with a minimum of work. The points at which further drilling may be done depend upon the results of this preliminary work. The number and distribution of holes necessary to ascertain essential data are governed by the characteristics peculiar to the deposit under investigation. When gold occurs regularly throughout the width and length of a deposit, the ground is divided into squares of from 250 to 1000 feet and a hole is drilled at each of the corners. This has been the practice in such ground as that of the Feather, Yuba, and American river dredging districts in California. When the gold occurs irregularly across the width, but regularly along the length of the ground, as in channels, the holes are laid out across it, either in lines that are far apart with holes near together or on lines that are near together with holes far apart. Holes are generally placed so that those of alternate transverse lines form longitudinal lines. They are then said to be 'staggered'. Regular spacing of holes is always to be desired. As an instance of the bad results of irregular spacing, holes were sunk close together, where preliminary drilling showed rich ground, and far apart where there was poor ground. This resulted in a falsely high average for the whole area, as was subsequently proved by dredging. Testing by drill was thereby locally discredited.

Preparing and Assembling.—The ground having been staked as described, the drill is hauled to the first point, and is there unboxed and assembled. An outfit to drill to depth of 25 ft. weighs about 2000 lb. and about 400 lb. for each extra 25 ft. drilled. It is usually shipped in about 10 packages. The drill can be sectionalized so that the heaviest piece weighs about 75 lb., and it can, if necessary, be transported on men's backs. As generally received, it takes about 2 hours to unbox and assemble the equipment. In addition to the outfit supplied by the manufacturer, it is necessary to have a battering-ram and pulling-lever, irons for which are furnished, as well as two poles to turn the pipe while pulling. These can usually be obtained near the place of drilling.

The Empire drill outfit includes the following: pipe, in 5-ft. lengths; cutting-shoes; pipe head; platform with rod-holders; horse-power appliance for rotating pipe; helical pocket pump; drilling pumps; rock-drilling bit; large and small auger drill-spoons; drill-rods in 5-ft. sections; 4 wooden sawhorses to support parts when not in use; 3 drill-rod wrenches; drill-

rod handle; pump-jar device; driving-cap; driving-ram; 2 pairs of chain-tongs; monkey wrench; Stillson wrench; ballpein machinist's hammer; 8-lb. sledge-hammer; 2 crowbars; cap, stand, chain, and lever for pulling; poles for rotating while pulling; gripping device; 2 pieces 1½-in. pipe, 6 ft. long, for lengthening wrench handles; cold, diamond-point Cape chisels; punch; assorted files; pick; shovel; axe; screw-driver; cross-cut saw; mixture of oil and graphite; brushes to clean threads; dump-box; 3 buckets; 3 tubs; dipper; hot-water tank and stand for frozen ground and cold weather; 6 gold-pans; gold-pan punched with ⅜-in. holes for screening; 3 concentrate dishes; magnet; 5 lb. mercury; phials; labels; forceps; annealing cups; nitric acid; alcohol stove; alcohol; retort-stand; magnifying glass; balance; note-books; tape; 2-ft. rule; cross-section paper; tracing-cloth; thumb-tacks; pencils and eraser; engineer's scale; drawing instruments; triangles; inks; lumberman's crayon; drill sheets.

After the parts are unboxed, the threads of the pipe, rods, and tools are cleaned and oiled with a

Driving Ram.

mixture of machine-oil and graphite, with just enough oil to make a thick paste. The rod sections are kept on two sawhorses, the pipe sections on two other horses; the tools are placed on two sticks of about 4 in. diameter. This is to keep everything off the ground, "to have a place for everything and everything in its place." These horses and sticks are placed just outside the circular path traveled by the horse in rotating the pipe, so as to have them handy.

Starting the Hole.—There are two ways of beginning the hole. When there is no overburden, or it is desired to sample the total gravel section, the procedure is as follows: A section of pipe is laid upon two sticks to keep it off the ground and to allow the use of chain-tongs without hindrance. A toothed cutting-shoe is screwed on. It must be kept in mind to use a small amount of oil and graphite on all the pipe-threads, otherwise it may be very difficult to break joints. The pipe used is extra heavy with special flush couplings. These couplings have coarse threads, about three to the inch, designed so as to screw up rapidly and not lock when in use. The necessity for oiling threads is obvious when it is remembered that the pipe sections may be set up very tight in hard ground by the horse pulling hard on the 10-ft. sweep. This is the same as making the joints with a 10-ft. wrench and a horse pulling on the handle. The cutting-shoe is 0.38 ft. outside diameter and 0.30 ft. inside diameter. It has an edge with teeth like a rip-saw, but

Drilling Frozen Ground. Notice Tank for Heating Water.

much coarser and made of very hard nickel steel, for its function is to cut into the material being penetrated.

The pipe-head is screwed on the other end of the pipe, but it is not necessary to screw it up very tight. It must shoulder, however, otherwise the threads will be damaged in driving. This pipe-head is designed to support a circular platform, 4 ft. 8 in. diameter, and has four recesses fitting into projec-

Drilling With Spring Pole.

tions on the platform. The five sections of the platform, namely the four plates and spider, into which the platform can be sectionalized for difficult transport, are bolted together. The spider consists of a crucible-steel casting with angles riveted to it. This casting is a little larger in diameter than the pipe-head, so as to permit the platform to slip over and on it without difficulty. The platform, which weighs 120 lb., is made of sheet steel, and angles:

perforated to lighten it, and the holes are so spaced as to hold the rod wrenches used in coupling and uncoupling, and rods and tools described later. This casting has two projections under the plate with holes to permit the sweep of the horse-power attachment to be fastened with a pin. Two rod-holders are screwed into pedestals bolted on the periphery of the platform 180° apart; these holders are made of 1½-in. pipe threaded on one end and on the other end provided with spring-steel jaws so made that the rods are easily slipped between them but cannot fall out. The section of pipe with the cutting-shoe and pipe-head attached, is erected on the surface of the ground, where the hole is to be drilled. This is held vertical by one man and then the platform is lifted over and slipped upon the pipe-head by the other men.

Driving the Pipe.—The driving-cap is placed on top of the pipe-head, where it projects through the platform and two men mount the platform. The battering-ram is handed up to them and they drive the pipe into the ground.

The driving-cap is a cup-shaped crucible-steel casting with a 1½-in. hole through the centre to receive the battering-ram pin. The battering-ram is a log used like a paving-ram with a wrought-iron ring on the bottom to prevent splitting. It has two handles made of 1-in. pipe, each end of which should project 12 in. from the log. These handles are placed about 30 in. above the driving end and the two pipes are at right angles to each other. This log should be 10 to 12 in. diam. and 4 to 6 ft. long, or it can be made like a paving ram, 14 to 16 in. diam. for about 3 ft., and 6 to 8 in. diam. for 2 ft. of its length respectively. It should weigh about 200 lb. A guiding pin may be driven into the centre of the driving end and fastened by a drift-bolt driven transversely through the log and through the pin. The pin must be securely fastened or it will become loose and fall into the pipe. The function of this pin is to guide the ram in driving and cause it to strike fairly on the driving-cap. This pin must project from the ram about 40 in. or its end may come out of the pipe at the time when in driving the ram is at its highest point.

As soon as the pipe has been driven a few inches into the ground, it requires less steadying; one more man then mounts the platform and assists in driving. Extreme care must now be taken to keep the pipe vertical, otherwise a crooked hole and subsequent trouble may result. When the pipe has been driven two or three feet, the ram and driving-cap are taken down. The horse-power attachment is then applied, the horse hitched to it and tied to the platform. The horse-power is essentially a structural-steel sweep, 12 ft. long. One end straddles the hub of the platform and is articulated to it by a pin. At the other end is a single tree and a wheel 12 in. diam. This wheel projects downward at right angles to the sweep and supports the outer end of the sweep.

Boring.—Sometimes, when the top material is barren, or it is not desired to sample it, the hole may be started by using the auger-drill spoon. As the name indicates, this tool bores, drills, and holds the material, even of the consistence of a stiff clay or hardpan. It has an auger point on a tapering barrel in the side of which is a slot, one edge of which is sharpened. The manipulations are as follows:

Before it can be used it must be screwed to a drill-rod section to which is attached the drill-rod handle so as to be at a height of 3½ ft. when the tool is erected and standing on the surface of the ground. The drill-rods are about 1 in. square and made in 5-ft. lengths with taper-thread screw-couplings. These couplings can be jointed and unjointed with less than three revolutions, and the threads cannot be crossed in coupling. By aid of the drill-rod handle the drillmen turn the auger-drill spoon or lift the string of tools, as the case may be. It consists of a crucible-steel jaw and two handles with a tool-steel locking and gripping device. Its construction is such as to permit rapid adjustment, attaching, or detaching, up and down, to and from, the rods, respectively.

The drill-auger spoon is manipulated like a post-hole auger and its construction is such that material is held in the barrel while being lifted out of the hole. When the ground is dry, a small amount of water is thrown into the hole to make the loosened material cohere and so not be dropped as the tool is raised from the hole. This tool, which can be made to penetrate roots or hardpan, by alternate lifting and driving it forcibly into the hole, and then turning, makes a hole large enough to receive the pipe at the rate of 10 to 30 ft. per hour. When material is barren and can be bored in this way, it is advisable to do so, for most rapid progress can be made. Sometimes in starting, a hole is shoveled to the depth of 2 to 3 ft. instead of doing as described above. The only precaution to be taken in working the auger-drill spoon is to keep the hole perpendicular. It is advisable to have two lengths of 1½-in. gas-pipe about 6 ft. long to slip over the ends of the drill-rod handle to give greater purchase.

Inserting the Pipe.—In case the hole has been started by boring or by shoveling, the pipe, to which the cutting-shoe and pipe-head have been attached, is placed in the hole, the platform put on, and the horse-power attached. All is now ready for drilling and beginning to take the sample. If the hole is dry, one or more buckets of water are poured into the pipe, for the pumps will not work unless there is water in the pipe.

Drilling.—The roustabout hands up the three rod-wrenches and a drilling pump to a man on the platform, who hangs the pump on a rod-wrench and lowers it into the pipe until it hangs suspended on the wrench resting on the top of the pipe-head. The rod-wrench is a forged-steel tool with an opening slightly larger than 1 in. square to fit loosely on the rods and squares on the tools. The rod-wrench has several uses: (1) as a handle and to raise or lower the tool or string of tools; (2) to suspend the tool or string of tools while hanging in the pipe; (3) to make or break joints in coupling or uncoupling the rod-sections and tools; (4) as a stop when making or breaking joints, by one of them straddling the

handle of the other and fitting through one of the holes in the platform, so preventing the first from turning.

A length of rod with graduations in inches is screwed to the drilling-pump and set up tight. This is done as follows: A rod-wrench is made to straddle the handle of the wrench, from which the pump is suspended, and at the same time to pass through one of the holes in the platform. A third wrench is then used to screw tight and set up the joint against the wrench, acting as a stop. When breaking joints, this operation is reversed. The drill-rod handle is now attached near the top of the drill-rod. The rod and pump are lifted off the suspending wrench by the drill-handle, the stop and suspending wrenches are then removed, and the string of tools lowered until the pump rests on the material in the pipe.

At all times the length of the string of tools in the pipe bears such a relation to the length of the pipe in use, that the depth of core in the pipe can be read by reference to the graduations. Thus, if there is no core, which means that the bottom of the pump is even with the edge of the cutting shoe, the zero mark of the graduations will be opposite the top of the pipe-head. For example, should the number 6 appear level with the top of pipe-head, it indicates that there are 6 in. of core in the pipe. On the other hand, should the zero mark drop below the top of the pipe and into the pipe-head, it shows that the tool is below the bottom of the pipe. This—drilling below the pipe—should be generally avoided, as it endangers the accuracy of the sample.

To resume the drill operations; suppose a considerable core to have been attained through driving the pipe and the depth of this core is read on the graduations and noted in the field-book. The horse is started and the pipe is thus rotated. At the same time, the men on the platform commence drilling by operating the string of tools, as in ordinary churn-drilling. The result of these operations is such that after 15 or more strokes, part of the core is crushed or drilled and forced up into the pump and held there by the valve. Simultaneously, the rotated pipe, being loose, sinks into the ground because of the weights of the platform and of the men on it; being assisted by the jarring due to the blow of the string of tools. The horse is stopped, the string of tools is raised and one rod-wrench placed on the square of the pump just below the coupling, thus acting as a support. A second rod-wrench is used as a stop by straddling as before, the third rod-wrench is used only to break the joint, while the unscrewing is easily completed by hand. The length of rod is lifted off and is stood with one end in the pedestal, and the other in the spring-steel jaws of the drill-rod holder. While one man is removing the rods, a second lifts out the pump and passes it to the roustabout, from whom a third man has taken another pump or tool, which he hangs on a rod-wrench and lowers into the pipe. The length of rod is again screwed on and set up, churn-drilling is resumed, and the horse is started as before. The roustabout carries the pump to the dump-box, into which he inverts it slowly until it stands on end. Usually the contents of the pump fall into the box and sufficient water is poured through and upon the pump to thoroughly wash it. It is frequently necessary to shake the pump in order to dump all the material. The coupling is dipped into water in order to remove all particles of sand and grit from its threads, and the pump is set in a convenient place.

The operation, as thus described, really carries the unique features of Empire drill apparatus, that is, the pipe is sunk by weight and by rotation with a horse, and a core is obtained, crushed or drilled, and pumped simultaneously. In ordinary placer prospecting with power 'rigs,' these operations are not simultaneous, but follow each other and each requires a change of heavy tools with diverse manipulations. Thus, first the pipe is driven to obtain a core; second, the core is drilled to crush it, so that it can be pumped; and third, the crushed core is pumped. These same results are simultaneously obtained by the rotating of the weighted pipe and the use of this special tool, the drilling-pump.

APPALACHIAN OIL DEVELOPMENT IN 1910.

By Raymond S. Blatchley

The Appalachian field includes the States of New York, Pennsylvania, West Virginia, and southern Ohio. Drilling in this region was only about half as extensive as the previous year, yet the new production held up remarkably well. This was due to increased activity in the Shinniston pool in Harrison county, West Virginia. In fact, West Virginia was the centre of new work for the year. Elsewhere steady development keeps up the usual annual yield. Several gushers were drilled in during the past 11 months.

The following table gives the new development by months, according to the *Oil City Derrick*, for the Appalachian fields, the average production of the new wells being given in barrels:

	Wells Completed.	New Production. Bbl.	Dry Holes.	Average of Productive Wells.
January	398	6297	122	22 9/11
February	359	3819	113	15 7/10
March	373	4481	124	18
April	479	5320	177	17 8/10
May	562	5622	170	14 1/2
June	582	5189	192	13 31/100
July	520	3582	174	13 1/2
August	460	3296	161	11
September	437	4042	134	13 1/3
October	411	2843	151	10 9/10
November	393	2633	124	9 8/10
December	...	....	...	..
Totals	4974	47,124	1642	

The following table gives the number of wells drilled in the Appalachian fields since 1907:

	1907.	1908.	1909.	*1910.
Alleghany county, N. Y.	575	493	468	264
Pennsylvania	3611	3748	3958	1812
West Virginia	1320	1329	1810	1501
Southeastern Ohio	1335	1344	2285	1397
Totals	6841	6914	8521	4974

*For first eleven months.

The Illinois Coal Industry

By Frank W. DeWolf

Several incidents of the year in Illinois coal mining have been without precedent. The strike, lasting from April 1 to September 10, opened the markets of the State to coal from Indiana, Ohio, West Virginia, and Pennsylvania, while miners suffered from hunger and mines from idleness and deterioration. Railways and large consumers thrived for a time on coal placed in storage in March, but the small consumer paid high prices all the time, and even the large users finally suffered. The Illinois Coal Operators' Association was all but disrupted, and the Walker faction of the United Mine Workers, though successful in winning the strike, apparently pulled farther away from the central organization and to this extent contributed to the growing friction. Despite the long period of idleness, it is likely that the coal production of the State for the calendar year will not fall far behind that of 1910. Illinois has probably lost second place to West Virginia. During the fiscal year* ended June 30, 1910, 48,717,753 tons was mined, in spite of the idleness of the closing three months. The figures are only half a million tons less than for the preceding year. Abnormal production in March in anticipation of the strike explains the large output. There are 881 mines. This industry required the labor of 74,634 men; some 350,000 people depend on it, directly, for support, and whole communities in 55 counties, indirectly so. It is an important revenue producer for 35 railroads. Since 1897 the output has increased 145%; the number of employees, 115%. In 1909, exclusive of the Cherry disaster, 213 men were killed and 894 seriously injured.

Notwithstanding its magnitude, perhaps because of its rapid development, the industry is not prosperous. Though daily wages are high and the mines are capable of producing coal at considerable profit, the average number of days of operation of the shipping mines in 1910 (fiscal) was only 171, so that remuneration to labor and to capital alike was unsatisfactory. Overproducing capacity has resulted in extreme competition and decline in profits. This is partly due to the anthracite strike of 1902, which created an artificial demand for coal and coal mines in the Middle West, and in part to the discovery of superior coal in southern Illinois where extension of railroad lines and the opening of mines has been rapid. The waste involved is enormous. Capital is tied up in mines for which there is no need; 70,000 men are employed but little more than half time, although 50,000 would amply suffice and be better rewarded, and 20,000 men would thereby be released to other vocations; the cost of production is materially increased by reason of irregular operation of plants; the tendency to centralize ownership of mines, as the weaker enterprises are wrecked, is unmistakable; the coal deposits can not be conserved when the pressure to control the cost of production is so insistent, neither can the physical condition of the mine, which involves the safety of the employees, be made what it should.

The strike of 1910 followed the failure of the Peoria Joint Convention of February 24, and the failure of the Joint Scale Committee to reach an agreement before March 31. Two weeks later the joint executive board of the miners and operators adopted an agreement covering emergency and repair work pending a final settlement of the difficulties. The Joint Scale Committee, in session at intervals, concluded that it could not reach a complete agreement, and referred the question to the second State Joint Convention which reconvened at Peoria, May 10. This second convention adjourned on May 20 without effecting a settlement. The miners were contending for an extra advance of 3c. per ton in the mining rate of Williamson and Franklin counties, and of 2c. per ton in the longwall mines of northern Illinois; also, for payment of the wages of shot-firers by the operators. The Operators' Association offered to advance mining rates 3c. per ton in all districts and to increase the price for day wages, dead-work, narrow-work, etc., 5.55%, as demanded by the Cincinnati convention of the United Mine Workers of America. Failing to reach an agreement, the convention adjourned on May 20 as stated. Four days later operators of the fifth district, representing 40 mines in St. Clair, Perry, Madison, Clinton, and Randolph counties, and of the ninth district, representing 32 mines in the same counties and the adjoining counties of Montgomery, Macoupin, and Bond, seceded from the Operators' Association and formed a district organization which promptly closed an agreement with the Mine Workers. Shortly afterward the Bunsen Coal Co., producing coal from a number of large mines in the Danville district for use of the United States Steel Corporation, also signed up with the miners. These movements came as a body blow to the Operators' Association, since it reduced their membership about 25%. Contributory to the settlement of the strike in favor of the miners was the existence of the Tanner and the Mitchell laws which prohibit importation of labor, and which also require miners to hold certificates of competency from county boards.

The strike threw on the operators the cost of shot-firers and increased the mining scale above that under which the Indiana mines operate. The differential in Williamson and Franklin counties still gives this region an advantage over the fifth and ninth districts. The operators feel that the failure of the miners to keep the agreement that hoisting engineers, pumpmen, and others necessary to maintain the welfare of mining property should work pending an agreement, was dishonorable, and renders future agreements of doubtful value. They feel that the fight between followers of T. L. Lewis and J. H. Walker makes factional politics of paramount interest to the miners, and brings about a sacrifice of principles important at once to the interests of miners, operators, and consumers. Mr. Walker's

*Fiscal year statistics are those published by David Ross, Secretary, Illinois Bureau of Labor Statistics, *Mining and Scientific Press*, November 26, 1910.

friends, on the other hand, feel that affairs were in such critical shape and the disruption of their union was so imminent, that self-preservation demanded the course actually followed. Naturally they are much gratified at the outcome of the long strike. The public at large is glad to note that a provision of the final settlement requires that in the future the question of scale will be taken up early, so as to permit a thorough understanding of the issues in time to prevent strikes. An effort will be made to complete agreements before March 10. Should this be impossible, a commission will then be appointed to sit until matters are adjusted. This will consist of 9 miners, 9 operators, and 3 disinterested men. It is interesting to note that J. A. Holmes, Director of the U. S. Bureau of Mines, is named as one of the three disinterested parties. Another agreement, that to arbitrate certain difficulties, is also commendatory. It is to be hoped that the present lack of harmony between the miners' factions can be arrested before further havoc is worked with the United Mine Workers' Association. A return to the condition of disorganization, carrying with it the inability to make group agreements, would certainly be deplorable. As a result of the strike, Illinois has lost some of its natural market. Splint and semi-bituminous coal from the East have acquired a foothold in the Northwest, and can only be displaced after considerable time, if at all. Production in the Northern Illinois fields, which naturally aspire to the market of the Northwest, has not regained normal volume. In the Southern field, on the contrary, the output during the four months since the strike, even making allowance for car shortage, has probably been above normal. Although railroad rates on coal have recently been raised, it has been a horizontal increase which still gives the Southern coalfields an advantage over Central and Northern Illinois in the competitive market.

Notwithstanding the somewhat disastrous year in the coal industry, legislative provision for study and revision of the mining laws is a sign of progress. The Commission appointed in 1909 presented to the special session of the Legislature in 1910 a number of comprehensive changes in the mining laws, including a requirement for installation of mine telephones, emergency gongs, fireproof stables, and fire-fighting hose. Most of the provisions have now been subjected to actual test, and have proved desirable. The law requiring installation of gongs, however, is regarded as a failure, and a provision for its repeal, together with new recommendations, will be presented to the Legislature convening in January 1911. The Commission created for the establishment of Mine Rescue Stations has been actively at work during recent months, and announces that the new Springfield station will be dedicated for active work early in January. Progress on the Benton and the La Salle stations is also satisfactory, and 15 sets of helmets and auxiliary apparatus, representing one-third of the total equipment, is now available for use in case of accident. The State rescue-cars connected with each station will probably be used to carry training to the mining camps, in case it is found that operators do not send their miners to the three central stations for training in rescue and first-aid work.

Few new mines have been opened during the last year, though a number formerly abandoned or closed on account of accident have been re-opened, and other new properties have been developed to their maximum capacity. This is particularly true in the vicinity of Matherville in Mercer county, and Norris in Fulton county. The Cherry mine has been re-opened to work the lower coal, but the workings in the upper seam are abandoned. The West Frankfort mine of the Dering Coal Co., which was the scene of a serious explosion, has been re-opened after an idleness of a year. Similarly, the Leiter mine at Zeigler, which has been the scene of several fatal explosions, has been entirely recovered and is being operated under lease by another company.

THE YEAR ON THE COMSTOCK LODE

Encouraging results have marked the course of development on the famous old Comstock in 1910. The Mexican and Ophir mines have been the scene of the principal operations in the Virginia City portion of the Lode; activities at the Gold Hill end are confined chiefly to the deep levels adjacent to the Ward shaft. During the year the water-level

C. & C. Shaft With Sub-Station of Gen. Elec. Co. in Left Foreground, Virginia City, Nevada.

at the C. & C. shaft of the Consolidated Virginia mine has been lowered from the 2350 to the 2650-ft. level, which is only a few feet above the bottom of the C. & C. sump. This has been accomplished by means of the Evans hydraulic ejector, which raises the water from the 2600-ft. level to the Reidler pump on the 2150-ft. level, which, in turn, lifts it to the level of the Sutro tunnel, about 20 ft. above the 1750-ft. level of the shaft. This has unwatered, not only the Con. Virginia, but also the Ohpir, Mexican, and Union workings to the same level, the 2600, there being open workings connecting these mines below the 2000-ft. level. The group of mines south of the Con. Virginia, including the Gould & Curry, Hale & Norcross, Savage, Chollar, Potosi, and some others, seem not to have been affected by the drainage of the Con. Virginia-Union group, there being no direct connection with them. Contrary to expectation, water seems not to have found its way along fissures, contacts, and other channels in the

intervening ground. The water-level in the great Combination shaft remains practically stationary, at about the 2000-ft. level.

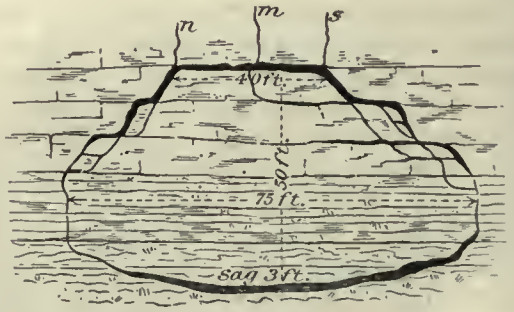
In the Mexican mine a vertical winze was sunk 500 ft. from the 2000-ft. level, and a level opened on a fissure in the east vein formation several hundred feet east of any of the old workings. A contact of the famous diabase dike with the earlier hornblende-andesite has been reached, and the diabase is found much altered, silicified, and mineral bearing, some excellent ore having been found. This ore occurs as a silicification and replacement of the shattered diabase, and is 40 to 50 ft. wide, and apparently is wider with depth, as demonstrated by development. The hope of the management lies in expectation of finding rich ore in quantity in this zone of mineralization, some very rich ore having already been discovered. During October the Mexican produced bullion valued at $17,000, though the November output was somewhat less, owing to lack of milling facilities, as the Butters plant was closed before the end of the month. This recent production of the Mexican is significant in consideration of the fact that the aggregate production of the mine in the previous 50 years had been but $2800, notwithstanding the fact that between $3,000,000 and $4,000,000 was expended in development during that period. A deep winze is being sunk in the Union mine on the 2000-ft. level, 1400 ft. east of the Union shaft, the object of which is to explore this east mineral-bearing formation in that property. This is 800 ft. north of the deep winze in the Mexican, and several hundred feet east of the line of contact, as developed in the latter mine. It is still in the diabase, which here shows little sign of alteration, though this is not unusual in the diabase where it occurs on the foot-wall side of an orebody, so there is no present indication of the proximity of ore in the Union winze, though it may not be far distant. There still remain many unsolved geological problems on the Comstock Lode, notwithstanding the hundreds of miles of development. One surprising thing, however, is that no mine manager has ever attempted to explore this east contact on the level of the Sutro tunnel, although there is every favorable 'sign,' except ore itself, where the tunnel crosses the contact. It would be well to run drifts both north and south from the Sutro tunnel along this contact. The probability is that such work would result in discovery of ore in both directions.

The Ward shaft on Gold Hill has been retimbered and is in good condition to the depth of 2475 ft. A pump-station has been completed at the 2100-ft. level, and a large electrically-driven Scranton pump installed there. At present it is lifting 2,000 000 gal. of water daily. A station is being cut at 2400 ft., which, when completed, will also be equipped with a large pump. Through the Ward shaft it is expected to recover the lower levels of the mines at the Gold Hill end of the Lode, and deep-level operations in the Yellow Jacket, and some others, are deferred pending the completion of the installations now being made, and the draining of the deeper workings.

Upper Mississippi Valley Zinc

By G. H. Cox

During the year 1910 the mining industry of the upper Mississippi Valley has been recovering from the great slump of 1908. There is now a spirit of conservatism that has never been seen before in the district. The irresponsible promoter, upon whose shoulders rests most of the blame for losses in the past, has left for greener fields. The true promoter which any mining district needs is still to be found, although most of the leases and purchases are now made by operators dealing directly with land-owners. During the past year leases were obtained by the payment of reasonable royalties and without the large cash bonuses required a number of years ago, before the property could be entered. Prospecting is now largely conducted in an intelligent manner by companies which already have producing properties. The price for drilling to the oil-rock has decreased from $1.25 to 75c. per foot, and the present employment of experienced drillmen results in excellent logs and samples. As usual in districts of this character, the tendency has been to mine the ore in the most rapid, rather than the most



Crevices n, m, s., Pitches and Flats, and Sag Characteristic of Upper Mississippi Valley Mines.

(From U. S. Geol. Survey.)

economical manner. It is generally considered that the mines are of too short life for any 'experiments.' The expansion of the larger companies has changed these conditions somewhat, and three lines of improvement are especially seen. In the first place, the shovelers are now paid largely by the 'can' and not by the day as formerly. While this has greatly increased the pay, it has nearly doubled the efficiency of these men and has made a saving of about one-third in the cost of loading and hauling the ore to the shaft; it also eliminates the former scarcity of such labor. In the second place, many of the operators, having experimented with various types of pumps, have reached the conclusion that the geared-lift pump, the old Cornish pump with its walking-beam replaced by gearing, is the most satisfactory and economical for the work of this district. There is, however, a tendency to increase the size of the column and decrease the number of strokes. In the third place, the Missouri style of mining the ore from one large face by the use of deep holes and large charges of powder has been introduced in a number of the mines with a considerable saving in the cost of excavation. The gen-

eral milling practice remains about the same as in past years. There has been a slight decrease in the amount of ore left in the tailing, and there is an interest in the possibility of decreasing the amount of fine and increasing the savings.

The Wisconsin and Illinois fields have been greatly benefited by the construction of an electric plant at Galena, Illinois, by the Interstate Light & Power Co. This plant is capable of developing about 5000 hp. and is connected by direct lines with the principal mining centres, at which points the current is stepped down and distributed to the various mines. So far, the introduction of electrical power has failed to lower the general operating expenses, but the following advantages are generally claimed by the mine operators: (1) decrease in the size and the installation cost of the plant; (2) the power is on day and night, except when it is necessary to stop for repairs; (3) it eliminates the difficulty of obtaining and storing coal for constant or intermittent needs. The Wisconsin industry is stronger than during the previous year. Numerous small companies have been organized, and the large companies have increased their holdings in view of future needs. This expansion has been especially by the Wisconsin Zinc Co., the Frontier Mining Co., and the Vinegar Hill Mining Co. Prospecting and mining have been carried on not as heretofore, but practically always with a care and consideration of geologic conditions. In Iowa, the Avenue Top mine at Dubuque is the only one that has been operated. There is, however, some prospecting and a small amount of ore is being obtained on the farm of Sam Strommy near Elkader. The ore production of northwestern Illinois has been limited largely to that from the Vinegar Hill, Hoosier, and Northwestern mines, which have been active throughout the year, and to the Unity, which started its mill early in the spring. During the past year prospecting has been carried on by the Vinegar Hill Mining Co. in the vicinity of the Vinegar Hill and Unity mines; on the property formerly known as the Pittsburg but now as the Great Western mine; and on the old Buck Hill range north of Galena. The Hoosier Mining Co. has been drilling to extend the outline of the orebodies of its mine and also on property one mile south of Galena. The Great Western mine has installed a gasoline engine, hoist, and pump, and is prepared to continue the sinking of the new shaft. The Ten Strike and Merry Widow mines, two miles west of Galena, have carried on development, and the former has produced ore. The Black Jack, Pilot Knob, Sheboygan, and Appleton mines have been inactive, and the last has been dismantled. The Royal Princess mine in the old California diggings has been kept dry and has seen some development, but has not been a regular producer. In the Elizabeth district the Kansas mine, which was running in 1909, has been closed, and the Skene mine plant has been dismantled. During the past year there has been no active mining in the Elizabeth, Stockton, or Morseville districts. In the vicinity of Mt. Carroll, at the extreme southern edge of the district, between 5000 and 6000 lb. of galena was taken from the farm of Judge Turnbough.

Gold Dredging in California

By Charles Janin and W. B. Winston

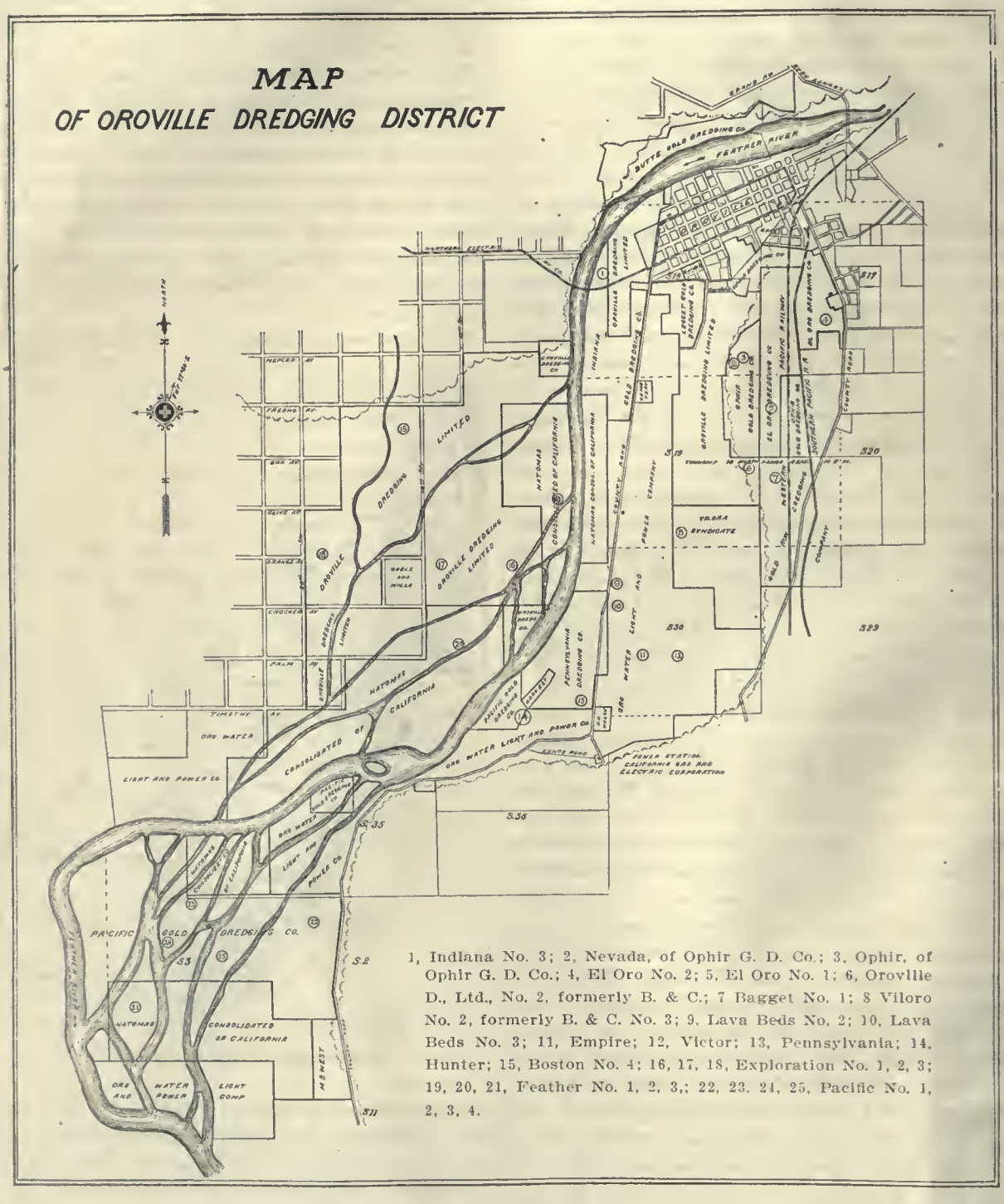
In 1910 there were 58 dredges in active operation in the State during most of the year. Two dredges were dismantled, one in Butte county, having worked out the property, and one old type dredge in Sacramento county, being no longer suited to the conditions under which it was required to operate. One dredge was shut down in Siskiyou and one in Placer county. Construction of four large 15-ft. bucket dredges was begun, one of which commenced operations in December. Also one 7-ft. bucket and one of 5 ft. were commenced. The following table shows the dredges operating at the end of December 1910, as well as those that were idle, dismantled, or under construction during the year. The counties and companies are arranged according to their relative importance in gold production and number of dredges operating.

In Butte county, Feather No. 3 dredge, which is

Gold-Dredging Localities in California.

under construction, will be put in operation during 1911 in the Oroville district on the north side of the river on property of the Natomas Consolidated of California. This dredge, which is being built by the Yuba Construction Co., and which will be the largest in the district, will be equipped with 15-cu. ft. close-connected buckets and will have a maximum digging depth of about 50 ft. below water-level and a capacity estimated at 350,000 cu. yd. per month. In Yuba county, Yuba No. 13, now being constructed by the Yuba Construction Co. for the Yuba Consolidated goldfields, will be equipped with 15-cu. ft. close-connected buckets and will be the largest gold dredge in the world, operating to a depth of 65 ft.

below water-level. In this district the Marysville Gold Dredging Co. began construction during the year on a new dredge, Marysville No. 3, which will be equipped with 7-cu. ft. buckets. The machinery for this dredge was in part furnished by the Union Iron Works. In Sacramento county, Natomas No. 8 dredge, which was constructed in 1910 and put in operation during the month of December, is equipped and contemplates installing a 9-ft. bucket dredge during 1911. In Calaveras county the Mokelumne Mining Co., operating on the Mokelumne river near Comanche, dismantled its old dredge early in the year and is now constructing a new hull for a 5-cu. ft. bucket boat. At the beginning of the year the Isabel Dredging Co., operating near Jenny Lind on the Calaveras river, changed hands and is now prin-



1, Indiana No. 3; 2, Nevada, of Ophir G. D. Co.; 3, Ophir, of Ophir G. D. Co.; 4, El Oro No. 2; 5, El Oro No. 1; 6, Oroville D., Ltd., No. 2, formerly B. & C.; 7 Bagget No. 1; 8 Viloro No. 2, formerly B. & C. No. 3; 9, Lava Beds No. 2; 10, Lava Beds No. 3; 11, Empire; 12, Victor; 13, Pennsylvania; 14, Hunter; 15, Boston No. 4; 16, 17, 18, Exploration No. 1, 2, 3; 19, 20, 21, Feather No. 1, 2, 3,; 22, 23, 24, 25, Pacific No. 1, 2, 3, 4.

with 15-cu. ft. buckets and will have a capacity of 350,000 cu. yd. per month. Natomas No. 9 dredge, which is under construction, will be practically a duplicate of No. 8. Both of these dredges will operate on Rebel hill at the upper end of the district. They were constructed by the Yuba Construction Co., and will be the largest dredges operating; digging partly cemented gravel to a depth of 55 ft. below water-level. In this county the Union Dredging Co. has secured some land above Folsom

cipally owned by I. L. Borden, of San Francisco, the resident manager being F. J. Estep, under whose direction the dredge has had a successful year, many former working difficulties having been overcome. In Placer county the Bear River dredge has been shut down temporarily, and there are no dredges now in active operation in this county. In Siskiyou county, the Scott River dredge has been shut down, probably permanently, owing to difficulties in dredging on the slate bedrock. The Siskiyou dredge, be-

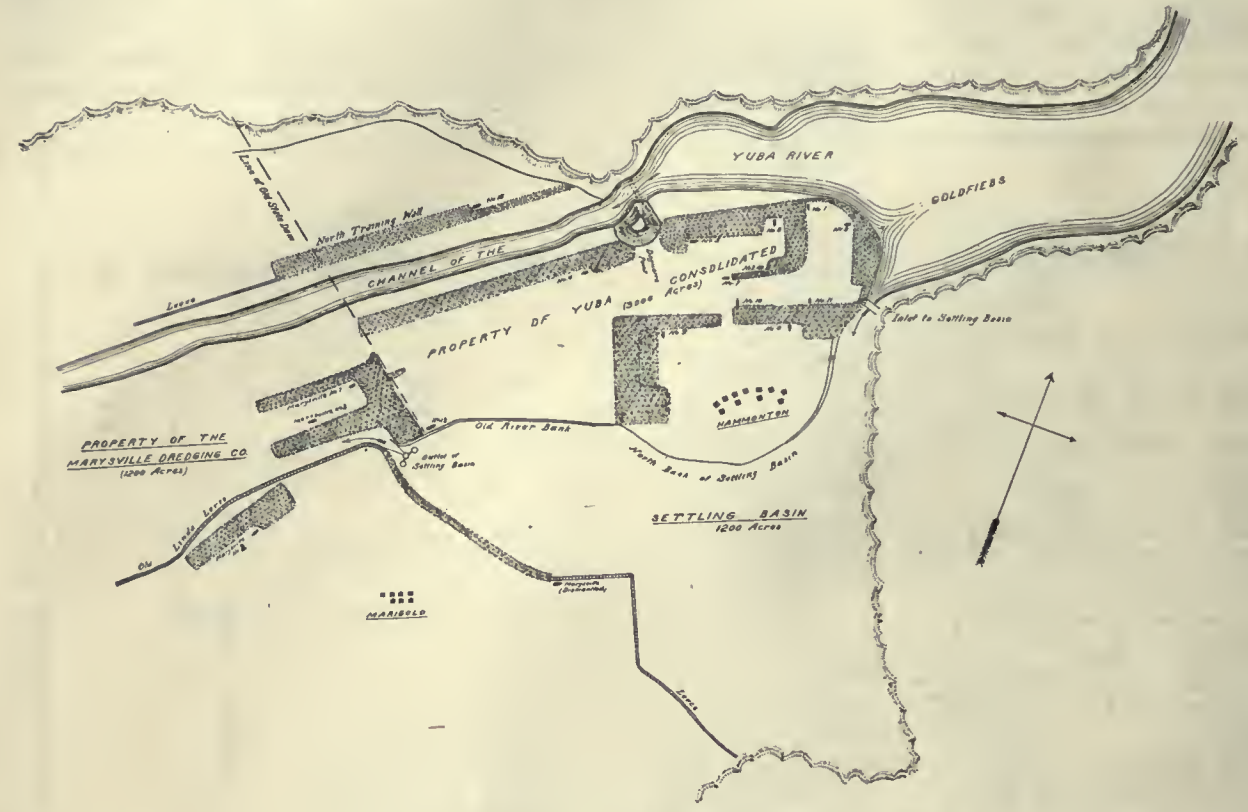
DREDGING OPERATIONS IN CALIFORNIA IN 1910.

County, District, and Name of Company.	Name of Dredge. Operating.	Idle or dismantled.	Constructing.	Total.....	Type.....	Cap. buckets, cu. ft.....
1. BUTTE COUNTY.						
OROVILLE DISTRICT.						
Oroville Dredging, Ltd.....	California No. 2..	.....	.....	..	*	5
	Exploration No. 1.	.....	.....	..	*	3
	Exploration No. 2.	.....	.....	..	*	5
	Exploration No. 3.	.....	.....	..	*	7
	Boston No. 4.....	.....	.....	5	*	7
Oro Water, Light & Power Co.....	Lava Bed No. 2..	.....	.....	..	*	5
	Lava Bed No. 3..	.....	.....	..	*	5
	Empire	.....	.....	..	*	5
	Victor	.....	.....	..	*	5
	Hunter	.....	.....	5	*	5
Pacific Gold Dredging Co.....	Pacific No. 1.....	.....	.....	..	*	7
	Pacific No. 2.....	.....	.....	..	*	4
	Pacific No. 3.....	.....	.....	..	*	5
	Pacific No. 4.....	.....	.....	4	*	7
Natomas Con. of California.....	Feather No. 1....	.....	.....	..	*	8
	Feather No. 2....	.....	.....	..	*	8
	.....	.....	Feather No. 3.....	3	*	15
Ophir Gold Dredging Co.....	Ophir	.....	.....	..	*	5
	Nevada	.....	.....	2	*	4
El Oro Dredging Co.....	El Oro No. 1.....	.....	.....	..	*	5
	El Oro No. 2.....	.....	.....	2	*	5
Indiana Gold Dredging Co.....	Indiana No. 3....	.....	.....	1	*	4
Viloro Syndicate, Ltd.....	Viloro	.....	.....	1	*	7
Pennsylvania Gold Dredging Co...	Pennsylvania	.....	.....	1	*	6
Gold Run Dredging Co.....	Baggett	.....	.....	1	†	7
Butte Dredging Co.....	.....	Butte	.....	1	*	3½
(District total, 11.)	24	1	1	26	..	..
WYMAN'S RAVINE DISTRICT.						
Leggett Mining Co.....	Leggett No. 4....	.....	.....	1	†	5
L. and J. Gardella.....	Gardella	.....	.....	1	†	5½
HONCUT CREEK DISTRICT.						
Kentucky Ranch Gold Dredging Co.	Kentucky	.....	.....	1	†	5
Gardella	Gardella	.....	.....	1	†	5
BUTTE CREEK DISTRICT.						
Butte Creek Con. Dredging Co.....	Butte Creek	.....	.....	1	‡	11
(County total, 16.)	29	1	1	31	..	..
2. YUBA COUNTY.						
Yuba Con. Gold Fields.....	Yuba No. 1-2.....	.....	.....	..	*	6
	Yuba No. 3-12....	.....	.....	..	*	7½
	.....	.....	Yuba No. 13.....	13	*	15
Marysville Dredging Co.....	Marysville 1 and 2	.....	.....	..	*	7½
	.....	.....	Marysville No. 3..	3	*	7
(County total, 2.)	14		2	16	..	..
3. SACRAMENTO COUNTY.						
Natomas Con. of California.....	Natomas No. 1....	.....	.....	..	*	13½
	Natomas No. 2....	.....	.....	..	*	8
	Natomas No. 3....	.....	.....	..	*	8
	Natomas No. 4....	.....	.....	..	*	13
	Natomas No. 5....	.....	.....	..	*	9
	Natomas No. 6....	.....	.....	..	*	9
	Natomas No. 7....	.....	.....	..	*	8½
	.....	.....	Natomas No. 8....	..	*	15
	.....	.....	Natomas No. 9....	..	*	15
	.....	Eldorado	.....	10	†	5
Ashburton Mining Co.....	Ashburton	.....	.....	1	*	7
(County total, 2.)	8	1	2	11	..	..
4. CALAVERAS COUNTY.						
Calaveras Gold Dredging Co.....	Calaveras No. 1...	.....	.....	1	*	5
Isabel Gold Dredging Co.....	Isabel	.....	.....	1	*	5
Mokulumne Mining Co.....	.....	.....	Mokelumne	1	*	5
5. SISKIYOU COUNTY.						
Siskiyou Dredging Co.....	Siskiyou	.....	.....	1	*	5½
Scott River Dredging Co.....	.....	Scott River	.....	1	*	7½
6. SHASTA COUNTY.						
Shasta Dredging Co.....	Shasta	.....	.....	1	*	5
7. MERCED COUNTY.						
Yosemite Mining & Dredging Co...	Yosemite	.....	.....	1	*	3½
8. STANISLAUS COUNTY.						
La Grange Gold Dredging Co.....	La Grange	.....	.....	1	*	7
9. PLACER COUNTY.						
Bear River Mining Co.....	.....	Bear River No. 2..	.....	1	*	7
10. ELDORADO COUNTY.						
Eldorado Placer Mining Co.....	Cash Rock	.....	.....	1	†	5
11. TRINITY COUNTY.						
(State total, 31.)	58	4	6	68	..	..

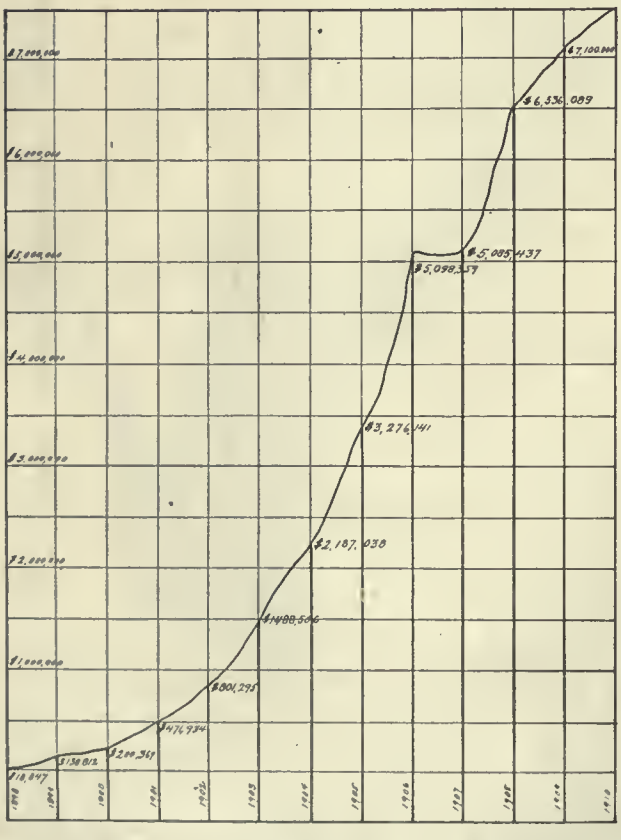
*California type. †New Zealand type. ‡Ed. L. Smith type.

longing to the Siskiyou Dredging Co., has had a successful year, the gold recovered from operations greatly exceeding the estimates from prospecting the property. It is reported that a small Risdon dredge has been operating during the year on the

There are several small old-type dredges idle in the county, and it is reported that E. L. Smith is to install a dredge near Weaverville, similar in type to that now operating near Butte creek, above Chico in Butte county.



Sketch of the Yuba Basin, Showing Dredges; Tailing Areas Shaded.



Production of Gold From California Dredges, 1898 to 1910.

The production of gold won from dredging operations in California in 1909 amounted to over $7,000,000, exeeeding the production of 1908 by approximately $500,000. In importance of production and

American River Dredging Field.

A, Ashburton M. Co. Dredge; No. 1 to 9, inclusive, Natomas Con. Dredges; Black Triangles 1 and 2, Rock-Crushing Plants.

El Dorado county side of the American river at Cash Rock near Forest Hill. As far as can be learned there were no continuous-bucket elevator dredges operating in Trinity county during the year.

numerical strength of operating dredges the counties ranged as follows: first, Butte with 29 dredges, and a production of about $3,000,000; Yuba second, Sacramento and the balance in the following order:

Calaveras, Siskiyou, Shasta, Merced, Stanislaus, Placer, El Dorado, Trinity. Statistics for 1910 not being available, the production for that year is estimated as nearly as can be determined at this date at $7,500,000. The relative position of the counties in importance of production may possibly be slightly changed. The lead which has been maintained by Butte county since the beginning of the dredging industry in California, will be closely competed for by Yuba county, and the latter county will probably be in the lead in 1911. Much of the land in the Oroville district has been worked, and in general the dredging companies work their best land first, so it is to be expected that from now on there will be a gradual decrease in the production from Butte county. A steady increase, on the other hand, may be expected from Yuba, Sacramento, and several other counties, for some years.

All of the dredges constructed during 1910 are of the California type. With the exception of six small ones of the New Zealand type, all of which except the Baggett are working in ground not exceeding 15 ft. in depth, all dredges now operating in the State are of the California type. It is evident that this type of dredge has proved its superiority over others, and that it is eminently successful is shown by the constantly increasing gold production of the State from this source, although the richest ground in California has been exhausted for some time. There was a controversy some months ago in the London mining papers over the relative merits of the New Zealand and California types of dredge. The champion of the New Zealand type was a manufacturer of such boats and consequently possessed of some knowledge of the subject, though, as might be expected, he was prejudiced in favor of his own boats, upholding the open-connected buckets, and lead-line dredge, and contending, among other things, that the dredges developed and used in California were far heavier and consequently more expensive than was necessary. Such statements would imply that the dredge operators of the State were not progressive, were blind to their needs, and oblivious to all dictates of reason and experience. The first successful dredges in California were those of the New Zealand type equipped with open-connected buckets, head-lines, and short-tray tailing stackers, and for a number of years dredges of this type were used with varying success. When attempts were made to work deeper, and cemented gravel had to be handled, it was found necessary to install heavier machinery to withstand the increased strain, and the modern California type dredge with close-connected buckets, spuds, and belt tailing-conveyor was gradually developed after years of experimentation. This dredge embodies the ideas of successful operators and engineers who worked with and greatly assisted the builders in developing them. It should be recognized that where the ground is shallow and easy digging, or where the area is not sufficient to warrant the installation of an expensive dredge, a light well constructed boat may be advantageously employed. The strongest argument, and, in fact, the only argument that should be necessary in favor of the California type dredge is, that practically all dredge operators in California, who are constantly on the alert for better appliances, and who have spent much time and money in investigating and testing dredge machinery, have demonstrated to their entire satisfaction the superiority of the present California type, with buckets from 5 to 13½ cu. ft., both for yardage handled and for working costs. With these dredges it has been possible to work areas that even a few years ago were considered economically impossible as dredging ground. At one time there were about 28 New Zealand type dredges operating in this State; now there are but six, as shown by the table accompanying this article, out of a total of 69 dredges in California in 1910. These dredges are cheaper than the spud dredge, with close-connected buckets, and it is obvious that had not the merits of the latter been thoroughly proved the California operator would still continue to use those of the New Zealand type. The consulting engineer of a dredging company operating in Burma previous to contracting with The Bucyrus Co. for a California type dredge, carefully investigated the merits of the various dredges manufactured in England, Holland, France, Germany, and the United States. His decision after a thorough study of the subject was to select a Bucyrus dredge of the California type as best suited to practical purposes. It is also interesting to note the opinion of a well known New Zealand dredge engineer, who recently visited the California dredging fields, that dredge construction and operating methods in California are far ahead of those of any other country.

The Butte district is best known to the public as a copper camp, but its zinc deposits perhaps exceed those of copper. Zinc mining has been discouraging so far owing to the complex nature of the ore. The silver mines are also important, and gold, lead, and tungsten mines have yielded good profit. The Goldsmith, in the northern part of the district, is one of the biggest silver mines of the Northwest. Ore discovered recently on that property by lessees yielded about $18,000 per car shipped to the smelter. Practically all of the new mining properties which were in a favorable state of development during the height of the copper boom and were compelled to shut down when the panic came, are still idle. The most important of these are the Amazon-Butte, Pilot-Butte, Colusa-Leonard Extension, Butte & London, and Butte & Bacorn. All of these have good properties, but it will depend on the copper market of the world whether they will resume operations.

The Cripple Creek gold output to December 1, 1910, is $215,000,000, and of silver 1,035,490 fine ounces. The first gold taken from the district was in 1891, with a production for that year of $449; silver was not produced until 1893, when 5019 fine ounces was sent from the district. From 1891 on, gold production steadily increased until it reached a high mark in 1900, with $18,073,539, and since that time it has been as low as $10,913,687, in 1907.

Progress in Treatment of Gold and Silver Ores During 1910

By Alfred James

General.—It seems particularly appropriate that America should this year take pride of place in progress. During past years it has been customary to refer to the practice at Kalgoorlie, or New Zealand, or South Africa, as ranking highest. This year improvements effected by such men as F. C. Brown (Idaho), J. V. N. Dorr (Denver), A. Grothe (Mexico), and C. W. Merrill (San Francisco) have been more generally adopted, and it can scarcely be doubted that for advanced successful practice such mills as Philip Argall's at Stratton's Independence, Goldfield Consolidated, Homestake, Esperanza, San Rafael, Dos Estrellas, and El Oro, take precedence. Kalgoorlie, renowned some years back for its successful pioneer work in the treatment of telluride ore, appears lately to have been resting, and its main effort for the last two years would seem to have been the adoption in a few cases, mainly for re-treatment purposes, of the fixed submerged (Cassel) filter. But this position of calm by no means indicates that all difficulties have been overcome. On the contrary, metallurgical troubles are possibly more prominent in the Colony now than for some years past. One misses the battle-cries of the stalwarts, 'Roasting *v.* Bromo-Cyanide', 'Wet-Crushing *v.* Dry-Crushing', 'Tube-Mills *v.* Pans'. Since Robert Allen published his valuable work on Western Australia practice but little new has come to light except for an occasional thought-compelling article by M. W. von Bernewitz, whose contributions to current technical literature should surely be collected for future reference.

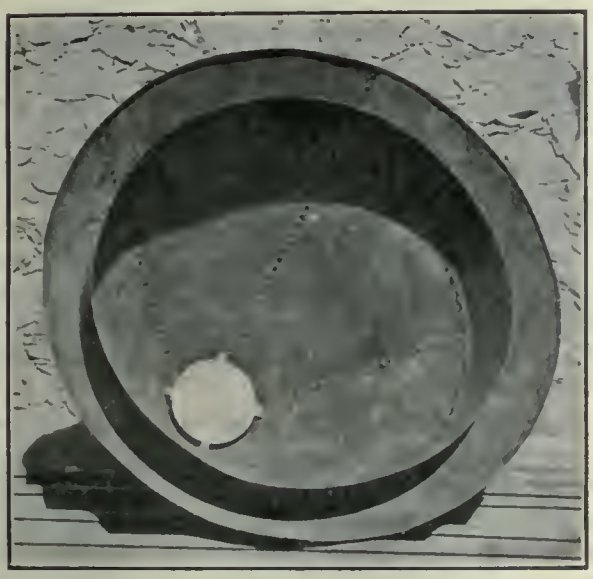
Africa still pursues its determined course of increasing the weight of stamps, although sound unshaken criticism shows no gain from such increased weight other than that resulting from the employment of fewer units. It has seemed to me that for the last three years Africa has been missing the point to which J. R. Williams and L. H. Diehl set themselves with such characteristic energy and carefulness, namely, the utilization of stamps for coarse crushing only, the finer comminution of particles being effected by tube-mill, and it has been apparently left to E. H. Johnson, of the East Rand Proprietary Co., to regain the laurels for the Rand in this direction by his work—referred to later—showing the advantage of increasing their present ratio forthwith from 2 to 10%. Even today the average duty of stamps on the Rand is less than that of the lighter stamps at the Giant in Rhodesia, and at the El Oro in Mexico—and there can be no doubt as to the toughness of the El Oro ore. The El Oro company indeed has been steadily showing the world for some time past how light stamps of under 1250 lb. weight can by the use of tube-mills be made to produce the heavy output above noted. Provided the tube-mills are not overloaded with pebbles, there seems no question as to the economy in power of such practice, and the better extraction resulting is undoubted. Recently, in a case where it was necessary to obtain the highest possible output with an amount of power severely limited, various schemes were tried, and finally the ratio selected as the most economical for this particular purpose was 6 tube-mills to 36 (1250-lb.) stamps, or 16.6%. This compares with the Waihi Grand Junction practice of 9 tube-mills to 40 stamps, the Santa Gertrudis practice of 10 tube-mills to 60 stamps (1550 lb.), the La Blanca practice of 6 tube-mills to 40 stamps (1250 lb.), and the El Oro practice of 14 tube-mills to 100 stamps (varying weights), and altogether surpasses the proportion of 7½% not long ago asserted by a Rand engineer to be the highest ratio in the world. The Rand has been considerably stirred of late by the introduction of the Butters filter. It must be considered a great personal triumph for its introducers. It promises to be even more widely adopted than the Adair-Usher process, and already, as a result of the operation of the plant at the Crown mine, installations are in hand for some other well-known mines of the district.

Rhodesia continues to pursue its own path of progress. First to set the pace in crushing with its 10-ton output at the Giant, it also appears to be the first actually to install and use 2000-lb. stamps, at the Bucks Reef, but its metallurgy appears to be conducted on more enterprising, though possibly more cautious, lines than that of the Rand; thus Pachuca vats are already adopted there, though the caution of the engineers is shown by their care actually to recover all their gold when once they have it in solution, and so two of the most recent plants, the Globe & Phoenix and the Lonely Reef, have installed the possibly to the American mind old-fashioned but safe Dehne presses, of which there is now quite a number of installations in that territory.

Eastern Asia has adopted air-agitation pretty generally, but is not yet altogether enamored of vacuum-filtration. A good general idea of the trend of practice may be gained from a perusal of Mark R. Lamb's recent excellent article in the *Engineering and Mining Journal*.

Concentration.—New methods of crushing have modified former practice, and the professional designer has now to face the problem of concentrating after very coarse crushing by stamps or after very fine sliming in tube-mills. E. Girault was able to deal with the problem characteristically and very neatly at Pachuca. Finding that his impalpably-slimed concentrate would yield to concentration, he crushed to a moderate mesh only (10 to 12) and installed Wilfley tables, which he uses as classifiers. He passes all his pulp over them and sends the concentrate to tube-mills, where it is ground with continuous return of the ground material to the Wilfleys until the latter cease to retain the impalpably-slimed particles, which are then in fit condition for cyanidation. But this simple method is unavailable when the concentrate has to be set aside for shipment or other special treatment, and in this case one has to face the loss in the pulp of comminuted particles which will not be separated out on the vanners. It

seems to me that to minimize such loss as would arise from the second grinding of already slimed concentrate particles it is desirable to adopt two-stage concentration: (*a*) tables for a sized product screened from the coarsely crushed (3 to 6 mesh) stamp-battery output and (*b*) vanners for the material from the tube-mills. The pulp for (*a*) could be separated out by Callow screens and then sized in cones for concentration as coarse and fine sand. Such a plant indeed may be seen in the Montana-Tonopah, but F. L. Bosqui in his later plant (Goldfield Consolidated) showed, it seems to me, no little daring and enterprise by boldly doing away with the tables and relying on vanners after tube-mills only. The decision must have required some courage and Mr. Bosqui certainly deserves credit for the successful working of his scheme. It is naturally to be anticipated that in his new sphere of labor, assisted and not hindered by local talent and experience, he will give a no less good acount of himself and be responsible for some fresh developments in African practice. Certainly the profession is indebted to him for his Goldfield Consolidated equipment.



Caldecott Diaphragm-Cone.

While on this subject of concentration, it may be well to add that Walter McDermott—no mean authority on the subject—makes the point that no table can be expected to compare with a belt for slime concentration for the reason principally that the concentrate once settled should not be disturbed until delivery. In spite of the real success of such tables as Deister No. 3, Mr. McDermott's point must be considered well taken, especially in view of the practice of slime concentration as carried out on tin floors, where ultimate recovery of high-grade concentrate is only possible by the settlement of the heavier particles and the surface washing off of the latter without disturbance of the former; a number of settlings and surface washings being requisite for ultimate success. A well-known authority in Mexico has discovered that his concentration costs him much less per ounce of bullion recovered than his cyanidation, and adds: "Experiments that I have made here lead me to believe that more profitable results can be obtained by thorough concentration and doing away with the cyanide process. You will see that *if* 85% of the metal could be gained by concentration, that method would prove more profitable than cyanide with a 96% recovery." I have italicized the 'if,' as that is just the rub. A small proportion of rich concentrate costs naturally but little per ounce, compared with the expense of cyaniding much lower grade material, but let him attempt to obtain from pulp of the same value (concentrate tailing) by further concentration, the same commercial recovery that he does by concentration, and his figures will alter amazingly. It is becoming more and more the practice for mines to treat their own concentrate on the spot. The cost of shipment plus charges, extras, fines, and deductions, is found to work out at a high figure, and even the Alaska Treadwell, which until recently owned its own smelter, is credited with saving $11 per ton of concentrate by the cyanidation on the spot.

Crushing.—The use of tube-mills has now become so general that there is but little to add to previous remarks on this subject. There has been no startling development in liners, which are mainly of silex blocks or of cast-iron pebble-retaining grooves, with local preferences for longitudinal bars or bolted plates. The reverse-screw in the discharge-end, first suggested by Walter Neal, is becoming more widely adopted as its advantages become known. As stated above, the Rand has been lagging behind Mexico and New Zealand in the number of tube-mills to stamps, but in his latest crushing results, E. H. Johnson, of the East Rand, has been able to obtain a 20-ton daily output per head from 80 stamps (1680 lb.) and 8 tube-mills, using a screen with 8 holes per square inch, with a final product of 90% through 90 (0.006-in.) mesh, of which 50% is treated as slime. Individual tests at the Cason and Angelo, East Rand Proprietary, show results of 23 to 25 tons per head with an estimated saving in power of 50%, and it is therefore proposed to equip the 220 stamps there with 22 tube-mills. On the other hand, as the *South African Mining Journal* points out (September 10, 1910), the Randfontein Central (Robinson group) is being equipped with 600 stamps and only 16 tube-mills for the same duty as the 220 stamps with 22 tube-mills mentioned above.

Dewatering and Classifying Pulp.—The wellnigh universal adoption of simple methods for effecting this object is possibly the greatest feature of the progress of the year. Reference has been made in these notes last year[1] to the Dorr classifiers, and now Charles Hoyle, at the Esperanza, uses a classifier which economizes height to an even greater extent than the Dorr and at the same time gives double the output. Mr. Dorr has modified his original gear and has a very cheaply operated and smooth-running machine. John W. Bell, at McGill, has a cone somewhat resembling the Caldecott, but with features of its own. It looks as if there may yet be a new conflict of 'Classifiers *v.* Cones'. At first

[1] *Mining and Scientific Press*, January 1, 1910.

sight the question is apt to be raised why classifiers, expensive in first cost and using power, should be used instead of cones, which are cheap and operate by gravity, but there is evidently a cogent reason, or the former would not be so extensively adopted. Probably a really continuous and automatic cone, which does not clog or require continuous adjustment, would readily win the day; which only shows that such a cone can not yet have materialized. For dewatering slime, the thickener suggested by Mr. Dorr is being widely adopted. Requiring but little space and little power for greater capacity, 30 or 35 ft. diameter by 10 ft. deep, and under 1 hp. for 100 tons of dry slime per diem, it has a variety of uses, so that it is difficult to predicate where its adoption will end. Used at present mainly for thickening pulp prior to agitation in Pachuca vats (Brown agitators), it is also convenient for use prior to vanners, not only delivering a pulp of the required thickness for most effective concentration, but at the same time, without pumping, sending to the vanner the necessary clear water for the operation (recovered from the pulp during thickening). A further use is the recovery of water used for sluicing away residue. This is a feature of the new Santa Gertrudis plant. While many thickening appliances have been referred to in recent years (see these notes for last year), no other seems so simple, cheap, and continuous as this.

Agitation.—The Pachuca 'tank' or vat continues on its path of triumph. The Transvaal is the latest country conquered, and in addition to the installation at French Bobs it is understood that the East Rand Proprietary is now putting in a number of them, while various modifications are also receiving much local consideration.

J. M. Nicol, in a criticism of these notes last year,[2] outlined a scheme, then in its infancy, suggested by A. Grothe and M. H. Kuryla (and J. L. Mennell?,) of continuous agitation in series in place of the use of each agitator as a separate unit, and this system has since been adopted at practically every new plant built in Mexico. It saves pumping, loss of level, and indeed is just the scheme for working these agitators in conjunction with the pressure-filters now coming so much into vogue, as the latter can be gravity filled, which makes the operation very cheap indeed. Mr. Nicol's criticism was so valuable, and his encomiums on the process so justified by its universal adoption, that I was content to bless the misunderstanding which evolved the criticism. I criticised a suggested process for treatment by continuous decantation in Pachuca tanks without filtration or any other method of recovering solutions from pulp. Mr. Nicol inferred that I was criticising the new suggestion of continuous agitation, *followed by filtration*, hence his valuable letter. The process I criticised is now as dead as the proverbial doornail; the method Mr. Nicol described will probably extend to the ends of the earth. There were two other criticisms of my notes. E. M. Hamilton[3] wrote to say that he obtained on the mines under his control results superior to those I ascribed to the fixed submerged filter. (Doubtless 'shortly' I shall be able to give the filter a definite legal name instead of risking the result of attaching to it any one of the seven names by which I have heard it described.) This is precisely what one would anticipate from one to whose professional work we are all so deeply indebted. Mr. Hamilton, I feel sure, would never countenance work on such lines as some of that which I came across, and I should like to confirm his remarks by adding that the best work accomplished by any filter of this type which I have yet seen in operation was that which I recently examined at a gravity-filled plant under Mr. Hamilton's professional supervision. There was another criticism, by Ralph Nichols,[4] who is remembered as the engineer that introduced to Kalgoorlie such up-to-date methods as the Moore filter and Merrill precipitation. Mr. Nichols will very possibly agree with me in stating that the possibility of channeling in the Dehne press—which up to date produces a greater proportion of the world's gold output derived from slime than all other filters and methods including decantation, and can therefore be considered a reasonably successful machine—not altogether improbable in a method of filtering by montejus formerly in vogue at Kalgoorlie, is much diminished, if not made entirely impossible, by the more recently introduced system of filling by pumps direct from the agitators and thus giving the pulp no time for that segregation in the montejus which led Herbert Moss to introduce air agitation as a corrective.

Recovery of Metals in Solution.—A casual observer who has noted the entire absence, of late, in the American technical press of the front-page announcements (regarding the great vacuum-filters) which used to amaze, or amuse, the public, must not thereby hastily assume that the day of vacuum-filters is over. May it not be rather that new processes or new fields are occupying attention formerly too highly localized or specialized? At any rate, Africa is paying a substantial and welcome compliment to the enterprise and business tact of one of the companies. But the fact remains that in the territory in which they have been mostly boomed, vacuum-filters appear to be suffering a setback. Pressure-filters are being widely adopted, particularly in the latest big mills, such as the El Oro, Esperanza, Veta Colorado, Santa Gertrudis, El Tigre, and El Carmen. At Guadalupe the Santa Gertrudis company had a prolonged and careful examination of the various prominent methods, ably carried out by Godfrey Doveton. The method of conducting these tests places the profession under no little obligation to Hugh Rose and the others concerned. The Moore (regular plant already in operation at the mill, the most recent one at that date at Pachuca), the Burt, the Merrill, the Sweetland, and the Kelly (at the outset only), were all represented, and the spirit of good-fellowship among the competitors would alone have made the test noteworthy. In the end the Mer-

[2] *Mining and Scientific Press*, February 26, 1910.
[3] *Mining and Scientific Press*, February 26, 1910.
[4] *Mining and Scientific Press*, April 2, 1910.

rill was adopted, with the Sweetland and Burt running very close in order of merit. As Mr. Rose justly remarks, however, conditions at Pachuca must not be held to be truly representative of any other conditions, and "a filter which is most suitable to our ores might be impracticable for others, and vice versa." The results of the tests are so interesting that I append a summary which shows how thorough they were. The total cost per ton of ore filtered, spreading the total cost and royalties, if any, taken for granted that because the re-washed feed to press assayed, for instance, 83.7 grammes Ag and 0.4 Au and the tailing as discharged 84 Ag and 0.4 Au, that therefore the press had made a recovery of over 99%. On the contrary, the discharged tailing was itself re-washed and the press debited instead of credited with any metal extracted during the process. This amount thus deducted varied from 0.5 to 4, and in one case 6 grammes per ton, or under 0.05 to 0.5% on the high-grade material

La Blanca Mill, General View.

La Blanca Mill, Concentrator Floor.

La Blanca Mill, Foundation and Framework.

over tonnage to be treated in five years, and including dissolved gold and silver lost, works out as follows:

	Cost, centavos per ton.	Dissolved metal lost, centavos.
Merrill	32.6	13
Sweetland	30.7	13
Burt	02.2	5
Moore	88.5	47
Butters	72.1	47

The full report shows the extreme care with which the tests were conducted. Thus, for instance, after determining the screen test, moisture in the feed, time and gauge pressure of cake-making; solution expressed; thickness, moisture, and weight of cakes, with the rate of flow during caking and washing; volume of wash, and of sluicing water; it was not tested. But even so, the recovery of the pressure-filters was very high indeed; approximating closely to 99%. In justice to the Burt filter, I ought to remark that the figure of cost in these tests, arising mainly from calculations necessarily based on a restricted output in the tests under consideration, must be regarded as quite exceptional and as not applicable to any other conditions. The extremely low loss of dissolved metal in solution is in keeping with the excellent work accomplished by this press at El Oro, where its cost of operation is as low as that of the Merrill at the adjoining mine, the Esperanza. Indeed, one of the most agreeable features of present North American practice is the decision of the owners of the pressure-filters that their presses are not invariably the best for any given ore and

that they will permit their presses to be installed only where suitable.

On the other hand, the vacuum-filters have not been idle. Butters can claim the great Dos Estrellas and Palmilla plants, while the Moore has two further installations at Pachuca to its credit, the Purissima and the La Blanca. A feature of the new Butters plant is the large pump and piping used for filling and emptying the filter-tanks so as to reduce the period available for the formation of cracks in the cakes. At the Crown Mines in the Transvaal the Butters engineers claim 0.12 dwt. residue, carrying 30% of moisture for 2d. per ton, which is remarkably good work.

It was a matter of surprise to me, after my experience at Waihi, to find the Mexican traversing filters were just as liable to the formation of cracks as those of the fixed-submerged type. They seem to manage things better at Waihi, and as the latter type of filter is supposed to require less acid than those used in Mexico, I have looked into the average costs and find that the cloths are cleaned once in every four months at a cost for labor and acid of 0.05c. per ton. This appears to confirm the above view. The Ridgway filters are working merrily along at the Great Boulder and elsewhere, but Ridgway, like every enthusiastic inventor, is busy at yet another filter. He is evidently anxious to have a new model with the washing capacity of the old type and the output of the new. But alterations of types scarcely make for permanency or for popularity. The Arbuckle process, with which persistent experiments have been made on the East Rand, does not yet appear to have been made a success, and it is rumored that the East Rand Proprietary is about to adopt the Butters filter.

Clean-up.—The substitution of Merrill presses for zinc-boxes has become more common this year, and the press has now gained a footing in Africa. At the Esperanza at the time of my visit (May 1910) the zinc-dust consumption averaged about 200 grammes per wet metric ton of ore, or about 3:1 of bullion. The precipitate carried about 60% of bullion and required no acid treatment whatever, but was simply melted down smoothly. The solution precipitated carried about 35 grammes of bullion per ton. It is essential to keep the press absolutely full of solution to prevent oxidation, and Mr. Hoyle, to whom I am indebted for much detailed information regarding improvements in Mexican practice, accomplished this by fitting a gooseneck to the discharge so that this reaches a higher level than the top of the press. In addition to all this, undoubtedly the substitution of a filter-press for all the paraphernalia of zinc-boxes and shavings gives a clean and neat practice, but to one who originally designed and first put into practice the type of zinc-box universally adopted over the world, the old-established practice would appear so firmly based as to not lightly be outplaced. But the scheme of J. S. Colbath, who was in charge of the well-run filter plant at El Oro referred to above, and incidentally the mine and business generally, whereby the use of a Merrill press was supplemented by a zinc-box, appeared to run smoothly to enable a much lower ratio of zinc-dust to be used (1:1) with consequent purer precipitate and less trouble in melting down. Mr. Colbath's idea, supplemented by his simple and efficient feeder the design of which he presents to the profession, is not to obtain absolute precipitation in the presses but to rely on a zinc-box to complete his precipitation. It might have been thought that as many zinc-boxes, though possibly with fewer compartments, would be required as before, since the amount of solution is the same, the press merely impoverishing it; but in practice one box seems absolutely affective; indeed, the precipitation appeared to be complete in the first two or three compartments.

Reference has previously been made in these notes to the failure of zinc-dust precipitation in Australia, New Zealand, South Africa, and India, but I admit that when face to face with an installation worked by experts, I am much more favorably impressed than with the results obtained by local enthusiasts based on information derived from written descriptions only.

Tilting furnaces are becoming more common. The practice of burning oil fuel in the melting-room without provision for the escape of the products of combustion to the outer air cannot be too strongly condemned. The old furnaces at Kalgoorlie were always connected to a chimney and no inconvenience was noticeable during fusing. The standard furnace runs with a consumption of about 120 cu. ft. of free air per minute at 45-lb. pressure, utilizing two Billow Atomizers Class F.M. and consuming 14½ kg. of Devoes' Brilliant oil per hour.

Among the prominent new mills of the year are the Bantjes (decantation), City Deep (2000-lb. stamps and decantation), French Bobs (Brown agitators, Butters filter, and Merrill precipitation), and Lonely Reef (Brown agitators and Dehne presses) in South Africa; and the Palmilla (Pachuca tanks, Butters filters, and Merrill precipitation), Veta Colorado (Pachuca tanks and Kelly filters), Carmen (Hardinge conical tube-mill and Kelly filter), La Blanca (Pachuca tanks, Moore filter, and Merrill precipitation), and Santa Gertrudis (Pachuca tanks, Merrill presses, and Merrill precipitation) in Mexico. The majority of these are not yet at work, although the Bantjes started some months since. In this case some tuning up seemed necessary, but this is natural to all new mills. (See an excellent article by A. W. Warwick, *Engineering and Mining Journal*, October 15, 1910.) The City Deep has not yet started, though the newspapers are crediting the 2000-lb. stamps as being designed for a duty of 9 tons each only. This is probably an error; the engineers responsible may be assumed to realize exactly the potentialities (expressed in these notes last year) of stamps of this weight. It is proverbially difficult to predicate from isolated examples, but it looks as though a high proportion of the new African mills will be designed for filtration instead of for the hitherto impregnable decantation, and that in the new Mexican mills the self-discharging presses will supersede the vacuum-filters in popular favor.

Revolutions and Mining

By T. Lane Carter

Not long ago there was published in the *Mining and Scientific Press* an interesting editorial on 'A Revolution in Honduras.' To those not acquainted with the Spanish-American republics, a revolution signifies the cessation of mining, and the stopping of all industry except that of fighting. Those of us, however, who have spent some time in these republics and have been in a revolution, know that they are by no means as serious to the mining industry as to the outsider, viewing events from a distance of 2000 miles and acquiring his information from the fertile and imaginative brain of a 'perspiring' newspaper correspondent. Of course, revolutions are not generally concomitant with successful mining, but in these Spanish-American countries you can usually keep running in spite of war's alarms. The greatest harm they do is to frighten outside capital.

There are times when a revolution means to improve mining conditions. Each party desires to stay on the good side of the foreigner, and frequently courts his favor by reducing taxation. Take, for instance, the case of the recent revolution in Nicaragua. Before Estrada and his following declared war against the Zelaya régime, the taxation on the mining industry was very heavy. One of the first acts of Estrada was to reduce the outrageous tariffs which Zelaya had placed on the imports consumed by the mines. The burden was cut in two by decree of the leader of the revolutionists. He also made himself popular with the mining people by abolishing a dynamite concession which had been given by Zelaya to some of his satellites, represented in Bluefields by the firm of Lopaz & Martinez. Not only was there a direct tax on every box of dynamite used by the mines, but a certain sum was paid on every box brought into the country and was appropriated by holders of the concessions. When the revolution broke out in Nicaragua the feeling among the majority of the people was that mining and other industries would have a far better chance than ever before. No one doubted for a moment that Zelaya and his crowd would be thrown out.

These revolutions interfere with the supply of labor. If the men at the mine had to choose between mining and fighting, there would not be many soldiers. The natives, however, are forced to join one side or the other. It all depends upon whether the revolutionists or the government recruiters reach the mine first as to whether the workmen become revolutionists or uphold the government.

After hearing rumors of an approaching revolution, the manager wakes up some morning at daybreak to find his mine surrounded by an armed force. These gentlemen have come to the mine to recruit soldiers from the miners. Their methods can not very well be designated as gentle. After a long parley with the recruiting officer, if you are diplomatic and suave, and have a good knowledge of the Spanish character, you may frequently persuade him to leave you one-half of your force. The other half of the miners marches off to the war, but you do not notice a martial air in the retreating forms. I have known of cases where a number of these volunteers would be sent down to the headquarters tied together with a long rope. With them there would be a note from the recruiting officer to the General in command, which would read as follows: "General: Please receive in good condition twenty volunteers. Kindly return the rope."

At one time I was in the wildest part of Spanish-America when a revolution broke out. I was the only American in the camp, none of my fellow-countrymen being closer than a two days' journey. The recruiting officer visited us early one morning and flashed a bull's-eye lantern into my face, saying, "You must join the revolutionists." When I told him that I was an American citizen there was not the slightest trouble as far as I was concerned. He obliged me by taking away only a small number of the men. My experience with revolutions in Spanish-America has been that the American who behaves himself has nothing to fear. There is a saying down there that if an American wishes to go to jail he must break in to get there. Of course there are exceptions. Cases of injustice are known to some of us, but now that the United States is giving more protection to the citizens in foreign lands there is a desire in these countries to give every protection to Americans.

Some mines are more fortunate than others. I know of one case in which the man in charge had twenty-four hours' notice that a revolution would break out, and that a press gang would be around to visit him to get volunteers. He simply whispered this news to the men, and the next day when the gang came out and surrounded the mine they found that nearly all the miners had fled to the thick forests.

There are some classes of the population in the Central American republics which escape military service when a revolution breaks out. In Nicaragua, for instance, the Jamaican negroes will not be taken away from you by the recruiting officers. These black gentlemen well know that the power of Great Britain is behind them. If they go to the wars at all it is because they wish to, not because they have to. If you ask the Jamaican what he is, he will tell you that he is a "British object, Sar." I do not know when he ceased being a subject. Another class in eastern Nicaragua exempt from military service is the Mosquito Indians. For many years the Mosquito coast was under the suzerainty of Great Britain, and when this section of the country was handed over to Nicaragua certain protection was promised to the Indians. It is because the Jamaicans and the Mosquito Indians are exempt from military service that every mine wishes to have a large proportion of these laborers. One-third Jamaicans, one-third Mosquito Indians, and one-third Spaniards, are the proportions aimed at. It will be seen therefore, that there are ways to keep a mine running in spite of the revolution.

The history of Central America for the last sev-

enty-five years is that of one revolution after another. Personally, I believe that the future outlook for revolutions and soldiers of fortune in Central America is bad, and, therefore, the outlook for mining in the coming years is much improved. The beginning of better times was noted when the republics, at the suggestion of the Mexican and United States Governments, reached a general agreement. Since this was signed there has been a great improvement in Central America. While it is still possible to have a revolution in a single republic like Honduras, it is now difficult to get up a general row. Honduras, for example, can no longer declare war on Nicaragua. Were it not for this agreement, there is no question but that Zelaya, in September 1909, would have involved all the republics in a bloody war. When it became known through the American ambassador that Zelaya had intentions of making war on other republics, the United States war vessels appeared off the coast

Map of Nicaragua.

of Nicaragua and thus averted a general outbreak of hostilities. Mining interests in Central America now feel sure that there will be no warring between the different republics. The next step will be to do away with internal revolutions in the individual republics, and make these turbulent centres as sedate as the Government of the United States. The outlook for peace is good and is growing better every year. Those acquainted with Central America know that there is a great difference between the republics. In Costa Rica, for instance, where revolutions are now unknown, mining and other industries are in a healthy condition. The populous republic of Salvador is also in a satisfactory condition. Probably Honduras is in the worst condition, with Nicaragua a close second, and Guatemala not far behind. The finances of Honduras are in a very bad state, but lately a proposition has been made to some leading American bankers to undertake the straightening out of the financial tangle of this unfortunate republic. Should this be done, the transaction will surely make for peace in Honduras. Nicaragua has just gone through one of the worst revolutions in its history. Zelaya, its evil genius, has been removed, and there is a feeling of relief in all the republics, just as there was in South America when the dictator, Castro, was recently removed from Venezuela. The new president of Nicaragua, Estrada, whom I have the pleasure of knowing, is most friendly to Americans and is eager to see mining resources of his country developed. The outlook for peace and stability in Nicaragua is therefore satisfactory. In Guatemala, mining is at a low ebb. The country has been a great silver producer, but at the present time the mineral output is insignificant. If Nicaragua were as well served with railroads as Guatemala, the gold output of the former would be materially increased. As a gold country, Guatemala is by no means as promising as Nicaragua. There are several districts, however, which will some day be big producers of silver, lead, and zinc. Mining and all other industries are much hampered by the unfortunate currency as well as the fear of revolutions. The fluctuations in the value of the paper money are so violent that the banks are at a great disadvantage. There is now a movement on foot on the part of some large financial houses to straighten out the currency problem of Guatemala. This will make for stability in the country and will aid mining as much as will the suppression of revolutions.

Those who have been to Central America and studied the mining possibilities there have been impressed with the vast undeveloped wealth of the republics. It is probable that the future history of the Central American countries will be a repetition of that of Mexico. Forty years ago there was no more discredited country in the world than Mexico. To get conservative capital interested in the country seemed almost impossible. By degrees, however, enterprising spirits undertook mining and other industries. Under the firm rule of Porfirio Diaz, huge sums of money have been invested there. In spite of the recent revolution in Mexico, even the most conservative owners of mining property have not shown any signs of panic. Their confidence in the future of Mexico is assured, and they state that they are convinced that a strong man will succeed the present ruler of the country. The enormous amount of capital that has come into Mexico has made for stability and confidence. By degrees capital will develop the Central American republics. The inter-republic wars are now done away with by the agreement entered into between the five republics. The increase in trade will make for stability, and in the course of years, revolutions will become as extinct as the volcanoes which overlook the Lake of Nicaragua. The completion of the Panama Canal will make these republics of far greater importance than ever before. The presence of the United States in Panama has already exerted an influence and will no doubt continue to make for peace. The troubles which face the miners and the capitalists in these countries are not overcome as yet, but the outlook is better today than ever before. Revolutions are, of course, always unfortunate, but I hope this article will show that their effects on mining in Central America are by no means as disastrous as would at first appear.

Iron-Ore Trade in 1910

By George H. Cushing

Placing the concrete facts of a given trade alongside the market gossip often produces striking contrasts. Unless prices are at top notch and collections easy, the trade gossip is inclined to be lugubrious. What is more to the point, the trade gossip correctly reflects the opinions of the traders, being gleaned directly from them. When it comes to the end of the year and there is an inventory, it may be found that a considerable increase has been made over the preceding year. The difference is not one either of tonnage or of profit, so much as it is one of disappointed hopes.

This philosophical and somewhat sophmorean introduction is inspired by the conditions existing in the Lake Superior iron-ore industry for the last year. From the opening of navigation last April to the close of ore shipments December 1, the persistent comment was that the business was far from flourishing. The carrying trade on the Lakes was unprofitable, because rates had to be held up by main strength. Furthermore, many of the bigger boats were tied to the docks for the better part of the summer. In the reports, the pig-iron trade has been languishing, with prices at rock bottom and no demand even at that figure. Furnaces were blown out and the influx of Southern iron was breaking the Northern market. In the steel trade, the buying has been practically nothing, because the railroads were harassed on one side by hostile legislation and on the other by the unfriendly attitude of the banks. This general slowing down of trade terminated the demand for coke before it began, and the coke-makers of the Connellsville district of Pennsylvania were beset to find a margin between production cost and selling price. Judging by the reports of the trade, the market has been awful.

Concrete facts are not so discouraging, especially for the ore shippers. They produced and sold within the season of navigation 42,620,201 tons of Lake Superior ore, compared with 41,683,873 tons for the season of 1909, giving them a gain of 936,328 tons. I submit that, considering the fact that this is a comfortable increase over the record year of 1907, and considering the business world is not fully recovered from the period of business depression, this was a splendid showing. Trade gossip will not admit it. The reason for that is that the ore shippers have been accustomed, in busy years, to jumps of 5,000,000 tons per annum in production, and feel aggrieved when their output falls a few thousand tons short of a million. Just the same, it is a question of disappointed hopes rather than an absence of real progress. Analyzing the figures of shipments, by ports, as compiled by the *Marine Review*, fails to bring out any peculiar significance. Previous years had shown, even on the surface, rapid gains in shipments through the ports from which come low-grade ores, and a decrease in the movement of the high-grade ores. To be specific, former years showed plainly that the Bessemer old ranges were falling off, while the Mesabi range was gaining. Broadly speaking, Escanaba and Marquette were losing while Two Harbors, Ashland, Duluth, and Superior were gaining. When a review of the chemistry of the year's shipments has been completed, it will probably show a further decrease in the average iron content of the ores shipped, but the surface indications do not show it. Escanaba shows a decrease in movement, but Marquette makes a corresponding gain. On the surface, the Bessemer old-range ores appear to have held their own, even though there has been a shift in the ports through which, principally, they are moved. On the other hand, Duluth and Superior seem to have made the largest gains; traceable, no doubt, to the increased shipments by the United States Steel Corporation from its own land. This fact may have something to do with the traders' comment to the effect that the market was dull; commercial mines may not have found so ready a sale for their ores as formerly they did. Exact figures to support this theory are lacking. It is a fact, however, that the Steel Corporation is developing its own lands in preparation for the opening, in vigorous form, of its new mills at the south end of Lake Michigan, at Gary, Indiana. The movement of boats, in increasing numbers, between the head of the lakes, at Duluth and Superior, and Lake Michigan points, may have had something to do with the difficulties in the way of giving ships employment at profitable rates. It surely was not a good year for either ship-owners or shipbuilders. The season started off early with no serious labor trouble, boats getting under way about the middle of April. The ore trade was then in a state of great expectation. The opening of the second half of the year was confidently expected to bring a full return of the period of business activity. The iron and steel interests wanted to be prepared for it and, regardless of certain stocks on lake docks and at furnaces, shipped down enormous quantities of iron ore from the head of the lakes. Iron trade hopes were indicated by the fact that the June shipment of ore amounted to 7,316,592 tons, which was a new record. The second half of the year failed to bring the expected trade revival, and the ore shipments began to fall off, the July tonnage being below 7,000,000 tons. There was a gradual letting down from that time, the reaction being especially marked after October 1. In November the slump became pronounced, and the movement was only 2,641,886 tons. At the end of November, ore shipments ceased absolutely, whereas a year ago a fair tonnage was moved in December. The influence upon the carrying charges was pronounced. Prior to the formation of the United States Steel Corporation Lake freight rates were peculiarly subject to the old law of supply and demand and were the subject of constant barter. For a good many years the freight rates had been around 90 or 95c. per ton, but with the opening of this century and the increased size of boats, there was a tendency for the rates to drop off to 85c. Then came one spectacular year—due to a quarrel between big inter-

ests—when the rates went up to $1.25. That was just prior to the formation of the Steel Corporation and was immediately followed by that company fixing a stable rate of 75c. per ton between the head of the lakes and Lake Erie ports, this rate including the unloading charge, as formerly. This rate has remained unchanged until this summer, when a renewal of the old bartering over charges was threatened. Owing to forceful persuasions on the part of a firm of powerful attorneys, the Steel Corporation consented to a maintenance of the old rates, even though, after the end of June, a good many boats went into ordinary. It was demonstrated, however, that owing to the increased size of the boats, the equipment of the docks with modern unloading machinery and the facilities at the furnaces for receiving and holding iron ore, it was possible to handle a vastly increased volume of freight with the same equipment. This has acted as a chill upon the shipbuilding industry for the time and has had a reflex effect upon the iron and steel trade. With more boats making the shorter run to Lake Michigan points from the head of the lakes and unloading at the splendidly equipped docks at Gary, this may be expected to increase rather than decrease. About the only offset is the promised demand for small boats to carry coal to the small and unimproved ports; this may give the shipbuilders some employment as the need for such boats has been strikingly expressed within the last season.

Looking broadly at the trade in finished steel products, the influences have been many and varied. It is now quite apparent that the big steel consumer, the railroad, has not been so greedy as upon former occasions, and this has not been altogether a matter of choice. According to figures compiled by railway experts, the carriers for the years 1908-9 were short in maintenance of equipment the tidy sum of $85,000,000 in round numbers, and enough more on maintenance of way to bring the total comfortably above $150,000,000. With that amount of assets taken from behind the capital, the bankers were not inclined to advance any more money for railroad development until that sum, which had been paid out in dividends, had been put back into the properties. This was hinted by George W. Perkins, of the firm of J. P. Morgan & Co. while upon one of his visits to Chicago. Obviously, there was but one way to obtain that money, and that was through an increase in freight rates. The various difficulties that have arisen, and which have so far prevented the increases from being made, are familiar to all. Since the railroads were without funds, they were not vigorous buyers of iron and steel; that is, they could not buy as much as the steelmakers hoped they would. Disappointed hopes led to the conclusion that the trade was extremely dull. What caused the rapid tumbling in values was the tendency of the steel and ironmakers to prepare for the expected demand, thus giving them facilities to far overproduce the actual demand. Thus, owing to the lack of balance, even temporarily, between supply and demand, the prices of pig iron ran off rather sharply, and No. 2 Foundry went as low as $12 at the Valley furnaces, with an average for the year of not over $14. This had an influence upon the production and sale of coke. The price started off vigorously, the producers reflecting the hopes of the steel trade. In the end, coke expressed the disappointment of the ironmakers, and as a result the prices went down to an equivalent of the cost of production, and, in some instances, even below that when sales were made on the spot market.

The Southern situation deserves, in this connection, one paragraph. Southern ironmakers, seeing the gradual exhaustion of the Bessemer old-range ores and the increased use of low-grade Northern ore, have been hoping for the time when their low-grade ore and open-hearth steel would give them an opportunity to command a certain share of the Northern market. In this connection, I am impressed with the tone of Southern comment of the last few months. A good many articles are being written calling attention to the freight-rate differential against the Southern ironmaker and calling for the Southern people to build at home a market for their home steel. This may be said to be one of the distinctive features of the year. Certainly it is a shift in sentiment which is significant.

At root in all this matter is the statement of the amount of iron ore shipped from the upper lake region. The figures, in long tons, are taken from the *Marine Review*, which makes a careful compilation, and are as follows:

Port.	November, 1909.	November, 1910.
Escanaba	701,646	452,351
Marquette	369,478	250,426
Ashland	600,469	276,612
Superior	758,073	635,002
Duluth	1,446,288	519,893
Two Harbors	1,023,266	508,062
Totals	4,899,220	2,641,886
Port.	To Dec. 1, 1909.	To Dec. 1, 1910.
Escanaba	5,632,421	4,959,869
Marquette	2,877,191	3,248,929
Ashland	3,736,744	4,093,822
Superior	6,505,527	8,437,261
Duluth	13,296,326	13,609,155
Two Harbors	9,116,150	8,271,165
Totals	41,164,359	42,620,201
1910 increase		1,455,842

Tin shipments from the Straits for the first half of December, according to cable advices of L. Vogelstein & Co., were 2080 tons, and for the second half are estimated at 2320 tons; total, 4400 tons. At this rate and allowing in the neighborhood of 3000 tons for U. S. deliveries, the visible supply promises to decrease about 1000 tons—practically a normal showing for a non-Banca sale month. If the Straits shipments are as small as expected there will be a decrease of 4000 tons for the year and a decrease in the visible of about 3000 tons. The price, however, which stood December 15 at 38c. as compared to 33c. last year, would seem to have discounted whatever favorable features there are in the situation.

Mining in the Belgian Congo, West Africa, in 1910

By Sydney H. Ball

The number of men employed in mining each year increases in the Belgian Congo, and though as yet this West African colony can scarcely be considered to have passed the prospecting stage, it at least gives promise of becoming a mining region.

The Kilo gold mine, situated in the northeastern part of the colony to the west of Lake Albert, is the only mine within the colony. This placer, worked by sluicing, is owned and operated by the State and employs about 28 white men and 2500 blacks. The production of this mine has been as follows, in ounces: 1905, 655; 1906, 6815; 1907, 10,545; 1908, 10,005; 1909, 21,085. In the first seven months of 1910 the production was about 2215 oz.

Map of Belgian Congo, West Africa, showing mines and transportation lines.

— Railroads
--- Projected Railroads
Head of Navigation
Mines and Prospects
Katanga Copper Belt
Katanga Tin Belt

Scale approximately 1" = 430 Miles

more than that of the corresponding period of 1909; in 1910, then, the mine should produce about 24,275 oz. of gold. The State likewise is reported to be exploiting on a small scale gold-bearing gravels near Bokwama on the Aruwimi river. These deposits, while less rich than those of Kilo, will, it is believed, pay the high costs of mining prevalent in central Africa. At least one other State gold deposit will be opened up, probably by dredging, in the near future.

In the southeastern part of the Belgian Congo is the Katanga copper belt first mentioned by Livingstone. In 1900 the Tanganyika Concessions, Ltd., began developing this belt for the old Congo Free State (represented by the Katanga Special Committee). The English company holds 45% of the shares and the State 55. There are 1,000,000 shares (par £1, quoted in the middle of November at £6 15s.), of which over 750,000 have been issued in addition to £2,600,000 in 5% debentures. The copper belt is about 200 miles long and contains over 100 distinct copper deposits, some of which are of large tonnage. The country-rock is sedimentary in origin and consists largely of sandstone, sandy schist, and limestone. The ore developed is almost wholly oxidized and is high in silica. The railroad from Rhodesia to Elisabethville (formerly called The Star of the Congo) in the Katanga, near which point the Tanganyika Concessions Ltd. is to erect its smelter, was to have been completed by September 1, 1910, and should certainly by now be in running order. The railroad has spurs to The Star of the Congo copper prospect, the limestone quarries at Mikola, and the smelter which will be located on the Lubumba river near Elisabethville. Later this road will be extended to the Kambove copper deposit, 90 miles northwest of Elisabethville. A smelter is en route, part being at Beira (a port on the east coast, 1700 miles from Elisabethville), and part on the road up country. This smelter, which has a capacity of 900,000 tons per year, should presumably in another year or two begin to produce copper in greater or less quantity. It is reported that the blast-furnaces will use European coke, and the gas producers depend on local wood. Eventually fuel will be obtained, presumably, at Wankie, Rhodesia, at which point there is a large coalfield. The results obtained in the smelting of this highly siliceous oxidized copper ore will be watched with interest. Until the erection of the smelter, there will presumably be but little work done on the copper prospects. The Ruwe gold mine in the Katanga, which has produced over 10,900 oz., is not at present worked. This gold was obtained by sluicing a blanket of residual matter, lying down the slope from a tabular mass of indurated sandstone. This veinlike body is 1200 ft. long, averages 8 ft. wide, and assays $17 per ton in gold, silver, and platinum. The tin deposits to the south of Lake Kabele which have not as yet been exploited, are reported to contain 20,000 tons of tin.

The Société Internationale Forestière et Minière du Congo, a joint Belgian-American company, has at present 25 engineers and prospectors in Africa. This company has exclusive prospecting rights over some 500,000 sq. mi. of territory. Particular attention is being paid to the gold-bearing gravels at the head of the Tele river in the Aruwimi region. These, so far as tested, run over $6 per yard. A party is also drilling dredging ground at Kanyama in the Manyiema west of Lake Tanganyika. The Grand Lakes railroad has suspended operations on the Bamanga copper prospect on the Congo river below Ponthierville. This company has at present about 20 prospectors in the field; the Lower Congo-Katanga railroad has four prospectors, and the Lower Katanga Mining Co. fifteen. The latter company has staked out one tin and two copper claims. Considerable interest is shown in the fact that the companies operating in the southern part of the Belgian Congo at widely separated points have found some 21 small diamonds, many of them of good water. It remains to be seen whether or not diamonds will

be found in payable quantities. As yet no workable coal beds have been found, and the fuel problem is unsolved. Thin stringers of coal are reported from one locality in the Katanga, while thin seams of lignite have been found by the Great Lakes railroad prospectors to the north of Ponthierville. This contains volatile matter, 47.94%; fixed carbon, 45.09%; ash, 6.97%. In the same region bituminous shale carrying 80 to 100 litres of oil per ton occurs. Recently a concession has been granted to build a pipeline from Matadi on the coast to Leopoldville, the lower limit of navigation on the Upper Congo. If built, this may aid future mines. Wood, some of which is good for fuel, is abundant in most mineral regions, while hydro-electric power can be generated at most points where ore has been found. Indeed, few countries will be more benefited by advances in the application of electricity to mining and smelting. When the difficulties, inherent to a country situated upon the equator, are overcome, it is probable that the Belgian Congo will in the near future possess a number of important mines.

QUICKSILVER FOR 1910

By Fred L. Lowell

The quicksilver situation for the past year was in as unsatisfactory condition as in 1909, although there was a slight increase in production in the United States. This was from the New Idria mine of San Benito county, California. The price was quite satisfactory during the summer, but as the year drew to a close there was a tendency to decline. The surplus stock on hand in California has been nearly exhausted because of recent large shipments to the Eastern States, and as the mines are not showing any great increase in production, and no new ones have been brought to the producing stage, it would seem that the price of quicksilver should advance soon. The market for quicksilver is regulated in Europe, so it is a hard matter to forecast the price in the United States. The consumption of the metal in the Eastern States is for the manufacture of drugs, fulminate of mercury, pigments, and scientific instruments. Most of the production of the past year has been consumed at home, in Central America, Canada, Mexico, British Honduras, Costa Rica, Guatemala, Honduras, Cuba, Nicaragua, Panama, Salvador, Santo Domingo, Brazil, Colombia, Ecuador, Peru, and Venezuela, with small shipments to Korea and the Philippine Islands. The manufacture of fulminate of mercury in Canada would account for a good portion of this export, while Mexico imports considerable for her mining industries. The extensive work going on in the construction of the Panama Canal has caused a heavy demand for powder and caps and, with the large mining operations in the United States, has caused a demand for mercury for fulminate. Honduras also imports considerable metal from the United States. The advance of the cyanide process in the treatment of gold and silver ores has caused a decrease in the demand for quicksilver for amalgamation. The substitution of earth pigments for mercury in the manufacture of vermilion has also caused a decrease in the use of the metal, but the products from the cheaper substitute are inferior.

The main supply of quicksilver comes from the Almaden mine in Spain, the Idria in Austria, and the Monte Amiata in Italy, named in the order of their production. The market for quicksilver is controlled by the Rothschilds of London and Paris, according to the Government reports. They have not shipped any mercury to the United States during the past year. The tariff of 7c. per pound protects local production. Exports from the United States for the year 1910 amount to 120,413 pounds of a value of $76,938. The amount exported during the corresponding first six months of preceding years was as follows: 1907, 384,918 lb.; 1908, 224,692; 1909, 510,241. The exports for the year 1910 show a marked decrease. There were no exports from June to the end of the year, and there were no imports of the metal during the year, according to the Government reports.

EXPORTS FOR 1910

	Pounds.	Value.
January	6,845	$4,570
February	8,797	5,514
March	69,257	45,210
April	3,430	2,196
May	17,965	10,934
June	14,119	8,514
	120,413	$76,938

The New Idria mine of California, which is the chief producer of the United States, is credited with an increase of production, and a total during the year of 10,800 flasks of 75 lb., and the Napa Consolidated, owned by the same people, with 500 flasks. The New Almaden, on the other hand, showed a decrease. The Guadalupe has a slight increase, and the Oceanic produces about 50 flasks per month. The Helen is not a steady producer. The total production for the United States for the year will be close to 18,000 flasks, or about 1000 flasks more than the year 1909. There has been a big demand for quicksilver from the Eastern States during the last few months, and the shipments have been made by rail rather than by water, in order to save time in filling orders; showing that there is something stimulating the demand. There has not been any large deposit of cinnabar opened during the year, but there have been reports of ore being found in Nevada. No mines there have been brought to the producing stage. The Black Butte mine in Oregon does not produce any great amount of quicksilver, and the deposit is one of low content in the metal; in fact, most of the ores being worked at the present time in California or other parts of the States are below 0.75%. Those of the New Idria averaged 0.496% for the year 1909. The mines in the counties north of the Bay of San Francisco are not great producers at the present time, because the bodies of payable ore near the surface have been worked out, and the mines are shallow. A few prospects have attracted attention lately, one being the Chicago mine near the Helen. It is not yet producing large quantities.

Improvements in Silver-Lead and Copper Smelting—I

By L. S. Austin

The advance during 1910 in silver-lead practice has been in the line of improvements in blast-roasting and in lessening the annoyance of smoke. In copper smelting is noted a remarkable development of basic converting which bids fair to cause radical changes in plant and equipment and in range of practice.

Copper Blast-Furnace Practice.—No change has been made in the size of the larger blast-furnaces. From 48 to 56 in. is the width at the tuyeres, and the largest furnace is that at Anaconda, 86 ft. long. However, the 56 in. by 15 ft. blast-furnace of the Tennessee Copper Co. has been recently narrowed to 44 in., and with that width the furnace runs fast, at times up to 800 tons in 24 hr. This may be contrasted with former performance at Anaconda of 420 tons, or the speed at Garfield of 650 tons. The operation of the 86-ft. blast-furnace thus far has proved the soundness of its principle; it operates better, is more suited to changes in the charge, and more certain in operation than the short furnace. On the other hand, since its capacity is 3000 tons daily, it needs a large property to keep it going. Where possible, advantage has been taken of the heat-giving quality of sulphide ores, increasing their quantity in order to reduce the amount of coke upon the charge—that is, the substitution of sulphides for coke. Since the calorific power of iron sulphide is 2400 calories as against some 7000 calories for coke, it is to that extent less effective.

The slag-spouts of the furnace and the forehearth, instead of being left open as heretofore, are covered by protecting hoods lined with ganister. This effectually retains the heat and so keeps the spout open. The high blast makes a good deal of fine, part of which builds up accretions above the feed-doors, and this tends to obstruct the outlet to the off-take. It is barred off two or three times monthly. Fortunately, it is self-fluxing, and when it drops into the furnace, can be readily smelted without the use of extra coke. At the Tennessee Copper Co.'s plant it has been found that where the matte is made in two stages there is less loss of copper in the slag than where single-stage smelting is performed. Here are some results:

	First smelting, per cent.	Conc. smelting, per cent.
Cu	0.23	0.37
SiO_2	41.0	38.4
Al_2O_3	5.5	3.4
FeO	41.3	45.8
CaO	7.2	7.3
MgO	2.4	1.9

The first matte assays 18.3%, the second 35 to 40% copper. Such first matte might be directly blown to copper in a basic converter, and it appears, that where used, this is done without undertaking to concentrate further in the blast-furnace.

Flue-dust disposal has been managed for some time by pouring low-grade, or first matte, into beds about 18 ft. wide, the borders of the bed being made of flue-dust. Upon this layer of molten matte is spread more flue-dust. Another potful of matte is poured on this, followed by another layer of flue-dust, and thus successively until the mixture constituting the bed is 8 to 12 in. thick. The flue-dust becomes incorporated with the matte, and the solidified material is broken up and fed to the concentration furnaces. Lately at Douglas, Arizona, where the converter matte is re-smelted, this is poured from the slag-car into a hopper, or funnel, into which, at the same time, is run flue-dust. The slag and dust form into balls or nodules of various sizes and make an acceptable addition to the blast-furnaces. In this way the slag may be made to carry 20% of its weight of dust.

Both at the Yampa smelter, Bingham, Utah, and at the Balaklala smelter, Coram, California, the coke is fed by hand and separate from the charge, being shoveled in at the end-doors of the furnace. At the ends of the furnace the feed-floor is lower, so that coke can be dumped there. The end-doors are then opened and the coke added by shovel. At Coram, the furnace being 20 ft. long, the coke when fed to the middle of the furnace must be thrown a distance of 10 ft. In handling certain ores at Coram coke is fed from the side with the charge.

Flame Indications in Blowing Copper Matte.*—In blowing copper matte, there are four distinct variations in the appearance of the flame. At the commencement of the blow there is an oxidation of zinc, lead, and arsenic fumes, and a burning of the sulphur and of coal which has been added at first to the charge. This is indicated by a full red flame carrying white fumes which after two to eight minutes begin to show at the lower central part a green color. Then begins the slagging stage, the iron sulphide being actively oxidized and forming a slag with the silica present. The green in the flame becomes more and more prominent, and after 15 minutes of blowing is of a vivid apple-green color. After 40 to 45 minutes of blowing, flashes of blue appear in the flame. These increase, and finally the flame is of a white-blue, due to the formation of copper silicate. It is a sign that most of the iron is slagged off, and at the end of some 60 minutes the white-metal stage has been reached. The slag is now poured off, some sweepings of matte and rich slag added, the converter is turned up, and blowing is resumed. The blow begins with a vivid red-brown flame and smoke, but this gradually decreases and a thin red-purple flame with some thin smoke results, this continuing with slight change to the end. The end of the blow, or 'calling' of the copper is most difficult to judge, but, besides the flame, to the experienced man the emission of little shots of copper, which no longer stick to the hood, is a guide. The second period of the blow takes from 60 to 75 minutes. The paper referred to gives color illustrations showing the flame at the four periods.

*Donald M. Levy. Bull. 74, Inst. M. & M.

Tooele Plant of the International S. & R. Co.—This reverberatory-furnace plant has been completed within the year and is now in operation. It is situated in Pine canyon, 4½ miles from Tooele Junction, which is on the main line of the San Pedro, Los Angeles & Salt Lake railroad. It is a compact side-hill plant occupying a space 1200 by 1300 ft., and is provided with seven miles of trackage. Its site was chosen so that it could be reached by a four-mile Bleichert tramway from the Highland Boy mine, Bingham. Smoke abatement agreements and options on adjacent lands were also secured in order to do away with the chance of damage suits and injunctions. The ore is put into receiving bins having a capacity of 3000 to 4000 tons. From these it is drawn upon conveying-belts which carry it to the crushing and sampling mill, all the ore being crushed to ⅜ in. for reverberatory treatment, since no blast-furnaces are used. There are four rows of 16-ft. diam. McDougall roasting-furnaces, eight in a row, 32 in all, whose combined capacity would be 1200 tons daily. The gases from these roasters, on their way to the stack, pass through a dust-chamber 140 ft. long, 120 ft. wide, and 30 ft. high. The cross-sectional area of the flue (3600 sq. ft.) results in a slowing down of the current to about 1 ft. per second, and this allows of an effectual settling out of the finest dust.* The chamber has a skeleton steel frame with curtain walls and thin flat-arched roof. Thus the frame is independent of, and does not rest on, the walls, giving proper stability and permitting of expansion without injury to the structure. The interior I-beam posts are cased in brick with an air-space. Air enters the air-space at the foot of the posts and escapes within the flue at the top, thus keeping the columns cool and free from corrosion by the fumes. The flues have three rows of hopper-bottoms and are built on four parallel foundation walls set 25 ft. above the roaster-house floor. This gives ample space beneath for drawing off the flue-dust into cars which run beneath on three tracks. There are five reverberatories, with room for two more, each 102 ft. long by 19 ft. wide. To supply them three lines of track run over the furnaces transversely, one line over the fire-boxes, and two lines for ore, these latter so placed as to charge the ore near the bridge end. At the front of the furnace are two tracks set in a tunnel 17 ft. lower than the hearth. Slag is tapped into 20-ton slag-cars standing on the nearer track. The other serves for cars into which flue-dust from the reverberatory flue may be drawn, this flue running along the edge of the tunnel. Each furnace is equipped with a single waste-heat boiler of the Stirling type. The five waste-heat boilers give sufficient steam to generate all electric power needed at the plant. There are in addition three 250-hp. coal-fired Stirling boilers used for starting up or for a reserve. At the back of the fire-box end of the reverberatories run two tracks set 25 ft. below the furnace hearths and at the level of the converter-floor. The nearer track is for the cars which take away ashes, the farther one serves the converter building. Since the reverberatory building is separated only by a partition wall from the converter building, the matte from the reverberatories can be tapped and run by launders to the converters at a distance of only 60 ft. Provision is also made for tapping the matte into ladles and taking it to the converters by traveling cranes.

The Basic-Lined Copper Converter.—Kelly tried converting in a basic-lined converter in 1890, and Heywood has given his experience in 1906 at Butte with the Baggaley converter. Pierce and Smith, after much experimental work, brought basic converting to a successful issue at Baltimore, and took out patents on certain details of converter construction. The shells are of ¾-in. plate, 26 ft. long by 12 ft. diam. and are lined with magnesia bricks in varying thicknesses up to 18 in. at the tuyeres and 9 in. near the upper part or throat of the converter. There are 32 Dyblie tuyeres, but opposite the outlet or throat these are not used, since it is desired to run as quietly as possible. The converter is carried on three riding rings which rest on trunnion wheels. The throat 40 in. diam. and 30 in. above the shell is of sheet-steel lined with clay or magnesia brick. In the tuyere region the brick are replaced by a ganister of magnesian material mixed with a binder such as linseed oil or water-glass. This insures a lining which is tight against air leakage, and which can be repaired by openings placed opposite the tuyeres and by which ganister is introduced to repair around the tuyere openings. Beside the throat opening is the breast closed with clay and magnesite brick. This has two tap-holes, the upper for slag, and the other, immediately below, for the matte. To allow for the expansion of the magnesia brick, a ¼-in. liner is placed in each fourth longitudinal row of brick. In the original patent the shell was parted above and was tied by strong rods which could be adjusted to the expansion. Longitudinal expansion was taken by I-beams also tied by rods which strengthened the head. The tuyeres themselves were packed with lead or asbestos to allow for movement due to expansion, and the air from each tuyere was carried by a cast or wrought-iron pipe through the 18-in. lining. However, these difficulties of expansion appear to have been exaggerated, and at Anaconda were ignored.

In operation, an initial charge of 30 to 40 tons of matte is poured into the converter and this followed by about 3 tons of silicious ore, and the blowing started. The blast-pressure is gradually in-

*Experiments on the rate of settling of blast-furnace dust made at the Copper Queen smelter, Douglas, Arizona, confirm this. With a speed of 4 ft. per second fully 90% of the dust that settled in the experimental chamber passed a 200-mesh screen, and it was found that the chamber need not be long for effectual settling. In this, L. D. Ricketts' experience agrees, he having found under such conditions a loss in some tests of 12 lb. per converter hour. To collect the dust he will put in a chamber where a velocity of 4 ft. per second of the escaping gases will be attained. This will settle the heavier dust, containing as much as 17% Cu, while the portion too light to settle at this velocity, containing an abundance of zinc, together with considerable lead and arsenic, and with but 2% copper, will be got rid of. Here is a case where a bag-house would be an actual detriment.

creased and blowing continued 30 to 45 minutes until the silica has been fluxed by the iron oxide forming. Slag is now poured and a ladle of matte (7 or 8 tons) added. This is followed by another charge of silicious ore, blowing resumed, and the resultant slag poured. This is kept up with smaller additions of ore in the later charges until the converter is filled with 'white metal' or even 'pimple metal'. Additions of matte and silicious ore are now discontinued and the charge blown to copper. The slag produced should not be lower than 25% SiO_2, since below this figure accretions of magnetic oxide of iron form. A fair average slag would go 26.6% SiO_2, 43.2% Fe, and 1.6% Cu. The cost of relining after a shut-down of two or three weeks would be $250 to $300, which would figure out 12c. per ton on a fair estimate of 2800 tons of blister produced on one lining. The converter drives so quietly that it seems to work slowly, and there is little or no foaming in the first stage. This is due to the gradual additions, and because the slag is poured off at short intervals. Nor is there foaming in the second stage or blowing to copper unless the charge becomes too cold. The tuyeres are harder to keep open than in acid converting, and need the constant attention of two men who use 1¼-in. punching rods in place of the ¾-in. ones. At Anaconda basic converting has been undertaken, using the ordinary vessels, and with a high degree of success, following along the lines found best at Garfield. The matte is of higher grade than at Garfield, and the silicious-ore additions consequently smaller, some of it being put in even before the first ladle of matte, then more ore after the matte is charged before beginning the blow. One may notice in the practice in both places that additions when finishing to blister are not needed, and if such an addition is made at all, it should be of white metal and not of the ordinary sweepings or 'dope.'

The advantages of basic as compared with acid converting are: (1) Lower cost of plant and equipment, since there is no need of the relining plant, and the converter building can for the same output be smaller, and, because of the use of lighter cranes, of lighter construction. (2) There is no handling of the converter vessel, hence large ones can be used. On the other hand, one converter must be kept in reserve. The converter is more continuously in use. (3) No clay is needed, since the lining is comparatively permanent, and the acid material need not be so silicious as when needed for a lining. (4) Less slag is produced and this is low in silica, that is, the silicious additions go further. Hence there is less for re-treatment and less copper going into it. (5) Low-grade matte can be treated as readily as high-grade, and there is no limitation in this respect. Of course, such matte can also be concentrated in a blast-furnace, but at a greater expense.

The disadvantages of basic converting are: (1) Fine silicious ore is blown out of the converter; indeed, the closing off of the tuyeres opposite the throat is to lessen this difficulty. (2) Accretions form at the end of the converter where the ore is charged, but this trouble will be overcome when the converter is so constructed as to have the throat at the middle of its length, not, as now, near the end. (3) Extra care has to be taken in working so as to avoid early burning out at the tuyere-zone, and extra tuyere punching is needed because the converter is run colder. (5) Time is lost in relining, and the lining itself is expensive. (6) Finally, it appears that in certain localities there may be a distinct disadvantage in using the basic-lined converter, and many where it would be more profitable than acid converting. Thus when there is a source of profit in the clay-binder, then acid work may pay; where barren clay only can be used and when the ore is not particularly silicious, then basic converting is indicated.

Converting Leady Copper Matte.—It has been long held that in attempting to convert leady copper matte made in silver-lead smelting, there was bound to be a serious loss of the contained silver, which was carried off when the lead was volatilized. But at Aguas Calientes it was found when a bag-house had been put in and all the fumes had been collected from the converters, that the loss of silver could not be more than 0.5%. This led the same company to install converters at Omaha, and these have been in successful operation there since 1905. At Perth Amboy basic-lined converters have been used successfully, and 1000 tons of copper bullion has been produced on one lining, and at a lower cost than with the converting of copper matte. At first a great deal of trouble was experienced at the bag-house from the destruction of the cotton bags by sulphuric acid. During the first blow the zinc and lead oxide fumes would neutralize the sulphuric anhydride, but at the second stage, if the charge was cold and foamed in consequence, there was a formation of the acid which attacked the bags. It would appear that the SO_3 must be formed from the SO_2 by decomposition at temperatures of 380° to 700° C., in the presence of catalyzers such as the flue-dust composed of copper oxides and sulphates, or iron oxides. Now by the admission of abundance of air, the hood gases may be cooled down below 380° C. and thus escape catalytic action. Cooling fume for introduction into bag-houses involves some unsolved problems in radiation. At the Mammoth plant in California it was found that much more radiating surface was necessary in practice than had been estimated on the basis of best available data.

Introduction of Silicious Ore into the Converter.—The idea of putting silicious material directly into the converter to flux the forming ferrous-oxide is not new, but the plan was abandoned in favor of the idea of borrowing the silica from the lining. As a result, the life of the lining is brief, after which the exhausted shell must be removed, cooled down, and re-lined. Within a few years, however, it has been found possible to make some silicious additions just before the matte was charged. This material would adhere to the hot semi-fused interior and served well to furnish some silica. With the coming in of basic converting, there was no choice but to add all the silicious material during

the blow, even though there was some dust loss from the finer ore thus added. I may add that such addition, where the throat of the converter is near the end of the shell, has resulted in a building up of unfused or partly-fused ore at that point, which tends to obstruct the throat, and which has to be removed. Now Arthur M. Day has revived, with a considerable degree of success, an old idea by blowing in the silicious ore through the tuyeres. In theory this would seem the best way to do, since, while the ferrous oxide was forming from the matte, it would be at once brought in contact with the silica. Broadly stated, the idea is to blow pulverized ore into the converter under high pressure through one or more of the tuyeres, made a little larger for the purpose. Plenty of material can be blown in in this way. Thus far the process is in the experimental stage, but some satisfactory slags have been made. On an acid-lined converter a slag has been produced that carried 43.6% SiO_2 and 46.1% FeO, while in the basic-lined converter a slag that carries as low as 10.2% SiO_2 and as high as 77% FeO has been made. In fact, it has been possible apparently to produce a slag of any desired composition. The latter slag could have no corrosive effect on a basic lining, and would be produced with the minimum of silicious ore and of resultant slag.

WORLD'S DEEPEST MINING

By J. Parke Channing

In the course of some professional work I have just had an opportunity of going into what is probably the deepest underground workings in the world, if we except the central section of the Simplon Tunnel, which I believe is some 8000 or 9000 ft. below the summit of the Alps. To the Tamarack mine, now practically a subsidiary of the Calumet & Hecla Mining Co., belongs the credit of having the deepest shaft in the world, and the deepest underground workings from which mineral is being extracted. No. 5 shaft crosses the Calumet conglomerate, at a depth of 4500 ft. measured from the collar of the shaft, and is now down to a depth of 5273.5 ft., it having at that depth cut the Osceola amygdaloid, and passed through it. It is interesting to note that at the upper portion of this lode considerable native copper was found. In a short time this shaft will be extended at least ten feet farther, in the cutting out of a sump, thus making it over a mile in depth.

No. 3 shaft of the Tamarack has been sunk to a depth of 5222 ft. The collar of this shaft, however, is 31 ft. higher than that of No. 5. This No. 3 shaft crosses the Calumet conglomerate at about 4650 ft. At the so-called eighteenth level, a cross-cut driven 800 ft. to the west, reached the lode at a vertical depth of 5181 ft., from which point a slope has been sunk 300 ft. to the twenty-first level, below which there is a sump of 7 ft. The bottom of this incline is 5368 ft. below the collar of No. 3 Tamarack shaft, measured vertically. The Calumet conglomerate dips at an angle of approximately 38° to the west, so that measured on the incline this point is very nearly 9000 ft. from the outcrop. At this point the lode looks fairly good, and is sufficiently rich to warrant its extraction and treatment.

The longest inclined shaft in the Lake Superior copper country is No. 4 Calumet shaft of the Calumet & Hecla Mining Co. which is down to the eighty-first level, this being approximately a distance of 8100 ft. along the slope, at an incline of about 38°. As showing the strong belief as to the persistence of the various lodes in Lake Superior in depth, and the possibilities of extracting copper at a profit, the Quincy Mining Co. has lately purchased, for $600,000, from the Canal company, a tract of land lying to the west of its own property, and which will not be reached by its present workings until they are at least 7000 ft. in depth measured on the slope.

As has been previously published, the rate of increase of temperature in the Lake Superior copper mines is not excessive, the rock temperature at a depth of 5000 ft. vertical being approximately 90° F., and if proper means of ventilation are used, there is no difficulty in operating at this depth. If, however, proper connections are not made, the air becomes excessively humid, thus materially reducing the efficiency of the miners. The mechanical difficulties in mining at these depths consist in the necessity of keeping the timber close to the working faces because of the great pressure due to superincumbent mass of rock, and the method of mining now used is similar to the long-wall retreating method of the coal mines.

When it comes to hoisting-ropes it is impossible to keep the same high factor of safety as in shallower mines, this factor being often reduced to 3.5. This, however, has led to no serious consequences other than that of some increased expense because of the necessity of more frequent changing of the ropes, so as not to keep them too long in service.

It is fortunate that in the Lake Superior copper mines, after getting down below the fractured-surface zone, practically no water is found. On the lowest levels of the Tamarack mine the only water visible is a slight seepage which is extremely bitter to the taste. Analyses of the water made by local geologists have shown the presence of chlorides and bromides of sodium and magnesium. There has been considerable discussion as to the origin of this water, some thinking it is the remnant of pre-historic ocean waters, and others believing that it is the water which deposited the minerals. However, from a practical point of view, the fact is that these mines, at the deepest levels, make only a little more water than is necessary for the use of air-drills. No pumps are installed in the mine and the little excess of water is bailed out once a week, or oftener.

There is, of course, a gradual decrease in copper contents of the rock as depth is attained, which has been made up for by increased efficiency and improved methods. It is a fact in biology that no organism develops beyond the needs of its immediate environment, and it is plain to see that this same rule exists in mining.

American Progress in Cyanidation

By An Occasional Contributor

Each year sees a marked increase in the percentage of the world's precious metals recovered through the agency of cyanogen. In the early days of the cyanide process, the opinion was prevalent among metallurgists that the successful use of cyanide would be confined to a few special instances where all other means had proved to be futile and where the physical and chemical natures of the ore were particularly favorable. Today practically the first questions asked when attacking the problem of treating gold-silver ore, are, what extraction can be attained by cyanide, and the cost of making it. It is only after these conditions are shown to be unfavorable that the possibilities of other processes are considered. As in the history of most of the other arts, the first years of cyanidation saw improvement follow improvement in such quick succession that there was great trouble in keeping pace with the march of progress, but as time went on, these improvements became less spectacular until today changes are more refinements of existing features than anything positively new. There are now plants that have attained a remarkably high degree of metallurgical perfection.

As has been the case for several years past, Mexico has led this year, though mostly through the efforts and ability of Anglo-Saxon engineers. Several remarkable new mills have been put into service there during the past twelve months, and several more are to follow in the first months of 1911. The flow-sheets of these new mills show that the 'Pachuca tank' will be used in almost every one. It is rather curious that although this was the invention of F. C. Brown, of New Zealand, it is used scarcely at all in Australia. A striking innovation has been made by the introduction of the continuous system of agitating which has proved an unqualified success. In the old method the pulp was agitated in separate vats which had no communication with each other, each constituting a self-contained unit. By the continuous system the 'Pachucas' are arranged in series or in batteries, and the pulp overflows from one into the next and passes through the whole series before its discharge to the filters. The method of communication used is a pipe set at an angle of 60°. The upper end of the pipe is placed in the discharging tank, half way between the central airlift and the side of the tank, while the lower end is placed in the same relative position in the receiving tank. The upper end of the pipe is distant about one-third of the height of the tank from the top, while the lower end is one-third from the bottom. A. Grothe states that both M. H. Kuryla and J. E. Mennell report increased extraction as a result of using this method, but this would seem probably to be due more to the fact that the old system of agitation was not carried to the point of maximum dissolution, than to any other reason. There is no reason to doubt, however, that there is a considerable saving of cyanide where the continuous process is used. Other advantages are, that the tank is used continuously for agitation, and no time is lost in filling and discharging. Also, the discharge being from the side, and not from the bottom, there is an economy of gravity pressure, which in most plants is important. Furthermore, the discharge being continuous, the pressure is constant; which is essential in many cases where the pulp is filtered in pressure-filters.

The use of the silica-sponge diaphragm has caused a good deal of discussion during the year, but so far has not proved of great value. The idea, as well as the application, is so new that further service may suggest changes that will bring it into more extended use. The reported disadvantage is that the volume of air which can be passed through the sponge is too small to prevent classification in the pulp, and that the interstitial spaces become choked easily and are hard to clean. Other operators report very successful results. C. A. Fullon says that in the San Matias mill at Guanajuato the process has been very successful and has reduced the time of agitation from 32 to 12 hours. It would seem that for successful use, the pulp agitated should be ground very fine and contain a very high percentage of floculent. The Claney process was announced late in the fall, but up to the present it has not been tried in enough places to give sure basis for judgment as to its practical success. At one well known property the experiments were brought to rather an abrupt termination at the instance of the management, as experimental work lasting over a considerable length of time proved that, so far as this particular property was concerned, there was little hope of its being used to advantage. Further application of the process will be watched closely, as the problem of treating ores containing combined gold is one of much interest. The wonderful increase in the use of the Dorr thickeners and classifiers shows that they have come to stay, for a time at any rate, in slime plants. Some new things are promised soon from South Africa along these lines in addition to the Caldecott diaphragm-cone, but a discussion of these will come better from the pen of some South African.

The various forms of filters, both vacuum and pressure, are still merrily warring for the favor of the profession. Among the former the Butters and the Oliver are going into many of the mills that are being designed by engineers favoring vacuum-filters. The Butters company is providing a filter of 1000-ton capacity for the Dos Estrellas which will handle the slime from the No. 1 and No. 2 plants, and it is understood that the Real del Monte is to use the Butters in its enlarged mill. Another new Butters installation is at the Palmilla, at Parral, while the La Blanca and others have put in Moore filters.

Among the pressure-filters the Merrill seems to be gaining great headway. The Santa Gertrudis engineers decided on this type for their new 600-ton mill after competitive tests (held at the mine on

ore of the usual character), and in which a number of manufacturers of different types competed. The Merrill filters, it is also given out, are doing good work at Esperanza, where the management has recently given an order for one more, making six in all. The New York Honduras & Rosario Co. is also installing two of the large 90-leaf type in Honduras. At first when the Merrill press was used it was found that a certain amount of granular material was necessary in the slime. By a very ingenious idea, known as 'centre washing', this objection has been largely overcome. The 'centre washing' system consists simply of filling the press to a point where there is left an opening through the centre of the cake about ¼ in. wide. Solution or wash-water is introduced into this opening through the nozzles on the automatic sluicing-bar or through the sludge-feed channel, and leaching begins. The flow of liquid commences at the centre and proceeds outward in both directions. The result is that instead of a solid 4-in. cake (which if very talcose, was formerly impermeable), there is now in the same leaf two cakes, each 1⅞ in. thick, which are readily permeable, even when formed of the most talcose slime.

Among other filters, the Kelly seems to be achieving an increasing measure of popular favor. The great value of the Kelly lies in the small amount of water used in its operation, which is no small factor in many places where the water supply is limited and evaporation heavy. At the new mill of the Veta Colorada, at Parral, 8 Kelly presses working in 2 batteries of 4 each, are being installed, and 2 are in use in the Carmen mill in Guanajuato. The Tigre mill in Sonora is also to be equipped with Kelly filters. This last mill is rather remarkable among Mexican plants from the fact that its stamps are to weigh 1250 lb. It would rather seem that there is a tendency toward heavier stamps in Mexico as well as elsewhere. Certainly the trend is all that way farther north, although as yet designers in the United States have not dared to go as far in the matter as have engineers in South Africa, where some of the latest plants include stamps of 2000 lb. weight. A number of mills are being designed for work on gold ores containing stamps weighing 1250 lb., and the probabilities are that, if these show good economic results, the fashionable stamp-mills of next year will include still heavier heads. Tube-milling is also gaining in favor steadily, as it has been shown that fine grinding results almost invariably in increased amalgamation as well as added extraction in the subsequent cyanidation. The distinctive feature, however, of the fine grinding of gold ore seems to be in a release of the gold in the sulphides, thereby shortening the necessary time of contact with cyanide solution. This makes possible in many cases the direct cyanidation of the sulphides in the same flow with the slime and thereby does away with losses due to concentration.

Costs at Goldfield Con. Mill.

(Published by Courtesy of J. W. Hutchinson.)

At Cripple Creek the subject of the economical handling of the low-grade sulpho-telluride ores remains still the important one. The metallurgists of this district have worked untiringly on this problem, and this year brings high hopes that the solution is near at hand. At the Stratton's Independence a second mill-unit has been started by Philip Argall. The process used here was described by P. H. Argall last year.* In the middle of the summer the new mill of the Portland G. M. Co. was started. The company has been loath to give out information as to results until success had been demonstrated beyond doubt, hence the incompleteness of published descriptions of the new mill. In a general way, it is understood that low-grade sulpho-telluride ore assaying $4 to $5 per ton is slimed by standard methods and agitated for about six hours with cyanide solution in Pachuca vats. This is followed by another agitation with bromocyanide and the pulp filtered and washed. It is said the extraction is about 80%, and the cost reasonably low, considering the complex nature of the ore.

In Nevada the year shows the Montgomery-Shoshone mill shut down, probably for good, but on the other hand it now seems certain that in the spring work on two new mills will begin. The Belmont will have its own plant, situated at Tonopah, and in all probability this mill will be modeled along the same lines as the Montana-Tonopah, which continues to give good satisfaction, and in which there has been a steady improvement in methods from the first. The Nevada Hills will, in all

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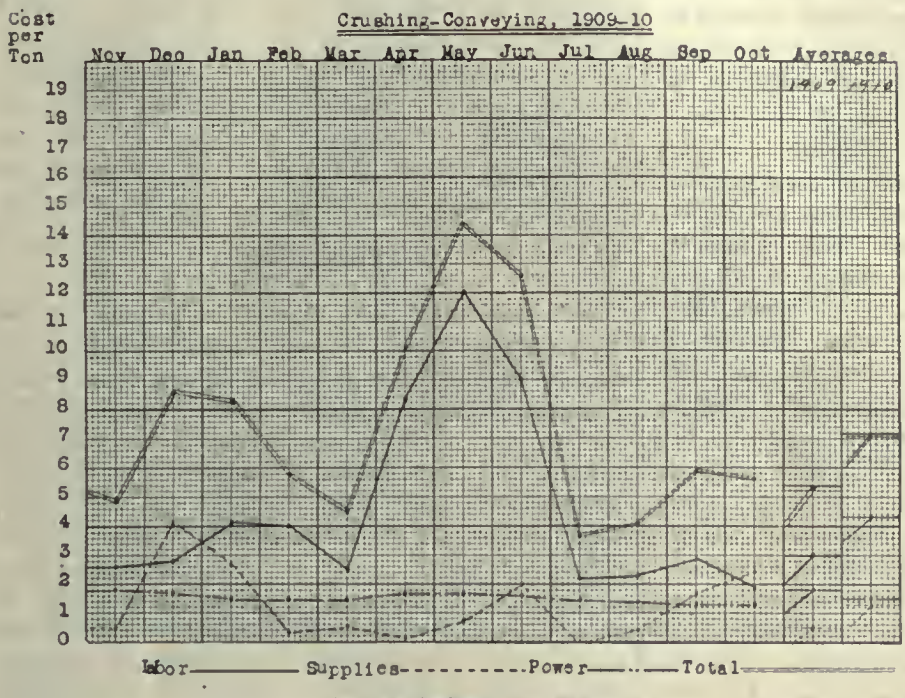
probability, erect a mill in the spring, although the tonnage to be treated still seems to be in doubt. It is rumored that the plant will contain 60 stamps and have a capacity of 500 tons per day. Being

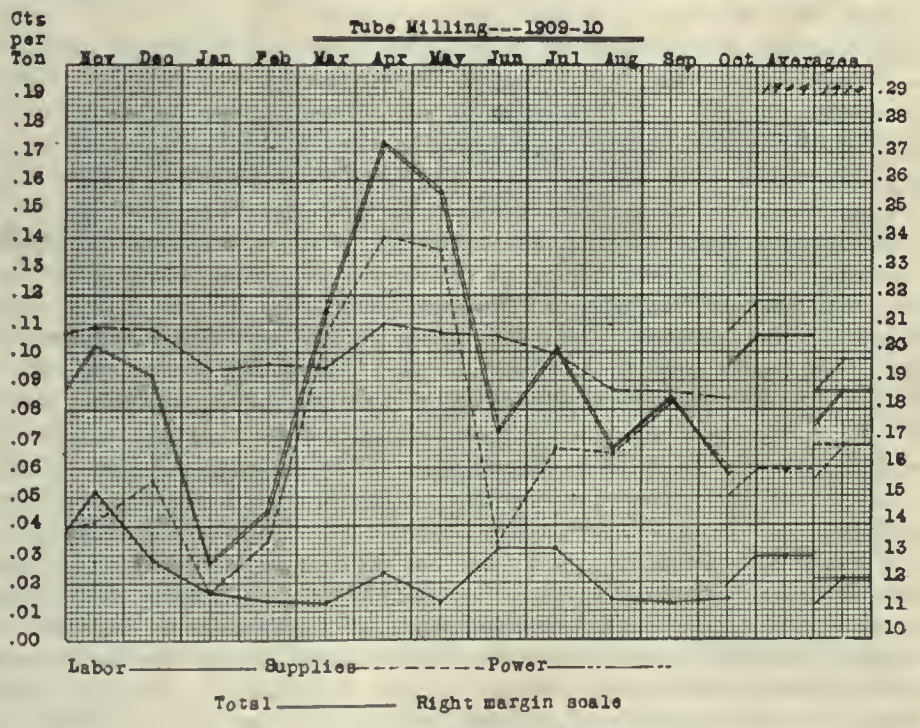


Costs at Goldfield Con. Mill.

(Published by Courtesy of J. W. Hutchinson.)

controlled by the same interests as the Goldfield Consolidated, it is not surprising that the provisional flow-sheet shows similarities to that of the great Goldfield mill. No article of last year's cyanide work is complete without some mention of the fire at the latter and the remarkable rapidity with which operations were resumed. It speaks volumes for the pluck and energy of the men responsible that, within a few weeks after such a disastrous fire, the mill was running as smoothly as ever. The Goldfield Con. engineers deserve the thanks of the profession for the information contained in a very attractive booklet which was sent to a large number of professional men. The information contained will be of great value, owing to the graphic representation of the actual operating factors in a large and modern plant. J. R. Finlay and J. W. Hutchinson are to be congratulated on having taken a step which it is hoped others will follow. Reproductions of three of these charts, covering filter-discharging, crushing-conveying, and tube-milling costs, accompany this article. In examining them it should be remembered that during April, May, June, and July only 70 stamps were dropping. Not only are the costs high for these months, but the averages for the year were necessarily raised by this circumstance. At the Pittsburg Silver Peak mill, 20 additional stamps have been put into service during the year, bringing the total up to 120. About 15,000 tons of ore per month is being crushed. Considering the fact that this company is operating in Nevada and under typical Nevada conditions of high cost for labor, power, water, and supplies, the working costs are little short of marvelous. The latest figures given out are $2.54 per ton, which includes not only the cost of the Pittsburg office, but takes care of all payments made for improvements and additions.

In California the new mills of note during the past year are those of the Trinity Gold Mining Co., in Trinity county, and the recently started cyanide plant of the Empire mine at Grass Valley. The Trinity mill is complete and modern, and should do good work. The process consists of crushing (40 stamps), amalgamation, separation of the pulp into sand and slime by Dorr classifiers, leaching of sand in vats, agitation of slime in 'Pachucas,' followed by Dorr thickeners, Oliver filters, and Merrill precipitation presses. The cyanide annex that has just been added to the Empire's crushing and amalgamation plant contains Oliver



Costs at Goldfield Con. Mill.

(Published by Courtesy of J. W. Hutchinson.)

filters for the slime and Merrill precipitation presses. This plant displaced the old-fashioned concentrating and canvas plant which has for many years done such good work. At the Homestake in South Dakota, there have been no changes of note during the past year. The slime-plant, with its 30 Merrill presses, has now reached a point where a 90c. product is being treated at a cost of 20c. per ton.

In British Columbia a large mill will be erected in the spring near Republic, where mining is becoming more active. The metallurgy of the Republic ores is extremely difficult, and, as the ore is of low grade, large tonnages must be handled in order to make a profit. Although the new mill is not yet under way, it is understood that it will consist of 100 heavy stamps followed by fine-grinding, probably in tube-mills. Agitation in Pachuca vats will be followed by Butters filters and zinc-dust precipitation. Engineers of the Mother Lode company are at present busy with the designs for a plant to be erected near Salmo, and work on the first unit will be started in the spring. In Ontario, spring saw the commencement of operations in the Nova Scotia mill at Cobalt, which was the handiwork of A. G. Kirby, of Reno, Nevada. The results obtained are said to be excellent, and this being the case, it would seem as if the main features of the milling of Cobalt ores were settled. Of one thing there can be no doubt, and that is, that Cobalt in time will come to be a district of many mills. The probability is that the high-grade ore will always be shipped, but operators will find not only the low grade, but probably the middle-grade ores to be well adapted to treatment in well designed mills. A short distance from Cobalt is the newly discovered camp of Porcupine, concerning which there is only one feeling on the part of the men who own ground there, and that is one of supreme confidence. This is being expressed by putting up mills. Two are now certain, with rumors of several more. On the Timmins property, a big mill will be built, but work has not yet begun. On the Dome property the design of the plant has been completed, the machinery ordered, and the coming spring will see a large force of men at work. The Dome mill will consist of 40 stamps of 1250 lb. weight, followed by amalgamation, Dorr classifiers and thickeners, tube-milling, agitation in Pachuca vats, Merrill slime-filters, and Merrill zinc-dust precipitation.

Some work is being done in Alaska, but the only feature to be commented on there is the announcement of operations in the cyanide plant of the Alaska Treadwell, where a mill has been built for crushing and cyaniding the concentrate that in the past has been shipped and smelted. At the termination of the present smelting contract, February 4, this mill is to be put in regular operation. The most striking peculiarity is that 80% of the gold in the concentrate will be saved on plates following tube-milling and prior to cyanidation. The new mill will effect a great saving for the company, and R. A. Kinzie and his associates deserve great credit for their work.

Summing up now briefly the features of the year's work in North America, the following stand out prominently: (1) The increased use of Pachuca vats and the application of the process of continuous agitation in them. (2) The tendency to demand heavier crushing duty of the various crushing machines, particularly of stamps. (3) The continued demand for fine crushing with attendant changes in classification and filtering practice. (4) The increasing growth of the practice of cyaniding the sulphides and vein-material in the same operation.

COPPER SURPLUS

Below are presented figures, in pounds, of the United States surplus, visible foreign supply, and world's surplus of copper, the figures being based on returns of the Copper Producers' Association.

1909.	U. S. Surplus.	Foreign Visible Supply.	World's Surplus.
January	122,357,266	124,716,480	247,073,746
July	154,858,061	150,928,960	305,787,021
1910.			
January	141,766,111	244,204,800	385,970,911
February	98,463,339	248,236,800	346,700,139
March	107,187,992	254,150,400	361,338,392
April	123,824,874	249,607,680	373,432,554
May	141,874,159	246,863,680	388,737,839
June	160,315,973	239,265,600	399,581,573
July	168,276,017	232,863,680	401,139,697
August	170,640,678	222,295,360	392,936,038
September	168,881,881	218,415,680	387,297,561
October	148,793,714	210,472,640	359,266,354
November	139,261,914	198,065,280	339,327,194
December	130,389,069	913,200,000	223,589,069

SIERRA MOJADA ORES

The ores of silver, lead, and copper at the Vita Rica mine, Sierra Mojada, Coahuila, Mexico, according to a paper read before the Geological Society of America by Frank R. Van Horn, occur on the contact or a short distance below the contact of an acid breccia with an underlying limestone of Cretaceous age. There are some indications of a fault plane between the two rocks, such as clay selvage and slickensides. There are two types of ore, one silver-lead and the other silver-copper. In the former, the minerals are all oxidized and consist chiefly of argentiferous cerussite with native sulphur and some gypsum. The bulk of the ore from this mine, however, seems to belong to the silver-copper group and contains sulphides as well as oxidized minerals. Minerals noticed here were chalcopyrite, chalcocite, covellite, along with native copper, malachite, azurite, cuprite, and gypsum. Another zone consisted of a silicious limestone containing up to 10% of barite which was impregnated with cerargyrite and native silver. Here the copper content was smaller and rarely exceeded 2%. Some three years ago, a fault was discovered in the northern part of the 'silver-lime' orebody. Along this fault-plane, silver and copper minerals of great richness have been found mixed with more or less barite. Some of the minerals noticed were native silver, argentite, proustite, and pearceite which has been found in but two or three localities in the world. A mixture of erythrite and barite was also noticed.

The Far East

By Thomas T. Read

Any review of mining conditions in the Far East for the past year must necessarily be semi-political in its character, so inextricably are the threads of international politics interwoven with those of economic development. Perhaps the most significant political event of 1910 is the formal annexation of Korea by Japan, completing the gradual spread of Japanese sovereignty since the Russo-Japanese war. Whatever the effect of the change on the Korean people, it is unquestionable that the mining industry can only be benefited by it. The regulations that the Japanese régime has imposed are eminently fair and reasonable, and place foreign capital at no disadvantage. And even if such were the case, it would still be an advantage to have a definite and aboveboard set of conditions to encounter, rather than to be obliged to thread the mazes of the court of the Korean Emperor. No less important is the secondary result that under Japanese control railroad-building will go forward as fast as is warranted by the development of industrial resources. Gold mines bear the handicap of distance from railroad and water transportation with comparative ease, but the other metals find it a heavy incubus, and the copper mines of northern Korea can scarcely be expected to flourish while under this disadvantage. The Chicksan mines, south of Seoul, have shown remarkable development recently, and, in addition to the large area of dredging ground proved last year, have opened up their main vein in numerous places for about five miles along the strike, finding excellent milling ore all along. The present 10-stamp mill is making a good profit and the second similar plant, which has just been completed, 3 miles farther north, has already more ore than it can handle from the development work in the neighboring openings on the vein. This mine promises to equal in importance the Oriental Consolidated, and a more detailed description of it will appear in a later number. The concession is owned jointly by a Japanese and an American syndicate, but the American interest will probably acquire the complete control.

In Manchuria the Pen-hsi-hu colliery has entered the list of producers, and its coal is being placed on the market by the Fu-shun colliery agencies, both mines being controlled by the South Manchurian railway. The mine has been opened with joint Chinese and Japanese capital, each nationality furnishing one-half of the $1,000,000 subscribed. The Chinese Government is to receive 25% of the net profits. The mine is well equipped, though not so large as its predecessor, which has probably produced 800,000 tons of coal during the year. I have not seen the coal now being placed upon the market, but all earlier advices indicated that it is somewhat inferior in quality to Fu-shun coal. The mine is about fifty miles southeast of Mukden, on the line of the Mukden-Antung railway. The technical man might wonder at the opening up of a new mine with borrowed capital within fifty miles of another that has just been developed to produce 3000 tons per day, and in the face of a coal market where prices have been constantly on the decline, owing to the steady entrance of new producers into the field. The same observer may also have been puzzled by the exceedingly expensive construction of the Mukden-Antung railway, passing through country that as yet shows no signs of profitable exploitation and joining two points that do not appear to have any economic need of connection, since Mukden is already well served by the excellent port at Dalny and is connected with Tientsin, Newchwang, and Vladivostok as well. It requires no great intelligence to detect the political significance of such operations. It may be taken for granted that Japan has no intention of ever restoring sovereignty of southern Manchuria to China unless compelled to do so. Recent developments further such designs in more than one way: Firstly, by increasing the amount of money invested in Manchuria, China, obliged to buy at a high figure all such improvements, as she sooner or later must do if she is to regain her sovereignty, may find herself seriously embarrassed to find the necessary capital. Secondly, in the event of another war with Russia (and prophecies of such a war are not lacking), Japan, instead of striking her first blow at Dalny, could strike it at Harbin, the point where she left off when hostilities ceased. Last, but not least, every fresh move of this sort increases the friction with the Chinese authorities and increases the possibility of bringing about a war reputed to be desired by Japan—a few months to capture Peking and a demand for Manchuria as a war indemnity would be such a simple Japanese solution of the difficulty! But so far China has allowed her nose to be pulled and her face to be slapped by Japan with patience and dignity, knowing that to assume a belligerent attitude would be fatal. Unless some other great Power comes to China's aid, her control over southern Manchuria will never be regained, and of course the northern part could no longer be held when the intervening territory was lost. Russian settlers are working coal mines south of the Amur river, and bid defiance to the Chinese authorities who have attempted to stop them. The Manchurian situation is absolutely critical from a political point of view, but even so important a political matter can scarcely be afforded more space in a mining journal.

The matter of the re-purchase of the collieries owned by the Chinese Engineering & Mining Co. still drags; it is apparently the definite intention to make the purchase, and it now remains for the Chinese Government to manage to obtain it at anything like a reasonable price. The mines have been worked to a great depth and only have about eight years' supply of coal in reserve, but it will only be natural for the company to try to sell on the basis of the present earnings. It will be a little too much, however, considering how the concession was originally obtained, if the Chinese Government is obliged to pay an exorbitant price for it now.

With the completion of the Tientsin-Pukow railway, which should soon be in operation throughout

its entire length, the coal mines near Yi-hsien, in southern Shan-tung, will enjoy the benefit of railroad connection with the two ports of Tientsin and Shanghai. But the chief effect of the mines, which possess a plentiful supply of good coal, must remain local, as the numerous coalfields of China are so extensively opened now that the entrance of a new mine into the market does not count for so much as it did a few years ago. The situation is entirely controlled by transportation facilities and will doubtless remain so indefinitely. More remote coalfields begin to produce as the railroads extend themselves into the back country. The southern edge of Mongolia has, for example, become a noteworthy coal-producing area since the opening of the Peking-Kalgan road throughout its length. The railroad itself owns one valuable mine, and many others throughout the district are in progress of change from ancient to modern methods.

The Han-Yeh-Ping Coal & Iron Co. has shown a considerable growth during the year, having started its new 250-ton per day blast-furnace and correspondingly increased its production of ore and coke. In addition to supplying rails, fish-plates, and track-bolts for the railroads now under construction in China, the company has been able to sell some pig iron both on the east and west coasts of the United States, in spite of the duty on pig iron. As the demand for rails in China becomes steadier, the company will gradually be released from the necessity of marketing any pig iron abroad, and can extend its steel plant. The demand for structural steel in China is still comparatively small.

One hears rumors from time to time of the starting of iron works at some point near the border of Honan and Shansi, but the project does not seem to have taken any definite shape as yet, and, indeed, it would be most inadvisable for it to do so, before exploration discloses the existence of a body of ore sufficient to support such a plant, the more especially as all the exploration already done indicates that no such supply exists. The neighborhood of Nanking offers a much more suitable site for the erection of a blast-furnace plant, but until the demand in China for steel products becomes great enough and steady enough to exceed the capacity of the Han-Yeh-Ping works, there seems little reason for starting a new enterprise. A small plant for the manufacture of wrought iron and crucible steel might be made the basis for the profitable production of cutlery and the like, and would present much greater possibility of success.

It not infrequently happens that the regions richest in mineral resources are the least accessible. China is no exception to this, for all that portion of her southwestern area which is most rich in minerals could until recently only be reached by many weeks of difficult travel, and shares with the neighboring Thibetan plateau the distinction of being one of the least known areas of the modern world. But this condition will change speedily, for the railroad constructed by the French has already reached Mêngtze and is being rapidly pushed northward to Yunnanfu, while an extension to Chaotong (near the Yangtze river) has already been surveyed. Construction work is also under way on the road from Hankow to Chen-tu-fu, so that two routes into the rich Ssu-chuan country will soon be open. It is not at all improbable that the mineral wealth of Ssu-chuan has been overestimated by travelers, few of whom were technically trained observers, and that Kuei-chou will prove in time to be the portion of the Chinese Empire richest in mineral wealth. At present it produces only antimony, zinc, lead, and mercury, the antimony being most important. Yunnan, with its copper and tin, is the leading province at present and is likely to retain its supremacy for some time. Approximately $1,200,000 has been subscribed by Chinese to re-open the old tin mines at Koju and equip them with modern machinery, so it is not improbable that the amount of tin produced in Yunnan will largely increase in the next few years.

Kuangtung and Kuangsi are being actively explored by a Chinese company, M. T. Yung being in charge of operations. They have opened up a promising lead mine, but have not yet begun extensive operations. C. Y. Wang has been appointed chief of the Mining Bureau for Kuangsi, and development work in these two provinces should now go forward rapidly.

No commentary on conditions in Southern China would be complete without reference to the foreign loan for the construction of railroads in the south and southwest. It will be remembered that the loan was about to be concluded with the English, French, and German governments when the United States demanded the right to participate. This was conceded, whereupon three obstacles appeared: an English company produced a half-forgotten concession, the rights of which, so it claimed, were being infringed; the English government ceased to exhibit any apparent desire to conclude the loan; and last, but most important, the native people seem to be really in earnest in their protest against the loan, and as the Government in China seldom attempts directly to controvert the popular will, it seems not at all likely that the loan will be carried to completion, in its original form at any rate.

The company that was formed to exploit petroleum in Shansi seems to be meeting with a moderate degree of success, but the district is so far from the ordinary lines of trade that accurate information regarding it is hard to obtain. The other company organized with foreign capital to exploit petroleum in Saghalien seems to have fulfilled its main purpose of selling stock, and the shares have considerably declined in value, while definite evidence of the actual existence of profitable quantities of petroleum is still lacking.

Gold mining in China is interesting, but for most portions of the Empire no stronger word would be justifiable. In almost all parts of the country some gold occurs and is worked in a desultory fashion in many of them. But only along the Amur river are workings extensive enough and the production sufficient to attract more than passing attention. A single exception should be made, namely, the cen-

tral portion of Shantung. Many promising districts are known there, and one mine has been developed until its value has been definitely proved. Some years ago a stamp-mill and a chlorination plant were operated, but extraction was unsatisfactory and the mines were shut down. Many attempts have since been made by foreign companies to obtain possession of the concession, but all have proved unavailing, and the dog-in-the-manger attitude was consistently maintained. Not long since, a request was made to have the mine included in the Wei-hai-wei zone, but such a suggestion could scarcely be acted on, for the Chinese authorities have jealously guarded against the Germans obtaining any greater foothold in Shantung than they already possess, and any concession made to British interests would immediately be followed by German demands. Recently the governor-general of Shantung has petitioned Peking to allow the mines to be worked, whether with foreign or Chinese capital is not stated. The difficulty of developing metal mines in China with native capital is twofold: there is a scarcity of capital for all the numerous phases of industrial development, and, further, the Chinese object to risking their money in the metal-mining industry since there have been few examples of successful operations. Coal mines have been so profitable that funds are available for opening new ones, and it is even likely that they may be opened up faster than the growth of consumption warrants. But metal mines are in something of a deadlock, foreign capital not being permitted and Chinese capital being unavailable until some profitable mines have demonstrated the soundness of the industry. The situation is not unlike that of the Irishman who remarked of his tight boots that he could get them on after he had worn them a few days.

No progress has been made in the organizing of a competent Mining Bureau for the Empire. Good men have been appointed in several provinces, notably K. Y. Kwong in Chili, C. S. Lowe in Ssu-chuan, and C. Y. Wang in Kuangsi, but a single man can do little when there is no organization or co-operation, and as long as the Boards in Peking remain under the control of men without proper training, the present inchoate condition will persist. It is most unfortunate that such waste of effort in obtaining accurate and trustworthy information regarding the mineral resources of the Chinese Empire should be allowed to continue.

MINERAL PRODUCTION OF GREAT BRITAIN AND IRELAND

The report by R. A. S. Redmayne, chief inspector of mines, on the output of metals and minerals in the United Kingdom during 1909 was published in November. The most important mineral produced is coal, of which the output was 263,774,312 tons, valued at £106,274,900. Of this amount, 4,258,980 tons was anthracite; this was mined chiefly in the district to the north of Swansea, but some also came from Scotland and Ireland. The figures compare with 261,528,795 tons and £116,598,848 during 1908. The amount exported was 65,694,267 tons. How large a proportion of the mineral wealth of the country is supplied by coal may be judged by the fact that the total value of all the minerals produced was £119,394,486. The output of iron ore was 14,979,979 tons, valued at £3,869,777; figures not much different from those of 1908. The iron ore imported during the year amounted to 6,328,623 tons, valued at £4,986,360, of which 75% came from Spain. In addition to this, 593,301 tons of purple ore was used, that is, the iron oxide residue from burnt pyrite. The total production of pig iron during the year was 9,531,987 tons, as compared with 9,056,851 tons the year before. The output of lead showed a slight increase, the figures being 29,744 tons of concentrate containing 22,463 tons of metal, as compared with 29,249 tons and 20,999 tons the year before. The production of silver from this ore was 142,006 oz. during 1909 and 135,154 oz. in 1908. The most productive mines are the Mill Close in Derbyshire, the Boltsburn in Durham, the Rhosesmor and Bryn-Celyn in Flint, the Queensberry and Leadhills in South Scotland, and the Foxdale in the Isle of Man. The import of ore during the year was 15,542 tons, and of pig and sheet lead 207,660 tons. The output of zinc ore in the United Kingdom continues to shrink. The figures were 9902 tons of concentrate as compared with 15,225 tons during 1908 and 20,082 tons during 1907. The Cumberland and Flint mines are producing much less than formerly, and the largest output was 1876 tons from the Great Laxey in the Isle of Man. The amount of zinc ore and concentrate imported was 73,814 tons as compared with 60,687 tons the year before, the chief countries sending it being Italy, North Africa, and Australia. In addition 121,552 tons of zinc was imported during the year, chiefly from Belgium and Germany. A small amount of zinc, 5314 tons, was imported from the United States, as was also 2622 tons of zinc ore. The amount of ore imported from Mexico was 596 tons. The only place where electrolytic zinc is produced in the British Isles is at Northwich, where Brunner, Mond & Co. extract a remarkably pure zinc by the Hoepfner process. The output of tin concentrate continues to increase slightly, and stands at 8289 tons as compared with 8008 tons in 1908 and 7080 tons in 1907. The figures are higher than any since 1895. The value of the output was £617,376. The largest producer was Dolcoath, with 1904 tons; then came Carn Brea & Tincroft with 1106 tons, Basset with 844 tons, South Crofty with 682 tons, Grenville with 633 tons, East Pool with 586 tons, Levant with 422 tons, Wheal Kitty with 241 tons, and West Kitty with 230 tons. The amount of tin ore and concentrate imported was 24,086 tons, of which 14,886 tons came from Bolivia. In addition, 41,725 tons of metallic tin was imported, 36,084 tons of which came from the Straits. Of other metallic minerals the production was: Wolfram 376 tons, manganese ore 2768 tons, copper ore 3531 tons, bauxite 9500 tons, and uranium ore 6 tons. The output of white arsenic during the year was 2880 tons, worth £28,187, as compared with 1936 tons worth £19,190 during 1908. The largest producer was Wheal Friendship near Tavistock, with 711 tons,

The Petroleum Industry in California

By Ralph Arnold

General Statement.—The year 1910 was marked by such an increase in production of heavy or fuel oils as to cause a congestion and an overstocking of the market, and a resulting fall in price from 63 to 30 or 40c. per barrel at the well. This has been especially true in the San Joaquin Valley districts, which have practically no local markets. In addition to the general halt in development caused by the overproduction and drop in price, the withdrawal orders of the President and application by the officers of the Interior Department of the Yard decision to oil lands, added materially to the pessimism of the operators everywhere and a fall in the price of oil land and oil securities. The Government withdrawals and the Yard decision have also affected the status of titles to such an extent that it is practically impossible at present to secure outside capital to even continue development, on government land in the withdrawn areas. This has forced many small companies to the verge of bankruptcy and has resulted in the acquirement of the interests of many of these companies by the stronger corporations. It is the hope of the oil men that remedial legislation by Congress and a possible reversal of the Yard decision as applied to the oilfields, will be brought about in the near future, and to that end considerable activity has been displayed by the various oil men's associations.

The completion of the Producers Transportation Co.'s 8-in. pipe-line, which connects the San Joaquin Valley fields with the seaboard at Port Harford, has been the greatest element in bettering the market conditions. It is a coincidence that this line was completed at about the time the great Lakeview gusher came in. If this line had not been practically complete at that time it is almost certain that the congestion of oil would have been such as to have entirely ruined the market for months to come. The Associated Oil Co. also completed a new 8-in. line from the Westside fields of the San Joaquin valley to San Francisco Bay, and this has likewise helped to relieve the congestion. The most important development in the marketing end of the industry was the agreement entered into by the Independent Producers' Association and the Associated Oil Co., whereby the latter is to market a large part of the product of the former. The sale of a considerable quantity of oil to two of the northern transcontinental railroads for use as fuel has also opened a new and promising outlet.

Coalinga District.—The Coalinga district lies in the western part of Fresno county and embraces more than 32 sq. mi. of highly productive territory. The main part of the district is separated into the Eastside, Westside, and Oil City fields. South of them are the Jacalitos, Kreyenhagen, and Kettleman Hills prospective fields. The Eastside field yields oil of 18 to 30° Baumé gravity, the daily production of individual wells being from 10 to 1000 bbl. per day. The Westside field furnishes 12 to 19° Baumé oil, the wells showing about the same range in production as the Eastside. The wells of the Oil City field are small producers, but the oil is light, being from 32 to 38° Baumé in gravity. The most important developments in the Coalinga district during the year were the finding of 37° Baumé oil at 3700 ft. in the Bohemian well in Jacalitos creek, five miles southeast of Coalinga, proving this new territory, and the bringing in of the Coalinga Mohawk well

Coalinga Devil's Den Oilfields.

with 30° Baumé oil on section 12, T. 20 S., R. 15 E., on the Coalinga anticline, marking an important extension of the Eastside field. The Bohemian well and that of the Azores Oil Co., a short distance south of the Bohemian, have been testing the limited area on Jacalitos creek, outlined by the geologists of the United States Geological Survey as possible oil territory. The prediction of the Government geologists, as to the depth at which the oil measures would be found, was verified to within less than 100 ft. in the case of both of these wells. In the Kreyenhagan field the results have not been especially encouraging. The El Cerrito well at the southern end of the field, was drilled to over 4000 ft., with negative re-

sults, and has been abandoned. Two or three other wells are drilling nearer the outcrop of the oil-sands than the El Cerrito and are meeting with better indications, but so far none have proved unqualified successes. The Kettleman Hills are receiving their share of attention. Two entirely different possible sources of oil are being tested; the sands of the Tulare and Etchegoin formation being penetrated by wells along the eastern flank of the hills, and the Vaqueros formation being sought by wells started near the axis of the anticline, in the heart of the hills. Oil in commercial quantities has, as yet, not been found in any of the wells. Those on the flanks have not proved productive in the horizons penetrated, and those in the centre of the hills have not yet reached the Vaqueros. The limits of the proved productive territory have been extended eastward in the Westside field by the Valley, Empire, and Nevada (Sec. 20) wells, while the well of the Coalinga Monterey Oil Co. on section 4 will still further extend the limits if it prove a producer. The well of the Standard Oil Co. in the northwestern corner of section 28, T. 19, R. 15, has practically bridged the gap between the northern end of the Westside field and the Eastside field. The southeastern extension of the Eastside field, even beyond the limits established by the Mohawk, is practically assured by the well of the Southeastern Oil Co. on section 18, T. 20 S., R. 16 E., although the depth at which the productive oil-zone will be penetrated is not yet determined. It is certain, however, to be the deepest hole yet drilled in this region, and will probably not fall far short of 4800 ft. The Polvadero Oil Co. is testing the territory between the Eastside field and the Kettleman Hills, but probably at a point where the productive sands lie at a prohibitive depth below the surface. A large number of new wells have been drilled in the main part of the Eastside and Westside fields, but aside from those mentioned, none added new territory to the previously proved area. The Acorn well, a half mile northwest of the proved limits of the Westside field, has practically shown that no lower formation than that now yielding the oil in this field, can be counted upon for production in that vicinity. The hoped-for southern extension of the Westside field to section 18, T. 21 S., R. 15 E., has not yet materialized, although the Roychester well in the northeast corner of the section is said to have recently penetrated a promising sand.

Devil's Den and Lost Hills Districts.—Considerable desultory prospecting was done in the Devil's Den district during the year, but no positive results were obtained, although much evidence supporting the theory that small flows will eventually be found at favorable points was obtained by these prospect holes. The most important find in the region was that made in section 30, T. 26, R. 21, near the south end of the Lost Hills, in the well of the Lake Shore Oil Co., where commercial quantities of 18° gravity oil were found at a depth of about 500 ft. This caused an immediate rush to the Lost Hills, and at present there are a number of portable and one or two standard rigs drilling in the region. Rumors of discoveries in these wells are hard to verify, as the operators are averse to disclosing their finds while the question of land titles is so unsettled. It is evident, however, from the find in the Lake Shore well that the classification of the land as originally proposed by the geologists of the Geological Survey was not correct and that the lines of possible oil territory are considerably wider on the flanks of the Coalinga anticline in this part of the country than was previously believed. The oil in this well either comes from the underlying Eocene or Tejon formation, which furnishes the oil in the Coalinga district, and migrates upward through a fracture along the axis of the Coalinga anticline, or else it originates in shales of the Santa Margarita formation and collects in the overlying McKittrick beds, as it does in the McKittrick, Midway, and Sunset districts to the south.

McKittrick District.—Little development of importance took place in the McKittrick field. Practically the only extension of developed territory was that made by the discovery of oil in section 36, T. 29, R. 21. Near the middle of this section and also in the southwestern part of section 32, T. 29, R. 22, heavy oil was found in prospect wells. Several new wells were put down in the Temblor field, six miles northwest of McKittrick, but these added but little to the already known productive area.

Midway District.—The development of the Midway district during the year has been rapid, in spite of the retarding influence of the President's withdrawal order of September 27 and other activity tending to discourage exploitation of government land, on which the Midway district largely lies. In the Midway field proper, which includes the Midway valley and the foothills flanking it on the southwest, the most important discoveries were those of the Standard Oil Co. on section 30, T. 32, R. 24, the Regal Oil Co. (Union Oil Co.) on section 14, T. 32, R. 23, and the American Oilfields Co. on section 36, T. 31, R. 22. Wells ranging in initial production from 3000 to 12,000 bbl. of 20 to 24° Baumé oil were brought in by the first two companies, while the last-named had one well that is said to have produced at the rate of 30,000 bbl. or more per day, for a considerable period. One of the interesting points about this last well is that the 12-in. casing with which the well was started was carried directly into the oil sand without any water being found, and therefore the well was completed with a single string. Enough sand was produced by this well to completely submerge the floor of the derrick and was built up in a cone about the well to the height of the belt-house roof. The Standard Oil Co. and the Honolulu company both brought in large gas wells in the Buena Vista Hills. The Standard's well on section 26, T. 31, R. 23, has been flowing steadily for several months at an estimated rate of 40 million cubic feet per day. The pressure in this well is so great that several accidents have attended attempts to shut it in. About 2 million cubic feet per day are being utilized by the company as fuel in the development of its properties in the Midway field. About 38 million cubic feet goes to waste. The Honolulu company has been more successful

in controlling its wells and now has the big gas well on section 6, T. 2, R. 24, shut off. With these two big wells practically proving the possibilities of an enormous gas reserve in the Buena Vista Hills, it is not surprising that rumors are now rife to the effect that a pipe-line is to be built to transport the gas which underlies at least a great portion of the Buena Vista Hills, to the parious parts of the State.

In the north end of the Midway field the development has been quite rapid, but has apparently reached the limit in sections 12, 14, and 15, T. 31 S., R. 22 E. The Union Oil Co. has drilled a hole 4680 ft. deep in the middle of section 10, T. 31, R. 22. This well is said to have gone through about 200 ft. of heavy tar sand at a few hundred feet below the surface, but farther down nothing was found but brown shale. This indicates that the commercial quantities of oil in the Midway field are, so far

Lake View Well, November 18, 1910.
(Photo by W. C. Mendenhall.)

as has yet been proved, confined practically to the basal McKittrick beds and that below the base of the McKittrick formation, that is, in the Santa Margarita and Monterey formations, there is little possibility of obtaining a commercial yield.

A considerable amount of development work was carried forward during the year in the Elk Hills field, which lies to the northeast of the Midway and McKittrick fields, but no definite results were obtained by any of the wells. Within the last month, however, the Associated Oil Co., it is reported, has found a light oil at a depth of between 3100 and 3200 ft. in its well on section 26, T. 30, R. 23. Tar and oil sands have been found in several of the wells at a less depth than this, but it seems likely that the productive beds lie at 3000 ft. or deeper throughout the major portion of the Hills. Development in the Buena Vista valley, which lies between the Elk Hills and the Buena Vista Hills, has not been attended by marked success, although oil sands have been reported here in one of the wells at a depth of a little over 3000 feet.

Sunset District.—The separation of the Sunset from the Midway district is arbitrary, the line generally accepted being that which marks the change from the San Bernardino Base and Meridian on the south, to the Mount Diablo Base and Meridian on the north. The famous Lake View well No. 1 is about a quarter mile south of this division line, so that it is in the Sunset district. This well, which is in the southwest corner of section 25, T. 12 N., R. 24 W., came in March 15, 1910, and has, up to the end of 1910, produced in round numbers about 8,000,000 bbl. of oil of about 20° Baumé gravity. Its highest rate of production was during the first two months of its existence, when by actual weir measurement, it flowed one day 68,000 bbl. At the present time the well is producing about 10,000 bbl. per day, of which from 10 to 15% is water. This water is believed to come from above the oil sand and to have been admitted into the hole through the wearing out of the casing by the constant friction of the sand which accompanied the oil during the initial stages of its flow. The Lake View is probably the most phenomenal producer ever drilled on this continent, if not in the world. The sand from which it produces is in the same oil zone as that furnishing the production throughout the Sunset, Midway, and McKittrick districts, and is in the lower McKittrick formation of upper Miocene age. In addition to the Lake View well, other gushers have been brought in during the year on the same fold, the 'thirty-five' anticline. Among them are the Consolidated Midway, American Oilfields, Monarch, Thirty-six, and several others. The proving of the eastern extension of the Thirty-five anticline by development has, perhaps, been the most important event in the Sunset field during the year. The finding of commercial quantities of oil in the Essex, Bronco, and other wells on the flat east of Sunset, had added considerable acreage to the proved ground of the main Sunset field. Along the foothills east of Sunset, the work of the Western Minerals Co. has proved the presence of commercial quantities of a greenish oil of about 18° Baumé gravity, which has been found to carry a high percentage of lubricants. No large wells have, so far, been developed in this new field, and the conditions do not favor the phenomenal yields of the north end of the district. Little work has been done in the old Sunset field, the companies operating there having contented themselves with the effort to keep the old wells open and producing. An attempt to extend the old field, especially northeast, has not met with success. The Anaconda well in the eastern part of the old field has been drilled down through the present producing zone into the Santa Margarita shale, but so far without commercial quantities of oil being found. A similar attempt with similar results, has been made on section 36, T. 12 N., R. 24 W.

Kern River District.—Development in the Kern River district was confined almost entirely to the outskirts of the previously proved area. The work of the Kern River Oilfields of California, Ltd., in section 19, T. 28 S., R. 28 E., on the north, the Overland Oil Co. on the east, and the Kern River Drillers, Metropolis, and Enos oil companies on the west and southwest extended the field slightly, but in most instances the small yields and heavy quality of the oil produced indicate that the limits of commercial productivity have practically been outlined.

(*To be continued.*)

Illinois Oilfields in 1910

By Raymond S. Blatchley

Illinois recovered from the general decline in production of oil in 1909, and in 1910 produced approximately 35,000,000 bbl., as against 33,685,106 in 1908, and 30,898,339 in 1909. General market conditions and the ability of the pipe-lines to cope with the supply enabled the State to continue its growth and place as third in rank. The returns for the first eleven months of the year only are available at this time. If it be estimated that the December output of the Ohio Oil Co. was equal to that of November: the general tank-car shipments were about 2,000,000 bbl.: and the oil runs outside of the Ohio pipe-lines, averaging 12,000 bbl. daily the first nine and 16,000 bbl. daily the remaining three months, were 4,680,000 bbl.: the total may be taken at over 35,000,000 bbl. The following table gives the pipe-line runs and stocks on hand (at the month-end) of the Ohio Oil Co. and also the Eastern pipe-line stocks, by months, in barrels:

	Runs, Ohio Oil Co.	Stocks, Ohio Oil Co.	Stocks, Eastern lines.
January	2,226,108	28,455,129	3,340,116
February	1,980,408	28,385,375	3,138,018
March	2,382,806	28,373,855	3,637,610
April	2,314,789	28,716,938	3,210,907
May	2,389,994	29,125,029	3,148,509
*June	2,399,606	29,213,290	3,724,919
July	2,638,253	29,271,719	4,187,362
August	2,572,859	29,289,164	4,141,713
†September ...	2,447,106	28,965,962	4,066,122
October	2,373,325	28,615,289	3,455,197
November ...	2,245,676	28,082,606	2,996,607

*Includes oil in iron tankage purchased.

†The Tidewater Pipe Line Co. ran 164,362 bbl. in September which was included in the Eastern pipe-line stocks.

The total runs of the Ohio Oil Co. in 1909 were 27,340,775 bbl. This company averaged 87,357 bbl. daily in 1908, and 74,903 in 1909. The total daily production of the State was 92,036 bbl. in 1908 and 79,810 in 1909. The tank-car shipments are those of the Sun Oil Co., Cornplanter Refining Co., Indian Refining Co., Missouri-Illinois Oil Co., W. F. Watson, Central Refining Co., and railroad shipments from Sparta, Ill. The pipe-line runs outside of the Ohio Oil Co. were made principally by the Tidewater Pipe Line Co., and the Indian Refining Co. The runs of the first half of the year were affected by the 1909 decline, but with the coming of summer, activity increased and the runs corresponded favorably with those of 1908 and the first part of 1909. The introduction of new pipe-lines into the fields increased the runs for the year. The prices of the two grades of oil remained stationary during the year. Oil of gravity over 30°B. brought 60c. per barrel, and under 30°B. 52c. per barrel.

Clark County.—The oil in and about Clark county was found at a depth of 400 to 600 ft. The area was drilled and exhausted so rapidly that there has been scarcely any work done in the field in 1910. Only the outer edges of the old Casey territory were tested more thoroughly, but without any notable results. One or two deep tests have been made in search of oil and gas in the lower rocks, resulting in one successful well. The Ohio Oil Co. drilled a well 2969 ft. deep on the K. and N. E. Young farm near Casey. A productive sand was found at 2750 ft. that yielded about 35 bbl. of oil. The oil seemingly comes from the Trenton limestone. The shallow territory of Clark, Cumberland, and Edgar counties scarcely produced 9000 bbl. daily during the year.

Crawford County.—The Crawford County pool is the largest in extent in Illinois and produces oil from various lenses of sand between 750 and 900 ft. deep. Over 5000 wells have been drilled in the area. In recent months drilling has been scattered over the entire Robinson pool. Some concentration of development took place near New Hebron and Flat Rock in the earlier part of the year. Early in the fall the drilling shifted to the Bellair, Licking township territory, in the northwestern part of the pool, where sands at depths of about 1000 ft. yielded a good production and enlivened the field once again. Crawford county produced as high as 100,000 bbl. daily in 1907 but in 1910 seldom reached 30,000 bbl. The new wells drilled during 1910 were small compared to earlier wells, indicating a sure drain that will cause the eventual abandonment of the field, unless lower sands yield oil.

Lawrence County.—A review of operations in 1910 shows that the active work continued to shift southward from Clark and Crawford to Lawrence county, where seven distinct sands produce oil in varying quantity and grade. They are found from 750 to 1900 ft., and in their order are: the Bridgeport sands No. 1 and No. 2, 750 to 900 ft.; the Buchanan sand, 1275 to 1400 ft.; the Kirkwood sand, 1550 to 1650 ft.; the Tracy sand, 1700 to 1750 ft.; the McClosky sand, 1825 to 1850 ft.; and the Green, Henry, and Pepple sands, each with but a few wells and of varying qualities of oil. The latter sands lie between 1850 and 1910 ft. The McClosky sand is found in the southern part of the county and is the richest developed in Illinois. The initial yield from wells in this sand is from 700 to 3000 bbl. The pool is narrow and small in extent, but seems to be longlived. The next best sand is the Tracy of the King-Applegate pool in the northern part of the county. The Kirkwood, Buchanan, Bridgeport, and Green sands follow in order. While the deep sands are rich, they are not as profitable as the old Siggins sands of shallow depth, because of the larger expense in drilling and the time required to complete the wells. The chief activities of Lawrence county in 1910 were in the McClosky and King-Applegate pools. Early in the year a new pool was opened on the outskirts of Lawrenceville. Only two wells, producing about 100 bbl. initially, were found in the pool, however, while several dry holes discredited the territory. The Lawrence County area is the source of many gushers from the deep sands, the average well yielding slightly over 107 bbl. initially. The average daily yield for the county during 1910 has been between 45,000 and 55,000 bbl. The oil comes from about 12,500 wells throughout the fields, all of which are connected

to the pipe-lines of the Ohio Oil Co. There never has been an oilfield of such extent opened up and the supply so well taken care of in so short a time.

Marion County.—The best recent results from wild-catting in Illinois were in Marion county. Three oil areas have been tapped, the first being the shallow sand midway between Sandoval and Centralia (now inactive); the Sandoval pool, the largest and most productive, and the Centralia pool. The oil from the two pools last mentioned comes from the Chester formations of the Mississippian series of rocks and is equivalent to the rich Kirkwood sand of the main fields. The most productive lens is known as the Benoist sand and is found between 1525 and 1600 ft. The greatest activity of the year has taken place in the Sandoval pool, just north of the town of Sandoval. Upon December 1 there were 35 producing wells yielding over 3000 bbl. daily, 16 dry holes, and 22 wells drilling. The outlet of oil from the field has been by railroad. Recently the Ohio Oil Co. completed a pipe-line from Sandoval to Vandalia, connecting with the Alton pipe-line, and is preparing to take most of the supply. The Centralia pool has four light producing wells, several scattered dry holes, and five wells drilling. A recent investigation of this territory was made by the State Geological Survey. It was found that the field lies along an irregular terrace upon the broad and gentle western flank of the Eastern Interior coal basin. The terrace is interrupted by structural domes. The general trend is north and south, extending to Duquoin, about 40 miles south of Sandoval, and to Brownstown and Pana on the north.

Bond County.—A new gas area was opened up early in the year near Greenville. The gas sand, known as the Lindley sand, was found from 950 to 1000 ft. deep, and yielded from 1,500,000 to 2,000,000 cu. ft. of gas per day from each well. The sand was easily correlated with the Benoist sand of Sandoval and the Kirkwood sand of Lawrence county. A recent test on the Brown farm, near Pocahontas, was carried to 1975 ft., where oil was found yielding an initial production of about 25 bbl. The pay came presumably from the Niagara limestone. Several other test wells have been put down in Bond county in an effort to outline more fully the present narrow limits of the gas area and the deep oil pay-sand. Much drilling is being done at the present time.

Wild-Cat Work.—There was a continued increase in wild-cat work during the year, particularly along the western side of the State. Drilling was in progress recently in Washington, Jefferson, and Perry counties in search of the irregular Sandoval-Duquoin terrace. So far the work has been unsuccessful. A shallow gas area was opened up near Jacksonville, Morgan county, in the late spring that developed six wells of small pressure. The gas was odorless and colorless, and burned with hot blue flame. It came from a depth of about 300 ft., near the top of the St. Louis limestone. Several wells have been drilled near Olney and Sumner, immediately west of the main Illinois fields. They were in the area lying near the axis of the Illinois basin. Other drilling was done in Gallatin county that was unsuccessful except for slight showing of oil in one or two wells. Other barren wells have been drilled near Iuka, Mt. Carmel, Carlyle, Waterloo, Vandalia, Walnut Hills, and Champaign.

The development in Illinois during 1910 is presented in tables below, compiled from the *Oil City Derrick*:

WELLS DRILLED IN ILLINOIS DURING 1910

Month.	Wells Completed.	New Production, Bbl.	Dry Holes.	Average Initial Production Per Well, Bbl.	Abandoned Wells.
January	111	5,331	17	56 2/3	0
February	158	6,840	43	58 2/3	5
March	128	5,593	29	56 4/9	3
April	157	7,260	41	62 1/2	10
May	192	8,091	43	54 1/3	6
June	211	9,267	50	57 9/16	14
July	172	6,386	43	49 1/2	17
August	235	10,042	47	53 2/7	2
September	234	8,419	48	45 1/4	7
October	198	10,133	30	60 1/3	7
November	177	8,832	39	64	8
Totals	1,973	86,194	430	....	79

WELLS DRILLED IN ILLINOIS DURING 1910 BY COUNTIES

County	Wells Completed.	New Production, bbl.	Dry Holes.
Lawrence	606	55,435	88
Crawford	1,133	25,222	238
Clark	107	1,700	30
Cumberland	15	162	2
Edgar and Coles	6	65	2
Marion	53	3,540	23
Miscellaneous	53	70	47
Totals	1,973	86,194	430

On January 1, 1910, it was estimated that 16,497 wells had been drilled in Illinois. Of these, 2379 were barren of oil. In the first eleven months of 1910, 1973 wells were drilled, with 430 barren wells, bringing the totals up to 18,470 wells drilled and 2809 dry holes. The following brief table shows the progress of development since 1906:

Year.	Wells Completed.	Producing Wells.	Initial Output, Bbl.	Average Yield Dry Wells.	Average Yield Per Well, Bbl.
1906	3,283	2,793	113,012	490	40.0
1907	4,988	4,260	139,163	728	32.6
1908	3,574	3,019	78,960	555	26.1
1909	3,151	2,593	89,756	†558	34.6
*1910	1,973	1,543	86,194	430	55.8

*Eleven months.

†Seventy gas wells included.

The Ohio Oil Co., representing the Standard Oil Co., controls most of the Illinois production. It has recently bought many large properties such as the Jennings interests, Parker and Edwards, Riddle Oil Co., Brown and Hogue, The Lee Oil Co., and others. The company has two 8-in. and one 12-in. pipe-lines from the field to the East, and one 8-in. line across the State to Alton, on the Mississippi river, where a large refinery was built in 1908. The Tidewater company has an independent 8-in. line to the East.

Reviews by States and Districts

ALASKA

The annual report on the mineral resources and production of Alaska for 1910 is now in preparation under the direction of Alfred H. Brooks, of the United States Geological Survey. The more important features of this report relating to the mining development during the year are abstracted below.

The value of the mineral output of Alaska in 1910 is estimated at $17,400,000; the value in 1909 was $21,146,423. Of this, the estimated value of the gold output in 1910 was $16,360,000; that of 1909, $20,371,078. The copper production in 1910 is estimated to have been 5,600,000 lb., valued at about $740,000; that of 1909 was 4,124,705 lb., valued at $536,211. The value of the other mineral products, including silver, lead, gypsum, marble, and coal, is estimated at $300,000—an increase over that of 1909. The total value of the Alaska mineral production since 1880, is $186,000,000, of which $179,000,000 is represented by the value of the gold output. The decrease in the value of the mineral production is entirely chargeable to the falling off in the output of Fairbanks, Seward Peninsula, and some of the smaller placer districts. Except in these camps and the coalfields, the output from all the mining districts increased. In spite of the decreased gold production and the handicap because of the delay in opening the coalfields, considerable advancement was made in the mining industry. Copper mining was prosperous and much development work was done on the copper deposits. More has been accomplished than in any previous year in the development of auriferous lodes. Much work was also done toward installing large mining plants for working low-grade placer deposits. The value of the output of the gold placers in 1910 is estimated at $12,000,000; the value of the output of 1909 was $16,200,000. Though much of the richest placer ground in the older districts has been worked out, there still remain enormous bodies of auriferous gravels the value of which is too low to permit exploitation under present conditions. Although there is still much unprospected ground in the several gold-bearing districts, it does not follow that the placers found in the future will be as rich or as extensive as those that have been developed in the past. The best prospect of permanency in the placer-gold output lies in providing means for economically mining the gravels of less value. Until this has been accomplished it is to be expected that there will be large fluctuations in the annual gold output. The year 1910 saw considerable activity in enterprises looking toward this end, more especially in dredges. Aside from these large enterprises the most important events in the placer-mining industry were the advancements made in the Iditarod region and the discovery of the Squirrel River placers in the lower Kobuk basin. There was also a marked advancement in prospecting in the Beaver Creek region, where encouraging results are reported. The marked advancement in lode mining in many parts of Alaska during 1910 is the most encouraging feature of the industry. This is in part reflected by an increase from 1909 in the production from gold lodes estimated at a value of about $300,000 and an increase in the copper output of nearly a million and a half pounds. More important to the future of the lode-mining industry, however, is the amount of dead work and prospecting accomplished in the various regions. Notable advances were made in the gold-lode districts of Juneau, Prince William Sound, Kenai Peninsula, Willow Creek of the Susitna Basin, and Fairbanks, and in the copper-bearing districts of Prince William Sound and the Chitina valley. There were 13 productive gold-lode mines in operation in Alaska in 1910, one more than in 1909. In addition to this, work was done on more than 50 gold prospects, a few of which produced some gold as an incident to the development work. Of the producing mines, six were in the Juneau district.

There were seven productive copper mines in Alaska in 1910, this being the same number as in 1909. The copper production is about equally divided between Prince William Sound and the Ketchikan district. There was a small increase in copper output of the Ketchikan district and a large increase in that of Prince William Sound in 1910 as compared with 1909.

ARIZONA

By C. F. Tolman, Jr.

During 1910, copper, king of Arizona, has been given a greatly depreciated rating, and consequently his kingdom has felt the effects of this unfortunate state of affairs, but just as the debasement of silver, years ago, proved in some respects a benefit to Arizona by turning the attention of the miner to the more valuable and lasting deposits of copper, so in a number of ways the depreciation of copper has indirectly been of some value. It is beginning to be recognized that in the mining of large low-grade orebodies, especially those of copper, the ordinary law of supply and demand is reversed. A low price for copper stimulates a large production in the attempt to make a profit, and at times of great demand and high prices, the productive capacity of the reduction plants is diminished by the large amount of low-grade ore that is treated because it then becomes profitable. One copper mine of Arizona is reported to have skimmed its milk by making large shipments of 18% ore to its smelter in the endeavor to keep even with the market. The extension of the application of copper to new purposes is hindered by fluctuating prices. These lessons once learned, the proper kind of 'copper combine' can be formed. The mining industry, more than any other, has profited by modern labor-saving devices. New machines and new methods of mining have been invented to reduce costs. This is due to the forced competition of lower-grade, or smaller, mines against higher-grade, larger, or more favorably situated properties; especially is this true among copper mines. The waste and carelessness that develop wherever competition is stifled are real dangers today, and the mining industry can teach us lessons along these lines. Slack times in Arizona have almost killed the wild-cat, and optimists have even dared predict that the cat will never completely recover. If this prove true, then a large item will be added to the profit side of the ledger. The development of prospects is now being carried on by individuals rather than companies, by men who know how to properly weigh the return of the gamble. Engineers, miners, prospectors, and at last the public, are recognizing the injury done by stock companies developing prospects, with the accompanying misrepresentation which must be made to cause the simple to part with their money. In the future, development must be done by individuals or special companies, that frankly explain their purposes and the chances they take. Formerly wild-cats alone were held up to criticism, but now the public is being informed that the injury wrought by overvaluation of good mines is still more serious, accompanied as it is by systematic withholding of information from the public, falsification of reports, and cold-blooded stock manipulation. The sheep have been sheared so closely at home that copper manipulators are quite active in Europe at present.

Turning to the Arizona copper camps: At Bisbee the Shattuck & Arizona has done all that the developments of the preceding year suggested. At Globe the Old Dominion is reported to have had excellent returns from its recent developments toward Pinal creek, a region which has been somewhat avoided for fear of increasing the flow of mine-water. The 'disseminated coppers' had previous to this year uncovered such tonnages that the increases in the official estimates are not of interest to the public. The splendid Miami mill, if not running before this is published, will certainly be operating soon after, and its larger neighbor at Hayden will follow soon. The disappointment furnished by certain of the Globe disseminated deposits, which to casual examination presented

attractive surface showings, suggest that there is still room for educating operators to the value of detailed geological examination in place of the easier method of a glance and a guess. The shutting down of the Imperial mines at Silverbell and the smelter at Sasco, has been a blow to all mining activity in the southern portion of Arizona, but the company has continued its explorations of the disseminated-copper deposits in porphyry and granite, the results of which are reported to have been satisfactory to the management. The Prescott, and western Arizona gold belts have suffered less than the copper fields, but no large new producers have been brought in. Arizona shares in part the dry-placer excitement which started in Sonora, due in large measure to the successful operation of the Quenner pulverizer. As has been described a number of times in the recent technical journals, this machine beats the cemented gravels by rapidly-revolving chains, and solves the problem of cracking the cement off the boulders of the indurated conglomerate, with a minimum expenditure of energy, and a large capacity for each machine. The placers of northwestern Sonora and southwestern Arizona are formed in the accumulations of débris washed down from low desert mountains composed of pre-Cambrian schists, gneisses, and granites, limestones mainly of Paleozoic age, and post-Paleozoic granites and other intrusives (the mineralizing agents). All these formations carry gold, especially the granites and gneisses, which are found reconcentrated in the desert gravels, not only near the surface, but in deeper channels, which in places are thoroughly cemented with the calcareous cement of the semi-arid region. Large amounts of gold have been taken from these deposits by Indians and Mexicans with the most primitive methods, but all attempts with modern plants and water concentration have failed. The Quenner pulverizer and the Mexican dry-washing machine may accomplish what more pretentious plants have failed to do.

AUSTRALIA

Until a few weeks ago it seemed as if the year 1910 would pass without a single mining discovery of importance being recorded in the vast extent of Australia. When it is remembered that the continent is as large as the United States and that settlement has only extended practically to 200 miles from the seashore, it can be understood that there are vast areas awaiting development. The drawback to the country is that a very large portion of it consists of arid territory. Prospectors, unless they are equipped to meet the greatest hardships, cannot penetrate safely into the greater portion of it. Consequently a large part of Australia is absolutely unexplored. It has merely been entered by the prospector, who has then had to retreat, baffled by the difficulties that he has had to face. Consequently the extent of mineral territory brought within the range of practical working expands slowly. Another natural disadvantage is that Australia is old geologically, and erosion has proceeded to such an extent that the ancient formations, those likely to carry minerals, are obscured by recent drift, and many of the mineral deposits are discovered only by accident. A case in point was the recent discovery of gold-bearing formations in the Yilgarn district, in Western Australia, which has occasioned a world-wide interest, in view of the richness of the neighboring field of Kalgoorlie. It is hoped that a goldfield of similar extent has been discovered at Yilgarn. The country is almost flat. In many places there is a hard surface cement, and it is only where an outcrop occurs that there is the slightest indication of quartz veins or other gold-bearing formation in a mineral belt 40 miles in length. On one side is granite and on the other greenstone, probably diorite. Along this belt, as is pointed out by the State mining engineer, the greenstones are found sheared and silicified, there being abundance of jasper and hematite, especially close to the granite contact. These zones have been fractured by earth movements with the subsequent formation of bodies of auriferous quartz. It is in this area that the Bullfinch mine was found. Half of it was sold for £1000; within a month such richness of gold had been exposed, and imagination of the public had been so wrought up by the stories told of this wealth, that an offer of £500,000 was made for the property. This discovery resulted in the greatest boom that has taken place since the days of Kalgoorlie. 'Wild-cats' innumerable sprang up, and it is certain, despite all the speculation that has resulted, that a fine mineral belt is about to be developed in this region. Unfortunately, no other mineral discovery of importance has been made in Australia within the year. This arises, in part, from the prosperous state of the pastoral and agricultural industries, in which fortunes have been made, and in the utilization of land suitable for the growth of cereals, or for sheep-runs. No such inducement has stimulated the mining industry. The price of base metals has been low, and the cost of gold mining has been high. This is because of the high rate of wages, the greater depths attained in the mines, and the refractory character of many of the ores worked. Still, at the present time, the mineral industry of Australia is merely dormant. The country is too vast, and its mineral possibilities too great, for the industry to long remain quiescent. As it is, the production is nearly £23,000,000 per annum, so mining really stands next in importance to the vast pastoral and agricultural industries.

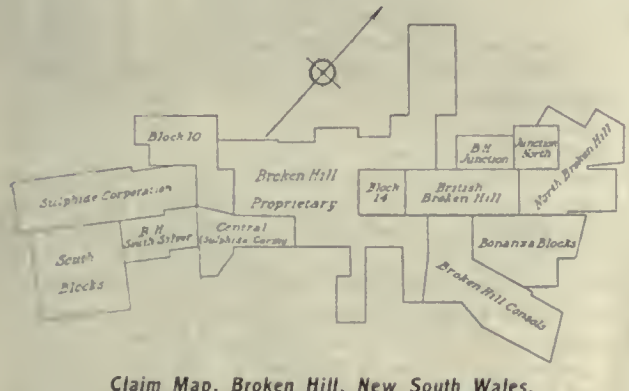
So far as gold mining is concerned, the old fields show declining yields. Taking them in the order of their importance, Kalgoorlie unquestionably is not the Kalgoorlie of old. The mines there, largely under the control of American engineers, have been worked on a large scale, quite in contrast to the more steady and slower policy of the Australian mining engineer of the eastern slope. Consequently, in Kalgoorlie, huge plants are at work and these have already dealt with all the high-class ore. With depth the ores of lower grade are still extensive. To make up for the lower grade of the ore mined, extra battery capacity has been provided, but the output of the field, nevertheless, shows a falling off. The compensating factor has been the reduction in costs, and it is wonderful how far the American managers have been enabled to accommodate themselves to the drop in the grade of ore. Still, that cannot go on forever, and without being unduly pessimistic, it is certain that the Kalgoorlie goldfield will continue to show a shrinkage of yield. Other parts of Western Australia have not so far furnished any gold-bearing resources to compensate for the decline in this centre. Whether the Bullfinch area in the Yilgarn district will do so, remains to be proved. In the eastern States of Australia the gold yield is also dwindling, but somewhat more slowly. Starting with Queensland, a great deal of the development at Charters Towers promises substantial results during 1911 should the formations that are being prospected at great depth prove to be payable. Gympie is dull, but there is some prospect of a revival in the Etheridge field, now that the Chillagoe company has extended its operations there. Mt. Morgan is becoming annually more important as a copper mine. Still its gold yield is no unimportant factor in the returns of the eastern Australian States. New South Wales, South Australia, and Tasmania do not count as large gold producers. Victoria, however, still outputs gold at about the same rate. It has been helped by a revival in alluvial mining and is being assisted still more by the development of side-zones in the Bendigo field. Hitherto mining has been confined largely to the Hustlers, New Chum, Garden Gully, and Moon zone. On some of these mining has been carried on to well over 4000 ft. in depth. At the present time sinking in the Victoria Consolidated on the New Chum zone has reached 4600 ft., and it is intended to go to 5000 ft. The State is aiding this work in the hope that the highly auriferous saddle formations developed in the upper levels of this mine will be repeated at great depth. Much more promising than this work is the outlook for side-zones of which there are several still undeveloped since surfacing was done on them in the old days, often with profitable results. E. J. Dunn, the Gov-

ernment geologist, holds that Bendigo, because of its extensive system of saddle formations on distinct lines, has a century's work ahead of it. The Australasian gold yield for the year 1910 can be approximated and compared with that of 1908 and 1909 as follows:

	1908.	1909.	*1910.
	oz.	oz.	oz.
Victoria	676,005	646,672	581,989
New South Wales	224,792	204,709	193,453
Queensland	461,359	450,937	434,785
Western Australia	1,648,505	1,595,263	1,460,514
South Australia	9,162	7,420	7,400
Tasmania	60,712	44,670	44,400
Totals	3,080,535	2,949,671	2,722,541

*December returns estimated.

The progress in copper mining has not been as great as was hoped for. This arises from the low price of the metal. The Mt. Lyell company in Tasmania is still the largest producer, its bonanza mine, the North Lyell, having been developed to 1100 ft. At that level the shoots of ore followed down from the 850 and 1000-ft. levels are less extensive, but above the 850-ft. level the ore-shoots were found to have pinched. It is hoped that another expansion of the mineralized zone will be found. However, the mine still has years of work ahead. The Mt. Balfour field has not come up to expectations and the boom is dead. In Australia proper the Mt. Morgan mine is close at the heels



Claim Map, Broken Hill, New South Wales.

of the Mt. Lyell. The high percentage of gold in its ore and the extent of its recources make it the greatest mine in Australia, and one of the most important in the world. It is now using pyritic ore from the Many Peaks mine, and so will cheapen costs and increase its output. Then, in north Queensland, the Cloncurry mines, like the Mt. Elliott and the Hampden, have developed large reserves of high-grade copper ore carrying gold. These mines, at an early date, will be dividend-paying and will put north Queensland in the lead of Australian copper producers, at least as far as any single district is concerned. British capital has done most to develop this part of Australia.

Tin mining is still an important industry, but it is slowly declining, owing to the steady depletion of the alluvial deposits. The New South Wales output has helped substantially by the use of dredges. In Tasmania, the Mt. Bischoff looks better than it has for years, and the deep levels are producing well, but the industry, as stated, is lagging. The same applies to the industry in Queensland. There, however, is found a formation carrying about 1% of tin which may yet be worked with profit.

Lead and zinc mining is still practically confined to the great Broken Hill field. The Broken Hill Proprietary Co. refuses to re-open its mine, notwithstanding that it has about 4,000,000 tons in reserve, until the price of lead is higher. Its neighbors, the Block 10 and Block 14, are within sight of exhaustion, but to the south the Sulphide Corporation and the South mines, working on the pitch of the great shoot of ore from the Proprietary's southern leases, have developed splendidly. The South Blocks, an English company, is doing very well, and the South Extended is opening a new orebody some distance south of the principal mines, and may develop another productive area. At the north end of the field the event of the year has been the remarkable cutting out of the shoot of ore worked by the Junction North mine. What effect this will have on the fate of the important North mine remains to be proved by actual work, which must determine whether, as it is on the pitch of the shoot, it will suffer similarly. Looking at the Broken Hill mines today, it can be said that in the leading mines there are ore reserves sufficient for 5 to 14 years. Still, just as the North has to consider whether it will find a contraction in the orebody it is developing, so the mines at the south end of the field have to determine, as work progresses, whether the orebody contracts in their leases as it has in Block 10 at depth.

The other great mineral industry is coal mining. There can be no question as to the extent of the resources of New South Wales and Queensland. But the New South Wales coal miner is a socialist and a person prone to quarrel on the least pretext. He caused the Newcastle field to become idle twelve months ago, and the result was that the collieries have suffered seriously in their over-sea trade. An excuse was also given to the Victorian government to start a State coal mine at the Powlett, where a large seam was discovered. So the coal industry in New South Wales is stagnating and collieries are being shut down. Because of this, another strike is threatened and the naturalization of the miners is demanded. As labor is paramount in Australia just now, no one can tell what will happen.

BRITISH COLUMBIA

The ore production of southeastern British Columbia for the year 1910 is estimated at 2,240,000 tons, which is an increase over 1909 of 50,000 tons. The valuation of this production, approximately, is $17,750,000, an increase over the preceding year of $350,000. The Boundary and Rossland districts will show an increased output, while the Slocan-Kootenay will show a slight decrease, owing to several big producers being closed down or only operated part time. Mining in Rossland district has progressed slightly. The Granby, interesting itself in the Cliff-St. Elmo group and putting a force to work, has had a stimulating effect. The Blue Bird was re-opened by its Spokane owners; the Mayflower, Nickel Plate, I. X. L., Lily May, and other small properties, worked; and an increased production was shown by the Centre Star-War Eagle, Le Roi No. 2, and the Le Roi mines. At the Centre Star group, work was carried on steadily all year. The ore reserves at the end of the year, after shipping an increased tonnage over last year, prove about 246,000 tons. A new rich ore-zone was opened in the War Eagle mine, while development of the Iron Mask and Idaho claims of this company resulted in discovering new ore. At the Josie mine of the Le Roi No. 2, Ltd., the work of sinking the main shaft from the 900 to the 1300-ft. level was completed, and the continuation of the North Annie vein was found. The company made a normal production and paid three dividends of 50c. per share each. The year closes with 18 months' ore in the reserves. Work was also started on the Surprise claim of this company in an effort to enter the ore-zone existing on the War Eagle. The Le Roi mine was not worked steadily, though it made an ore production of 2000 tons in excess of 1909. The company has gone into voluntary liquidation, and the mine and plant are for sale. In November and December there were rumors that they would be bought by a strong company. Granby engineers have been through the mine, but there is nothing definite known yet. At the Trail smelter and refinery the amount of ore and concentrate treated amounted to 456,750 tons, as compared with 432,450 in 1909. The value of this product is close to $6,000,000. The Consolidated M. & S. Co. during the year acquired the Number Seven and Molly Gibson mines and shipped regularly from its Centre Star-War Eagle, St. Eugene, Snowshoe, Richmond-Eureka, Sullivan, and other mines. In the Boundary district the Granby company made a production of over 1,000,000 tons

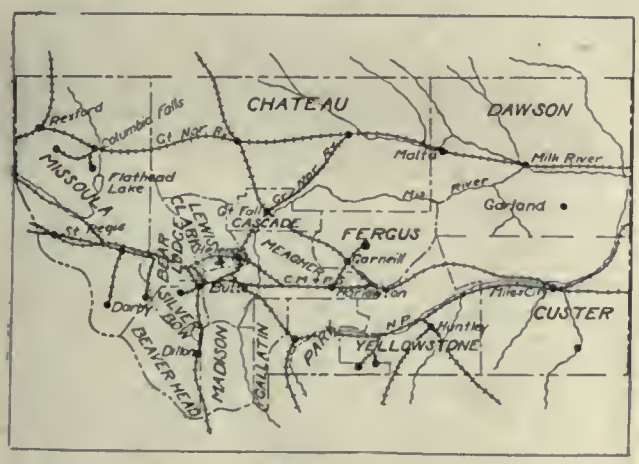
of ore, and it is estimated that $4 per share was made by the company during the year. One dividend of $1 per share was paid in December, and the company had nearly $1,000,000 cash on hand at the end of its last fiscal year. In April, Otto Sussmann examined the Phoenix mines of the company and reported 6,000,000 tons of ore in the reserve, which caused a drop in the company's securities. The Hidden Creek mine, Observatory Inlet, was acquired at a cost of $400,000 for an 80% interest. A fire occurred at the Phoenix mines in August which destroyed the machine-shop, oil-house, and No. 3 outlet. The old buildings were replaced with new brick and steel structures, equipped with heavy modern machine-shop tools. The company also acquired the Cliff-St. Elmo group at Rossland and placed compressed-air power on the property, beginning actual development. The British Columbia Copper Co. made a steady production, except in the month of May, during which there was a strike of the miners in Greenwood. This concern enlarged its Greenwood smelter, placed its Jackpot mine on a shipping basis, as well as the Rawhide mine of the New Dominion Copper Co. A tramway is being built from its Lone Star mine to Boundary Falls, at a cost of $75,000. At Hedley, the Hedley Gold Mining Co. spent nearly $100,000 for additional boilers, engine, generator, water-wheel, motors, tube-mill, Deister tables, and filter-presses. An increased tonnage of ore was made, and $144,000 was paid in dividends. In September the Kingston group at Hedley was bonded by the Redeemable Trust Co. of Boston. At Princeton the Princeton Coal & Land Co. made additions to its coal-handling and ventilating plant, while the Osoyoos Coal Mining Co. worked a small force at diamond-drilling on its 15-ft. coal seam. At Granite Creek the Columbia Coal & Coke Co. put in a 100-hp. steam compressed-air plant, and rock-drills to drive on its bituminous coal.

In the Nelson district the Silver King was operated under lease until June. The Athabasca was worked during the year; and the Granite-Poorman mine and mill were operated at a profit of $30,000 to the owners. The Dominion Government appropriated $50,000 for experimental work, toward solving the zinc problem of this district. The French Complex Ore Reduction Co. also built an experimental plant at Nelson and will run some tests next year. About $350,000 was paid as bounty to the lead miners this year, the rate of bounty being $15 per ton. Some mining property changed hands in the Sheep Creek district, including the Clyde-Belt group, Vancouver, Davenport, Eureka, and Kootenay Bell. The final payment on the purchase price of the Queen mine, $175,000, was made, as well as the final payment on the price of the Nugget mine, $40,000. The 20-stamp mill at the Queen worked all year on ore averaging $12.16 per ton. The 4-stamp mill on the Nugget was also worked steadily; and the blocking-out of ore on the Mother Lode was carried on. The vein in this mine has proved-up well, and a millsite is being cleared for a 50-ton concentrator, about to be ordered. Compressed air was used at the Mother Lode from the Queen system, carried through a 4-in. pipe 10,000 ft. long; four 3¼-in. drills and two hammer-drills were installed. The Yankee Girl Gold Mines at Ymir has a new 7-drill compressor and four drills. The company's production shows an increase of ore over that of last year. This ore averages $21.21 per ton; and the mine contains a large tonnage of $9.50 ore for which a concentrator may be built next spring. The Dundee Gold Mines Co. installed a small air-compressor and drill, the Wilcox mill produced a small tonnage of concentrate, the Second Relief mine and mill were operated at Erie, and work was resumed on the Big Bump. In the Slocan-Kootenay district ore shipments were resumed at the Sullivan mine after a long shut-down. The Slocan Star also resumed shipping. The Blue Bell mine and mill were operated until March only. A forest fire in August interrupted work at the Rambler-Cariboo, Lucky Jim, and other mines in the Kaslo district. The Lucky Jim company later put in a five-drill compressor and will continue development work this winter. The Rambler-Cariboo compressor plant was working again in September, and the ore will be hauled to Three Forks this winter, to be shipped over the Canadian Pacific railroad, as the Kaslo & Sandon railway bridges were burned. In the Standard mine at Silverton the ore widened in No. 5 tunnel to 30 ft., 24 ft. of which was of shipping grade, carrying 70% lead and 70 to 100 oz. silver. A sale of the property at $400,000 was recently reported. The Van Roi has a new vein and the 100-ton concentrator on Four-Mile creek is nearly finished. The North Star mine paid a dividend of 2%, amounting to $26,000. The Crow's Nest Pass Coal Co. has produced as high as 6200 tons of coal per day, but the output has now dropped to about 5000 tons. Two dividends were paid during the year amounting to nearly $125,000. The Corbin Coal & Coke Co. and the Hosmer Coal Co. both made average productions. The Canadian Geological Survey parties worked in the Slocan this year, and made a topographical and geographical map of Franklin camp; also a similar map of the Mother Lode and Sunset ground near Greenwood. The Sullivan mine was mapped in east Kootenay, and the Atlin country, Portland Canal, Vancouver Island, Tulameen, Hazelton, and Babine mining districts were covered.

BUTTE, MONTANA

Important events have marked the progress made by the mining industry in Montana during 1910. The merger of the leading copper-producing companies of the Butte district, was brought about during the year, whereby the Anaconda, Boston & Montana, Butte Coalition, Butte & Boston, Washoe, Original, Trenton, and Parrot mines, formerly operating independently, are now operated under the name of the Anaconda Copper Mining Co. The merger was probably the most important move in the copper-mining industry during the year. There are a number of independent companies still operating in Butte, but at least one of them, the North Butte, will eventually be taken into the Anaconda merger. The other independents include the East Butte, Elm Orlu, Tuolumne, Butte-Ballaklava, Butte & Superior, and the Butte Central Copper Co. The merger of eight of the principal copper companies has made possible the introduction of economies in a number of departments; and whereas the average cost of production of the eight companies had been close to 11c. per pound, the cost under the merger was reduced to 9c. per pound. This low cost, which included operating expenses and a liberal allowance for depreciation, was maintained until the policy of curtailment was adopted. It is not possible to reduce the working forces in the Butte mines greatly without a complete shut-down of some properties, and with the mining costs only slightly reduced and the output cut about 15%, the cost of production necessarily increased again, and for three months or more Anaconda costs have been about 10c. per pound, with copper delivered at the seaport. Changes are being made to introduce further economies, and for greater concentration of operations which will bring costs so low, according to the claims of Anaconda engineers, that no fear need be felt that any other district in the world can do better. The installation of the new hoisting plant on the Anaconda hill is aimed to be a step in the line of cost reduction. The plant will not be ready for use for several months. Electricity will be applied for hoisting purposes at three of the mines of the Anaconda company. Hoisting will be done with compressed air from electrically-driven compressors. The installation of the new plant referred to cost $400,000, and it is estimated that by its operation the cost of hoisting will be reduced to one-third the former figure. Electric pumping-stations are also being installed in the mines. In addition to the surface improvements being made by the Anaconda and other companies, much development is being done in the mines. The Anaconda company is sinking three new four-compartment working shafts, one each at the Badger State, Gagnon, and Belmont mines. The shaft on the last named is in the southern part of the district, and will eventually become the main

working shaft for all the Anaconda hill mines, with the workings of which it is being connected. The purpose of the new shaft on the Gagnon is to replace the old incline, to be used only as an air-shaft when the new one is completed. The Gagnon shaft will be sunk to a depth of 2300 ft., and is down about half that depth now. Some rich orebodies have been opened at that depth in the Gagnon mine. The Badger State is being developed into one of the most important properties in the district, being the farthest north of any of the copper mines. It has been opened to a depth of 1800 ft. and regular shipments of several hundred tons of ore per day were begun a short time ago. The North Butte Mining Co. has been devoting more time to mining and less to stock markets recently, with the result that the property is coming into its own again. The lowest level opened is at 2200 ft., and a station is now being cut at 2400 ft. During the copper boom days the North Butte mined and shipped about 1500 tons of ore per day and turned out about 3,000,000 lb. of copper per month. The management then had its eye on the stock market and kept all information to itself until the rich orebodies appeared to be exhausted and the insiders had unloaded their stock. Those were the days when the stockholders were ignored, and the officers of the company used to tell the seekers for information and publicity that the public and the newspapers made them tired. After



Montana.

the crash, there was a different tune, and now the stockholders are furnished with quarterly mine reports, and the affairs of the company are more open to the public. The company is shipping now about 1000 tons of ore per day, but the copper production is under 2,000,000 lb. per month, the cost of which is about 10½c. per lb. The East Butte Copper M. Co., owner of the Pittsmont mines and smelter, is the most important company outside of Anaconda influence. It is making about 1,000,000 lb. of copper per month at a cost of about 10c. per lb. The most important discovery of copper ore made in the district in several years was made in the Pittsmont a few months ago. The new orebody was opened on the 800-ft. level, and is several thousand feet in length, and has an average width of 38 ft., the ore from it, so far as mined, assaying 7% copper and about 6 oz. silver per ton. The Tuolumne is another important producer and may develop into a dividend payer. The company has settled its litigation with the North Butte company and is now in position to do profitable mining, several remarkably rich orebodies having been opened. The property has been opened to a depth of 1400 ft., and has good equipment; but the directors, as soon as the litigation was settled, announced their intention to put up a new hoisting plant at a cost of $200,000, and to sink the shaft 2500 ft. deep. It is officially stated that there is no intention of paying a dividend soon. The Butte Central Copper Co., owner of the Ophir mine, has developed that property extensively, and, according to estimates, has 1,000,000 tons of ore in sight down to the 500-ft. level. The ore contains considerable silver and gold, and a 100-ton concentrator is to be built next spring. The Butte-Baliaklava Copper Co. developed a large body of high-grade copper ore on the Burke and Baliaklava claims, but after it had started to ship ore and produce copper at the rate of 600,000 lb. per month, the Anaconda company stopped work by injunction, claiming that the orebody belongs to the Mountain Chief, one of the Anaconda properties. While the orebody in question is tied up, the Butte-Baliaklava company is developing other veins in its ground. W. A. Clark has been working only two properties in Butte since he sold the Original and Stewart groups to the Anaconda company. These are the Elm Orlu, a zinc producer, and the Poser, which yields copper ore; although the old Moulton mine, a silver property, is being placed in condition for mining again.

The result of the copper curtailment cut the 1910 production of the Butte district about 26,000,000 lb. below that of 1909, but it is still about 12,000,000 lb. more than 1908. The monthly production in pounds for the last two years follows:

	1910.	1909.
January	19,224,250	26,502,600
February	13,755,620	24,871,730
March	24,757,700	28,077,510
April	25,087,200	25,347,420
May	28,363,760	26,443,244
June	26,356,200	25,187,780
July	24,303,500	26,580,820
August	24,762,800	26,061,140
September	22,990,050	26,584,180
October	22,913,781	28,166,166
November	23,636,550	27,649,140
December	22,879,116	14,675,880
Totals	279,030,527	306,147,610

Outside of Butte more prospecting and development was done in Montana during 1910 than for several years. The most important results were achieved in the Georgetown and Southern Cross district, Deer Lodge and Granite counties. It is estimated that half a million dollars in gold was taken out of that district in the past six months. The Southern Cross mine, upon which the Guggenheims had an option for $900,000, has ore that is hard to treat, and for this reason the option was allowed to lapse. The Cable mine is in the same district, and has also been a steady producer for 20 years. The Conrey Placer Mining Co., in which Harvard University is interested, is extending its operations at the mouth of Alder gulch, and is just completing its fourth dredging boat, which will be one of the largest dredges in the world and will cost $270,000. It will have a capacity to work 8000 cu. yd. of earth yer day. The dredge is 150 ft. in length, 58 ft. wide; will work to a depth of 55 ft. below the water-line, and has a chain of 86 buckets, each capable of lifting 16 cu. ft. of earth. The machinery will be operated by electric power. This company is working in ground that yields 17c. per cubic yard at a cost of 5c. per yard. In the Helena district, the Jay Gould mine and 40-stamp mill are in operation, and the old Belmont mine is being explored for new orebodies. In the Radersburg district the Keating is employing 85 men and shipping ore to the East Butte smelter. The Black Friday, in same district, is also shipping ore. It is probable that a railroad will be built from Toston to Radersburg in the spring. The Barnes-King company has again ceased operating its mine at Kendall in Fergus county. As the company has about $300,000 in its treasury, the directors are looking for a new property, and there are reports that they will purchase the Santiago mine, adjoining the Barnes-King, or the Kendall property nearby. It is estimated that the gold production of Montana in 1910 was about $4,500,000, an increase of $500,000 over the production of 1909; the value of the silver production of 1910 was $16,000,000, against $15,125,000 in 1909; the estimated value of the 1910 copper production is $36,400,000. The State produced considerable lead and zinc, and some tungsten, besides its output of sapphires and other precious stones, which was important.

ELY, NEVADA

The best record ever made by a new company in the copper business is that of the Nevada Consolidated, of Ely, which for 1910 produced, approximately, 65,000,000 lb. of blister copper, as against 43,000,000 lb. in 1909. During the past six months, in harmony with other large companies, it curtailed production about 20%. Had it continued at full capacity for the entire year, its output would have been increased about 10,000,000 lb. The company has demonstrated its ability to make copper at the lowest cost of any company operating in the United States or Mexico. The cost of its output for the year averaged a little less than 7c. per pound. During the months when the plant was running to its full capacity the cost was 6.44c., and this would have been maintained for the balance of the year had not the order been issued for the curtailment of output. The gross earnings of the company for 1910 amounted to $3,609,000, which stands without a parallel in the history of copper mining, considering the age of the company and the low price of the metal for the year. This marked success was due both to the great magnitude of the sulphide ore deposits and to steam-shovel mining at the minimum cost. During the greater portion of the year six steam-shovels were employed, four on overburden and two on ore, but owing to the fact that the rolling-stock was somewhat limited the machines were not worked to their full capacity. During December three dinky engines arrived, and will soon be engaged in and near the pits, making ten engines engaged in that class of work. This, however, will not affect the output of ore from the pit, which is limited by the capacity of the Steptoe concentrator, which can be easily served by two steam-shovels. When the eight sections of the concentrator are in operation, from 9000 to 10,000 tons of ore per day are treated, though between 11,000 and 12,000 tons have been treated within 24 hours under the most favorable conditions. During the year the exploration of new territory has been continued by churn-drill operations, with the result that the net gain over extraction has been more than 11,000,000 tons, which, added to the ore reserves previously demonstrated, gives the total of more than 40,000,000 tons of commercial ore. It will require many years of churn-drill exploration to demonstrate the ore reserves in other territory owned by the company. The output for the year 1911 will doubtless depend largely upon the price of the metal. Should the price continue to advance a much larger output than last year may be expected, and this can be accomplished without material increase of cost, because additional rolling-stock has been provided at the pit, and much necessary dead-work was done during the year on the new Liberty pit, which can soon be drawn upon for additional supply of ore.

Next to the Nevada Consolidated in area owned and tonnage of ore demonstrated, is the Giroux Consolidated, which is yet in the development stage, but it is estimated that it has 25,000,000 to 30,000,000 tons of the highest-grade ore in the district. Much of the sulphide ore of the Giroux company lies near the surface, affording ideal conditions for steam-shovel operations, similar to those of the Nevada Consolidated; but the ore is much higher in grade, assaying from 2½ to 7% copper. In addition to its sulphide ore the company has explored a large body of carbonate and oxide ore in its Alpha workings, sampling 10 to 15% copper, and also containing more gold than the Nevada Consolidated ores. This portion of the property has been equipped during the year with one of the largest hoisting plants in the United States, a technical description of which appeared in the *Mining and Scientific Press* in its issue of June 11, 1910. The new equipment will be in operation within a few weeks, after which the company will be able to produce ore that will stand the cost of transportation to Utah smelters. However, it is not probable that ores of this class will be shipped, as Thomas F. Cole, president of the company, has stated that a smelting and concentrating plant will soon be erected in the Ely district. The company did little development work during the year, aside from churn-drill prospecting, which proved satisfactory. The work of the year was confined mostly to sinking the new 5-compartment working-shaft in solid limestone. This shaft has now reached a depth of nearly 1400 ft., and a cross-cut is to be driven from the 1400-ft. station to the Alpha workings, a distance of 700 ft. Similar cross-cuts have already been driven from the 700 and 1200-ft. stations of the new shaft. The property is evidently ready to produce a large tonnage of high-grade ore, which apparently is in demand at the Tooele plant of the International Smelting & Refining Co. While it is evident that the Giroux company will soon enter the producing class, in the opinion of your correspondent, it will not do so until after it has erected its own concentrating and smelting plants. It is probable, however, that some of the high-grade ore from the Alpha workings, which it will be found necessary to raise to the surface in doing development work, may be shipped to the Tooele smelter for treatment.

GERMANY

The mining industries of Germany are practically summed up in two items, namely, coal and iron. The third, of international importance, is potash. Petroleum is obtained in considerable quantities, and other minerals in greater or less quantities are found. Unfortunately, the mining statistics, except for coal, are not published with such punctuality as are manufacturing statistics, although it might appear that the former would be the more easily made up. However, some idea of the production of iron ore may be got from the quantity of crude iron produced, although it is to be remembered that considerable foreign ore, notably Spanish and Scandinavian, is imported. The quantity of crude iron produced in the first ten months of the year amounted to 12,213,908 tons, November and December still to be accounted for. The ten months' production for 1910 is almost as much as that for the twelve months of 1909, and is greater than the twelve months' output of 1908. The figures for 1909 and 1908, respectively, were 12,917,653 and 11,813,511 tons. The total production for this year, as was explained at a recent technical meeting in Germany, will make about 14,000,000 tons, and this contrasts with about 500,000 tons in the year 1860. In an article appearing in the *Stahl und Eisen* in November, it is shown that the German iron ore reserves are estimated at 3,916,800,000 tons. The quantity looks large, but in view of the steady advance in consumption the prospective life of the iron industry in Germany would not appear to be a long one; but similar calculations can be made with respect to all the iron-producing countries in the world.

The quantity of coal extracted between January and September, inclusive, this year, made 112,740,266 tons, which compared with 110,339,981 tons in 1909, shows a substantial increase, and as the last winter was a warm one, the increase will appear all the more important as indicating a larger use in the industries. As to brown coal, there was a slight decrease in production, amounting in nine months to 49,930,607 tons this year, as compared with 49,999,987 tons last year. The most interesting element in German mining this year is that of potash, which has become one of international importance, both economically and politically. Early in the year the efforts to gather all the potash mining industries into syndicate form, embracing particularly those that had stood out in previous years, met with a good deal of success under the protecting influence of the Government, which introduced and ultimately carried into law a scheme apportioning to the various individual interests their shares in the general production of the country, especially as far as permission to export the product is concerned; the law sets certain fiscal limits to development, beyond which the product is liable to a 'super-contingent' tax. American readers are no doubt aware of the trouble that has existed between the American buyers and the German sellers, but they may not be so well acquainted with the fact that, owing to the protection afforded by the new potash law, this industry has become the pet field of the German company promoter and amal-

gamation organizer. Almost daily some new scheme is before the German financial world for exploiting the national potash reserves. One of the developments in the potash mining industry of some technical interest is that the law requires at least two shafts for each mine, but numerous concerns have managed to comply with the law by using each other's shafts, whereby two contiguous mines form an underground connection, thus avoiding the sinking of an extra shaft. This was the only way in many cases by which the extra shaft could be provided and the interested companies remain alive, for the cost of sinking a new one would have hopelessly crippled them. Sometimes the mere fact of connecting the shafts has not provided the safety contemplated in the law, and it is stated that the Government will intervene and require that all such connections shall be not only in existence, but shall offer all the adequate protection that it was the intention of the law to secure.

German petroleum production is always laboring under the oppression of outside competition, so that there is not much new to be said of it except that the reserves show considerable persistence. They have not had the brilliant history of the gusher fields of the Caucasus and other parts of the world. But many of the wells are showing long lives, and hopes are entertained that in Alsace the petroleum industry is on the eve of considerable extension. In round figures, the German oilfields produce 350,000 tons a year; and a monopoly is on the tapis. It should be stated that the German Government is said to be contemplating an extension of its proprietorship in coal mines, particularly in the district of Linden.

JOPLIN DISTRICT

While the year 1910 has not been a record-breaker, the production closely approximates that of 1909, both in lead and zinc, and the year was marked by increased and important mine development. With only two weeks to be reported, the zinc-ore shipments are but 5000 tons behind those of 1909, and with the surplus in the bins the actual production is equal to that of last year. This means a zinc production of approximately 300,000 tons, of which slightly more than nine-tenths is blende and the remainder calamine. This year there was a greater falling off in calamine than in 1909, and yet calamine ore prices averaged higher. The reverse was true of blende. In valuation the zinc product will approximate $12,250,000 for the year. With but two weeks to be accounted for, the total value of the blende has reached $11,316,897, and of the calamine $674,160. This shows a decrease from 1909 to $359,416. The average price of blende for 1910 to December 20 has been $41.89, and for calamine, $25.57, as compared with $42.16 and $24.02 in 1909. Lead shipments for 1910 will, it is believed, equal those of 1909. In production they will certainly surpass last year, for the year closes with a heavy surplus in the bins. With two weeks lacking, the present shipments total 42,146 tons with a valuation of $2,207,975. As compared with the same period of 1909, there is a decrease of $179,079 in value. It is already known that the last two weeks' shipments of lead for the year will be heavy, owing to purchases already made. The average price per ton has been $52.38 as compared with $54.82 in 1909. The year opened with zinc-ore prices strong at $46 to $49 base, but they declined gradually during January and slumped heavily the first week in February, continuing until in March, when a revival took place and prices for two months ranged between $40 and $45 per ton. With the coming of April they dropped again and the price went to $36 the last week in April; the lowest price for the previous twelve months. May, June, and July was a season of recuperation and steadier markets when $38 to $41 was the prevailing quotation. August showed a slump to $35, the lowest point of the year. Thenceforward the market advanced, until in November a $48 base was paid for some ore. December so far has shown another decline, and the fourth week shows prices of $38 to $42. To correct these lowering prices and stop the accumulation of further surplus stocks, there has been a general shut-down of many of the largest producing properties of the district for an indefinite period.

There have been some remarkable developments during the past twelve months in the opening up of new fields and the extension of already well known mineralized areas. In the north end of the district at the new camp on the north fork of Spring river, north of Neck City, much progress has been made. Some of the richest mines the district has ever known have been producing heavily here for several months. The developments promise to greatly extend that area in the immediate future. It is a territory of 'soft ground', immensely rich mines, and greatly resembles the old Badger camp in many respects. Another new area of great promise is the Toms Station camp, due north of Joplin and due west of Webb City, where a large acreage of ground has been well tested and some rich mines developed. This work is just reaching the productive stage and the amount of drilling done assures a large camp within another year. This, too, is an area of 'soft ground' and rich orebodies. Some of the largest mining companies in the district have entered this field and are engaged in its active development. West of Carl Junction is another area

The Missouri-Kansas Zinc and Lead Fields.

that attracted attention this year. The old Lehigh camp is being revived under the active management of the United Zinc Co. That company has taken leases over 280 acres in the very heart of this old camp and has been getting it ready for operation for some time. The work is now reaching the productive stage. In the west field new drill-prospecting has revealed a vast acreage of territory highly mineralized. This is all virgin land, and shaft-sinking is now in progress. The ore here is also of the 'soft ground' type. The old camps of Joplin and Galena show some new developments, especially at Galena. A number of milling plants of modern design have been built and production increased. Galena, too, has felt the activities of the Playter interests, for they, more than any other, have taken over leases and undertaken new work there. The development of the new deep-ore horizon has not gone far enough to test it. Two mills are now ready to try out the possibilities of this ore, and another six months should yield some definite knowledge. The most important development in new deep ground has been at Oronogo, where the Oronogo Circle Mining Co. has put down five core-drill holes from the 230-ft. level of its present working mine and discovered a stratum of ore that has probably a 44-ft. face averaging 12% zinc. It is in flint and limestone. This is the first successful core-drilling in the district.

LAKE SUPERIOR COPPER DISTRICT

By R. H. Maurer

As nearly as can be calculated at this time, the production of the Lake Superior mines during 1910 was 222,630,000 lb. fine copper, as compared with 233,364,273 lb. produced during 1909, and with an annual average production of approximately 200,000,000 lb. for the past decade. A table showing output every fifth year since production began in 1845 is appended:

Year.	Lb. Copper.	Year.	Lb. Copper.
1845	24,880	1880	49,718,337
1850	1,281,280	1885	72,147,889
1855	5,809,334	1890	101,410,277
1860	12,068,375	1895	129,330,749
1865	14,358,592	1900	142,151,571
1870	24,622,759	1905	230,437,992
1875	36,039,497	1910	*222,630,000

*Estimated.

As in the two previous years, low prices for the finished product prevailed, the average for the year being around 13.05c. per pound, which compared with 13.48c. during the preceding year with 13.51c. during 1908 and with 20c. during 1907. In 1880 copper sold for 21.43c., and in 1894 the average was but 9.52c. During the last decade the average annual price fluctuated between 12.16c. in 1902 and 20c. in 1907 and for the decade averaged 15.47 cents.

In consequence of low prices and the voluntary restriction placed on production, dividend earnings were reduced, though in most instances the reduction was slight. The year's disbursements amounted to $6,191,700 with seven companies contributing. These same companies disbursed $6,309,200 during the previous year, and in 1906, the banner dividend year, yielded in excess of $13,250,000 in dividends. The first dividend of which there is any record was one of $60,000, paid by the Cliff mine in 1849, and with this payment there began a dividend record such as no other district can show. The total amount yielded in dividends by the mines of this district now stands at more than $182,000,000. Against this amount there is charged a total of about $77,000,000 in assessments levied by the various companies that at one time or another attempted, and some of which are at the present attempting the development of profitable mines. Though success came to comparatively few, the money realized by these assessments was expended in honest endeavor, with a few exceptions. Several of the failures of earlier years have since developed into profitable producers, and one of them has a dividend record of $6,300,000.

Considerable attention was paid to the development of new territory which has added much to the known mineral resources of the district. The most important discoveries of new copper deposits were those made in the 'Lake district' in Ontonagon county, where the Lake amygdaloid was first opened in 1906. On several properties rich deposits were found by boring which has greatly stimulated activity there. Work of this nature was done along the belt from the Keweenaw Point to the Ontonagon river. The number of active companies was increased by several new organizations during the year and now totals 47, of which 17 may be classed as producers, the remainder being engaged in exploratory work or development. Among the more likely prospects which may be among the producers before another year passes are the Hancock, Winona, Ojibway, and Lake. The Indiana, South Lake, Algomah, Adventure, New Baltic, and Houghton have each succeeded in finding promising copper deposits and are now engaged with the development of these discoveries. None of the mines is threatened with immediate exhaustion, but in the case of a few the end is already in sight. The original Calumet mine will be worked out in possibly 12 to 15 years; also the Wolverine. In the meantime other producers are coming in and the productive limit of the district appears not to have been reached. The annual production averages slightly in excess of 200,000,000 lb. for the past decade, and the total output for the district exceeds 5,000,000,000 pounds.

An estimate of the production in pounds of fine copper of the several Lake Superior copper mines for the year 1910, also actual figures of production for the preceding year, are here given. Estimates are based upon the most reliable data obtainable. Official figures will not be available in some instances for several months to come.

Mine.	1910. (Estimated.)	1909. (Actual.)
Ahmeek	11,760,000	9,198,110
Allouez	4,850,000	4,031,532
Baltic	18,110,000	17,817,836
Calumet & Hecla.....	71,300,000	80,298,195
Centennial	1,600,000	2,583,793
Champion	19,360,000	18,005,071
Franklin	1,200,000	1,615,556
Isle Royale	7,450,000	5,719,056
Mass	1,600,000	1,723,436
Mohawk	11,470,000	11,248,474
Osceola	19,060,000	25,296,657
Quincy	21,750,000	22,511,984
Superior	3,150,000	1,485,646
Tamarack	11,560,000	13,535,207
Trimountain	5,730,000	5,282,404
Victoria	1,250,000	1,062,218
Wolverine	9,740,000	9,980,000
Miscellaneous	1,600,000	1,971,100
Total	222,630,000	233,364,273

Labor was plentiful, commanded fair wages, and despite outside agitation, worked in perfect harmony with itself and with capital. The number of workers was smaller than in the preceding year, and is now 19,000, of which quite 16,000 find employment in Houghton county, 2000 in Keweenaw county, and something like 1000 in Ontonagon county. The total a year ago was nearer 21,000 men employed in every branch of the industry in the three counties. Representatives of a Western labor organization early in the year attempted to unionize local labor, but met with little success, and in the end abandoned the attempt without attaining their object.

MEXICO

A review of the mining industry of Mexico in 1910 shows steady progress, with important gains along industrial lines. The opening of the year found Mexican mining investments, which had suffered from the prospect of unfavorable mining legislation, and the low prices of silver and copper, recovering favor in the United States and attracting attention in England and France. The Santa Gertrudis deal, pending during 1909 and definitely closed in January 1910, by which the Santa Gertrudis silver mines in the Pachuca district passed into British hands at a price of $9,000,000, served to stimulate interest in Mexican mines and strengthen faith in the future of the white metal. Later in the year Mexico profited by the advance in the price of silver, and in connection with the Centennial celebration the Republic favorably impressed the world. Had not the month of November witnessed anti-American rioting and revolutionary outbreaks—the latter having continued—the year would have ended with conditions generally satisfactory. That the disturbances, which have revived the old question, "After Diaz, what?" will affect Mexican investments to some extent is to be expected. But the revolutionary trouble has not assumed serious proportions; the Diaz government has shown its strength and can be depended on to preserve peace. And for several reasons, one of which is the very preponderance of foreign capital in Mexican enterprises, there is little probability of disturbed conditions enduring after the passing of Diaz. With Mexico ranking first among silver-producing countries, the price of the white metal is of surpassing importance, and the advances of the year just closed have resulted in increased activity in mining and milling. In January the average price of silver was 52.38c., and in November 55.63c. Only in February and March did the average fall below that

of January. In October it sold as high as 56⅞, and in November as high as 56⅝. In the fiscal year 1909-1910 silver to the value of ₱76,349,121.72 was exported from Mexico. Notwithstanding that the average price of copper remained below 13c. during the greater part of the year, the 1910 statistics will show that copper production in Mexico was well maintained. In the first ten months of the year the Cananea Consolidated Copper Co. produced 38,795,000 lb., as against 44,937,365 in the twelve months of 1909. The November and December returns are expected to raise the total above that of the preceding year. The Boleo Copper Co., of Lower California, which sends its output to Europe, produced 23,405,683 lb. up to the end of October. Owing to scarcity of water for concentration at the end of the long dry season, the Moctezuma Copper Co. will show a decrease in production for the year. The Teziutlan Copper Mining & Smelting Co., which dropped out of the list of producers following the slump in copper, to await better prices, blew in two 500-ton furnaces late in April, and has been operating during the greater part of the time since, although at much below capacity. The Mazapil Copper Co., of Zacatecas, another important producer, has maintained its average in 1910.

Government reports show a gold export of ₱42,636,399.29 in the fiscal year 1909-1910. Returns for the calendar year

Mexico.

are expected to show a gold production in excess of ₱45,000,000. The increase in Mexico's gold production in the last 15 years has been extraordinary. From ₱2,456,989.86 in the fiscal year 1893-1894, the production jumped to ₱9,366,139.25 in the year following, and a steady increase was recorded until 1898-1899, when the gold output reached ₱18,450,885.87. There was a decrease of ₱3,000,000 in production in the next fiscal year, but in 1900-1901 the total almost equalled that of 1898-1899; and since that time every year has shown an increase.

Zinc mining in Mexico has continued to suffer by reason of the high import duty imposed by the United States, but possibly not to the extent generally supposed. Due to the high prices prevailing, much high-grade zinc ore was shipped to American smelters during 1910. From the Monterey territory shipments to the United States have been three to four times heavier than the shipments to Europe, by way of Tampico. At the request of zinc miners, with a view to encouraging the exportation of zinc ore to Germany and England, the National Railways of Mexico reduced the rate on the zinc product to Tampico, and increased it to border points. The establishment of a zinc smelter in Mexico continues to be discussed, but so far nothing has been done. Concessions for zinc smelters were granted in 1909. Mexico's lead is principally the product of the important silver-lead mines of the northern portion of the Republic. In the fiscal year 1909-1910 the lead exports had a value of ₱6,808,465.

The feature of Mexico's oil development in 1910 has been the success attained in the Juan Casiano field in Veracruz, the property of the Huasteca Petroleum Co. of Los Angeles. This is a subsidiary of the Mexican Petroleum Co. of Delaware, which also controls the Mexican Petroleum Co. of California, operating at Ebano, State of San Luis Potosi. Two gushers and several flowing wells have been brought in, and an 8-in. pipe-line has been built from Juan Casiano to Tampico, 65 miles, at a cost of approximately $1,000,000. Late in the year a contract was made with the Waters Pierce Oil Co. for the delivery of 2,500,000 bbl. of oil to the Tampico refinery. In October the Huasteca company became a dividend payer, and as a result the payment of dividends on the common stock of the Mexican Petroleum of Delaware has been commenced. The company has distributed over $3,600,000 in dividends on its preferred stock. The year saw the completion of a pipe-line and railroad from the Furbero field of the Oilfields of Mexico Co., in the State of Veracruz, to the Gulf port of Tuxpan, and the delivery of Furbero oil by tank steamer to the Minatitlan refinery of the Pearson-Aguila interests on the Tehuantepec isthmus. The Pearsons have a contract for the present output of the Furbero field, and advanced over ₱2,000,000 for the construction of the pipe-line and railroad. Oil exploration has been in progress along the Gulf coast of Mexico during the last year. The West Coast of Mexico Oil Co., in which English capital is principally concerned, was recently organized to work along the west coast of the Republic. Arrangements have been made to start drilling on the Buenavista ranch in northern Sonora, a short distance southeast of Nogales. The Mexican Petroleum of California has continued to supply about 6000 bbl. of fuel-oil per day to the National Railways of Mexico. The oil war of the Waters Pierce and Pearson-Aguila interests has shown no abatement.

In the first nine months of 1910 the output of the Coahuila coalfields, at present the only fields producing coal in commercial quantities, amounted to 1,213,163 tons. In the same period the output of the four Coahuila companies producing coke totaled 165,653 tons. The production of coal and coke has continued at about the same rate during the last three months of the year. There are nine companies now marketing coal in Coahuila. There has been much development work during the year at the Barranca coalfields in the State of Sonora, the property of the Sunset Development Co., a Southern Pacific concern. The results have not been satisfactory, due to the broken character of the drifts. J. F. and C. R. Williams as lessees have been developing Los Bronces coalfields, in the same part of Sonora, and have been selling some coal to neighboring mining concerns. These fields are owned by Ramon Corral, vice-president of Mexico. The existence of commercial coal in the State of Oaxaca has been proved by the Oaxaca Coal & Iron Co..

The Monterey Iron & Steel Co., operating the steel plant at the Nuevo Leon capital, continues to be principally responsible for iron mining in Mexico. The Mexican Iron & Steel Co., a Boston concern that in 1909 contracted to buy the Tula iron mines, foundry, timber, and lands in the State of Jalisco for ₱1,000,000, has during the last year remodeled the foundry and purchased a traction train for the transportation of ore. The company's investments now amount to about ₱500,000, the greater part of this sum having been applied on the purchase price. A modern steel plant and tool and implement works are planned. The exploitation of Oaxaca iron deposits in connection with the coalfields of that State is proposed. English capitalists are considering the purchase of iron properties in the State of Colima.

Moves of importance to the custom smelting industry of Mexico were made in 1910 by the Pacific Smelting & Mining Co., of New York, which since its organization has owned the Fundicion copper smelter and other former holdings of the Douglas Copper Co. in the State of Sonora. Early

in the year a financial readjustment was effected, and since that time the lead smelter erected at Guaymas several years ago by the Mexican-American Smelting & Refining Co., a W. C. Greene enterprise, and the concession granted by the Sinaloa government for a custom smelter at Mazatlan, have been taken over. Contracts for copper and lead ores have been made, and it is expected to have the Fundicion and Guaymas plants in operation some time in 1911. Early in 1910 the American Smelters Securities Co. purchased the Matehuala smelter of the National Metallurgical Co., and the Guggenheim concern is now completing the installation of a new 500-ton furnace. The American Smelting & Refining Co. increased the capacity of its Chihuahua smelter from 450 to 750 tons per day. A contract made a few months ago by the Cananea Consolidated Copper Co. will bring the product of the big concentrator of the Miami Copper Co. of Arizona, into Mexico for smelting at Cananea. The custom smelters of Mexico are no longer respecting one another's 'territory,' their agreement along that line having been abandoned, and operators are benefiting from active competition. Silicious ores of shipping grade are in great demand.

NEVADA

By H. E. Davis

The metal production of the State of Nevada for 1910 was approximately $45,000,000; gold, silver, and copper predominating in the order named. Aside from these metals, there has been an output of lead, bismuth, antimony, zinc, graphite, tungsten, salt, borax, quicksilver, and sulphur. The metal production for 1908 was valued at $15,000,000; for 1909, despite the lack of public confidence and the difficulty of financing mining ventures, it reached $30,000,000. The estimate for 1910 is based upon the figures turned over to the State bullion tax officials. The geological and metallurgical developments in Tonopah, Goldfield, and Ely are most interesting. Contrary to predictions, the ore deposits of the Tonopah and Goldfield districts are proving to continue to great depth. The Belmont mine at Tonopah, for instance, at more than 1000-ft. depth is proving better than ever. During the year a mill has been constructed by the Tonopah Extension M. Co., in which it profited by the problems that had been worked out by the other companies operating in Tonopah district, and has a plant equipped for amalgamation, concentration, and cyanidation. High-grade ores are sent to smelter. In the Goldfield and other districts in southern Nevada the milling problem is more complex, due to the occurrence of both oxide and sulphide ores. The wide range of ores found in the same mine makes the task of the millman a busy one, for he must keep some sort of uniformity in the product that is sent to mill. The Consolidated plant of 100 stamps at Goldfield, with amalgamation, concentration, regrinding, and cyanidation, is making an average saving of 93% from ores that assay $30 to $40 per ton. The Florence, with a similar process, is saving 95% from $12 to $20 per ton ore. The Consolidated reduces its own concentrate by regrinding and cyaniding, while the Florence ships its concentrate to smelter. Mining at 1000-ft. depth in the mines of the Consolidated company is developing large bodies of milling ore, with some streaks of rich ore; and interest now attaches to the operations in properties lying east and south of the Consolidated group, where work is being done at 1200-ft. depth. Should these properties also prove to contain large bodies of good ore the future of the district will be assured. The Florence Goldfield company has heretofore done little work at a greater depth than 350 ft., and this has been in the way of cleaning up the ground above the level that had been opened by leasing companies. Now, however, this property is to be opened from 350 to 1000 ft. in depth, and its operations in virgin ground will be of interest geologically and may result in greatly increasing the output of Goldfield district.

The Nevada Consolidated company at Ely produced 65,000,000 lb. of copper the past year; and the Giroux company is making extensive preparations for mining in that district. A smelter is being constructed at Wabuska, principally for the reduction of the copper ore of Yerington district. Thus the industry of the eastern part of the State exemplifies the approved methods of handling porphyritic copper ore, while in the western part are being developed modern methods of mining and treating high-grade copper ores which occur in lodes that require mining, not quarrying. With a better understanding of Nevada geology and metallurgy a period of mill-construction and development of low-grade orebodies is beginning. All over the State, little 5 to 10-stamp mills are being erected, some of which are operating profitably, paving the way for the bigger mills that will replace them later. 'Make the mine pay its way' is the slogan of the Nevada operators of today, and some of the little mills that are being constructed represent the triumphs of the chemist's and engineer's skill. Mill building and development of low to medium-grade properties is notably under way in the Manhattan and Round Mountain districts, Nye county; in the El Dorado district, Clark county; in the Rawhide and Hornsilver districts, Esmeralda county; in the Yellow Pine zinc district, Clark county; at National, Humboldt county; at Austin, in Lander county. The Comstock mines are increasing their production of silver, and prospects are that man will yet triumph over the floods of hot water that have for so many years filled the deepest workings on the Comstock lode. Pioche is reviving and soon is to have milling facilities. A 100-ton mill has just been completed at Gold Mountain, Esmeralda county, which is to handle the ores of that district and the output of the two developed properties of Hornsilver, while a mill for Hornsilver camp itself will be constructed in the near future. A new mill is soon to be built on one of the Goldfield properties, and a 50-ton plant is being erected at Railroad Springs, 20 miles from Goldfield. Fifteen miles from Tonopah the Liberty company has a 100-ton mill at work, and in the Bullfrog district no less than seven small mills are either dropping stamps or are under construction. The promoter and stock salesman have given way to the engineer and the assayer, who are working together. Their work is being shown by the production and dividend record of Nevada.

PITTSBURG DISTRICT

By S. L. Goodale

The make of pig iron for furnaces in the Pittsburg district during the year 1910 is as follows, according to the monthly figures of the *Iron Age:*

January	603,261	July	502,711
February	541,791	August	510,352
March	592,494	September	505,342
April	543,531	October	507,508
May	510,514	November	445,083
June	483,909	December	424,000
Total, first half	3,275,500	Second half	2,894,996

Total, 6,170,496 tons.

The late months of 1909 and early months of 1910 witnessed the record production of pig iron; and it may be seen from the above figures that for the year as a whole Pittsburg has made a very creditable showing; that altogether it has been a good year. In this connection it is interesting to note the railroad and river tonnage for the district as supplied by the Chamber of Commerce; for the last four years:

	Railroad.	River.	Total.
1906	113,000,000	9,000,000	122,000,000
1907	146,798,351	14,395,816	161,194,167
1908	104,500,508	11,454,895	115,955,403
1909	145,580,388	12,426,154	158,006,542

And the figures for 1910 are estimated by the same authority to be in excess of those for 1909, although it will be some time before exact totals are available.

November and December production of pig iron show very sharply the result of blowing out a large number of stacks; and of the furnaces that are in blast much of the

product is being stocked, and most of the plants in the district have already fairly large stocks. Productive capacity in the iron and steel trade has grown so rapidly that just now it is considerably ahead of the rate of consumption. Nowhere near the average market demand of the year just passed could have been supplied by the furnaces existing and in blast only four or five years ago; and it does not seem either surprising or alarming to find that at a time like the present only perhaps 65% of the furnace capacity is in blast. From early fall of 1907 until the present time some 41 new blast-furnaces were built in this country, and some 10 more nearly or completely finished, while only 12 rather small furnaces were abandoned or dismantled, the result being a net increase in productive capacity of over 6,000,000 tons of pig per year. A few years ago 65% of the present business would have looked large.

While prices now are at a lower level than at the beginning of the year, especially in certain classes of product, as shown briefly below, still it cannot be said that the market is by any means demoralized. Orders on Panama Canal work, rail and other buying by the railroads, structural steel orders, etc., seem to be sufficient to keep the mills running a half of each week at least. It is estimated that builders offered the manufacturers about 1,750,000 tons of structural steel business during the year. In rail orders there is a tendency toward more exacting specifications, and considerable of the heavy tonnage offered by railroads has not been accepted on this account; although some of the mills are said to be rolling now on orders for the first quarter of 1911. The situation in all departments seems to be about the same as for the blast-furnaces; that is, it mostly is a question of how soon enough furnaces will be blown out to bring production down to consumption. The following figures, taken partly from the *Iron Age* are of interest in regard to prices:

	1907. High.	1909. Low.	1910. High.	1910. Dec.
Bessemer pig iron, valleys..	$23.28	$14.58	$19.10	$15.00
So. No. 2 foundry, Cincinnati.	$26.00	$14.25	$17.25	$14.25
Bessemer billets, Pittsburg..	$30.00	$22.00	$27.50	$23.00
Structural shapes, Pittsburg.	1.70c.	1.10c.	1.55c.	1.40c.
Steel bars, Pittsburg.....	1.60c.	1.05c.	1.50c.	1.40c.
Sheets, 28 gauge, Pittsburg..	2.55c.	2.10c.	2.40c.	2.20c.

An important new construction of the year has been the plant of Jones & Laughlin at Aliquippa, on which, however, considerable progress had been made prior to 1910. Four new blast-furnaces have been completed with accessories, and the building of four large Talbot open-hearth furnaces is nearly or quite completed. The plant is well arranged as to handling of material about the works and exhibits rather adherence to good standard metallurgical practice than the introduction of many novelties. The coal-hoist on the river is capable of handling 900 tons per hour, and space is provided for the erection of a large coking plant. Several departments of the mills are at work, including the wire and nail mills and the tin-plate department. "Woodlawn, the new industrial town which is being built by Jones & Laughlin for the men at Aliquippa, is pleasantly situated on the higher ground near the plant. Five hundred houses are being built of six to ten rooms each, and schools, churches, stores, and banks are also being built. One of the features of the new town will be the large club-house of two stories height, 100 by 162 ft., and equipped with all conveniences for recreation and amusement. It has been the company's aim to build a town that will not only be modern in every feature, but also attractive to the highest class of labor." In this connection, mention should also be made of Marianna, the model coal-mining town of the Pittsburgh Buffalo Co., where the endeavor of the company has been to provide their workmen with comfortable convenient modern homes at a moderate cost. A large number of these miners' houses have been built, and also a fine club-house containing a ball room, a theatre, bowling alleys, and billiard and pool rooms, and equipment for other amusements. At the shaft, change rooms are provided, equipped with shower baths and locker arrangements, and men leaving the mine step directly into this building without first being exposed to the weather. The trend of improvement in local coking practice is well shown at Marianna, where the waste gases from the beehive ovens are conducted to the boilers for the purpose of raising steam. It is said that one oven will develop about 14 to 16 hp. while burning. This is a great advance over the prevailing practice of totally wasting these gases, and is a long step in the right direction toward the use of by-product retort-ovens wherein practically the full value of the coal will be used in some way. On this same line of better provision for employees comes the announcement that the U. S. Steel & Carnegie pension fund of $12,000,000 will be made available on January 1, 1911. This fund is to be administered by twelve trustees through J. B. Erskine, manager, with headquarters in the Oliver building, Pittsburg. Three classes of pensions are provided: (1) pensions by compulsory retirement, granted to employees who have been 20 years or longer in the service and have reached the age of 70 years for men and 60 years for women; (2) pensions by retirement at request, granted to employees who have been 20 years or longer in the service and have reached the age of 60 years for men and 50 years for women; (3) pensions for permanent incapacity, granted to employees who have been 20 years or longer in the service and have become permanently totally incapacitated through no fault of their own. These monthly pensions are to be paid from the income of the fund, and range from $12 up to $100 per month. The H. C. Frick Coke Co. has also established a relief fund, available from May 1, 1910, and effective for one year, with the announcement that a similar plan may be put in force later. This relief plan is entirely voluntary, and no deductions from the men's pay will be made. Relief is to be paid for not to exceed 52 weeks to those injured or the families of those workmen killed in the service of the company. The minimum is 35% of the daily wage paid at the time of the accident to be paid to single men, and 50% for men married and living with their families, and this is increased by 2% for each year of service with the company over five, and also somewhat for larger family responsibilities.

Conditions in the coal and coke business are not altogether satisfactory, especially as to the price secured for the output. It is doubtful if any other great industry of the country is conducted on as small a margin as is the mining of coal. Aside from this feature, the year has been a good one, starting in even with prospects of a boom year. Early in the year some delay in transportation was caused by car shortage; this has not been true in the later months, as some of the railroads have been able to borrow motive power and cars to assist them in this respect. On January 10 last, the H. C. Frick Coke Co. posted notices at all their plants in the Connellsville district to the effect that wages were to be restored to the scale effective in 1907. Later in the spring, and after several weeks' agitation, the operators of the district and miners of the United Mine Workers of America signed a wage scale on April 29, effective for two years. Labor conditions in the district have, in general, been good. As there have been extensive labor disturbances in other bituminous fields, a good deal of tonnage has come to Pittsburg which ordinarily would have been supplied elsewhere. In the lake trade, especially, is this true. The lake tonnage from all districts for the ten years ending 1910 is as follows:

Year.	Pittsburg District.	Ohio District.	W. Va. District.	Total.
1901	3,795,706	1,954,825	787,572	6,538,103
1902	4,704,093	2,689,974	965,769	8,359,836
1903	6,092,047	2,458,265	1,539,435	10,089,747
1904	6,058,383	2,138,247	1,279,876	9,476,506
1905	7,443,883	2,062,692	2,109,262	11,615,837
1906	9,287,272	2,560,906	2,743,732	14,591,910
1907	10,549,995	4,074,296	3,420,941	18,037,232
1908	8,700,000	3,600,000	3,450,000	15,750,000
1909	8,687,305	3,002,815	3,874,570	15,564,690
1910	11,911,900	4,297,300	6,629,500	22,838,700

These figures are supplied by courtesy of John H. Jones, who may be quoted further: "The production in the Pittsburg district this year will be about 50,000,000 tons, and 1911 should surpass this. General mining conditions are very favorable for a good production in 1911, inasmuch as the miners' scale has been settled and does not terminate until April 1, 1912. * * * The wonderful prosperity in the Northwest, brought about by good crops, and its great industrial activity, should even cause an increase in 1911 over this year." A great deal of attention has been given by the operators this year to the matter of providing every known safeguard for the health and safety of their employees. The authority just quoted says: "The Government testing station here has done great good, and I believe that with the progress that has been made, the United States will continue to lead the countries of the world in a low mortality rate per million tons of coal mined." The following figures show that we now head the list (with great room for improvement): United States, 3.84 lives lost per million tons of coal produced; Great Britain, 4.15; Germany, 6.35; France, 6.56; Belgium, 5.71; Austria, 8.16. The Pittsburgh Coal Co. mined in the Pittsburg district, for the first three months of 1910, 3,485,055 tons, as against a production of 2,130,389 tons for the corresponding period of 1909; and produced 146,867 tons of coke in the later as against 96,046 tons in the earlier period. For the first nine months of the year the same company mined coal and produced coke as follows:

	1909.	1910.
Coal mined in Pittsburg dist., 9 mo..	9,718,334	11,470,112
Coke burned, 9 mo.	344,079	459,930

This shows that the large figures of the earlier part of the year have been maintained through the summer months. The production of coke in the Connelsville district may be stated as follows, giving figures for 1908 and 1909 for comparison, and estimating the total for the last three months of 1910 from weekly reports available: production 1908, 10,700,000 tons; production 1909, 17,800,000; production 1910, first six months, 11,238,425, second six months, 8,968,000.

The average price quotation for 1909 has been given as $1.05, based on run of mine, with an increase to $1.15 during the last three months of the year. For 1910 the figures show about $1.25. Quotations on coke show:

	Furnace.	Foundry.
First nine months.....	$2.00 to $2.35	$2.25 to $2.50
Last three months.....	1.75 to 1.85	2.20 to 2.45

The production of the Pittsburg district is estimated by another large operator to be about 85,500,000 tons for 1910, including, however, a larger territory in the term than Mr. Jones, namely, the first, second, fifth, seventh, ninth, eleventh, thirteenth, fourteenth, sixteenth, seventeenth, nineteenth, and twenty-first bituminous districts of the State. The year has been a rather uneventful one, with no new capacity added in the district, and no considerable change from 1909.

In the field of technical and engineering education the year at Pittsburg has several interesting features, including the gift of Andrew Carnegie of $3,500,000 for the Carnegie Technical Schools, of which $1,500,000 is to go for endowment and $2,000,000 for additional building construction and equipment. Not only is the present attendance of students as large as the schools can provide for with their present equipment and funds, but a great many more have applied for admission than can be received, so that this last gift will permit the advantages of the schools to be extended to a greater number seeking admittance. At the University of Pittsburg, it is announced that four fellowships have been provided in the new department of industrial chemistry. This is a continuation of very important research work begun by Robert K. Duncan at the University of Kansas and now to be continued here, connecting the chemical department of the University directly to the practical needs of the manufacturers of the district. A thoroughly trained man is employed exclusively on one problem, having the laboratories and equipment of the University at his command, but the salary being paid by the manufacturer, who is to have for a definite period the exclusive right to any new processes developed, the University at the end of the period to have the right to publish full accounts of the work. In the School of Engineering of the University, the co-operative plan of technical education has been adopted, whereby each student is to have each year three-quarters at the University and one-quarter at some shop or mill, still under the direction of the University, thus combining very closely the advantages of practical and theoretical education in a well planned course. The School of Mines of the University is unique in offering, besides the usual courses for the mining degrees, including the co-operative feature of the engineering school when desired, every facility and almost unlimited opportunity for the practical man, whatever his age and training, to attend the school pursuing such courses as he may profit from to broaden his grasp on his own subject.

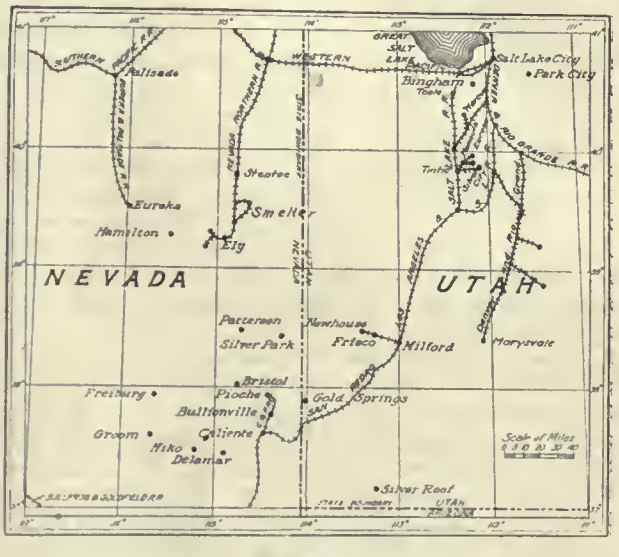
UTAH

The metal-mining industry in Utah for 1910 has been characterized by an increase in the production of copper, and a nearly normal output of lead, silver, gold, and zinc. The principal increase in copper was due to the gigantic operations at Bingham and to doubling of milling facilities for concentrating the low-grade copper ores which occur in porphyry and quartzite of that district. Within the year there was accomplished the absorption of the properties of the Boston Consolidated by the Utah Copper Co., the increase of this company's Magna mill to a capacity of 13,000 tons per day, and the remodeling of what was formerly the Boston Con. mill, and raising its capacity to 7000 tons per day, giving the Utah Copper Co. facilities for concentrating 20,000 tons of ore per day. In the meantime, this company has built a railroad of its own from the mines in Bingham canyon to its mills, and to the San Pedro line at Garfield. The Ohio Copper Co., whose mine is mostly in quartzite, lying on the east side of Bingham canyon, completed and put in operation two units of its concentrator last spring, and has recently finished its third and fourth units, giving the plant a capacity of 2500 tons of ore per day. Besides, there is a separate plant for classifying and concentrating the slime from the principal mill. The Ohio workings are among the deepest in Bingham district, the 14,000-ft. adit, that starts from the millsite at Lark, tapping the orebodies at a depth of 1400 ft. on the incline. The Yampa smelter, having McDougall roasters, and reverberatory and blast-furnaces, has operated mostly on copper ore from the Yampa mine, but has taken some custom ore. The Utah Consolidated Co. has carried on extensive development from levels below the main haulage adit No. 7, where a big tonnage of ore was made accessible; but concerning reserves in the entire mine there have recently been wide differences in the estimates made by examining engineers. An aerial tramway was built during the last year, from the mine to the International smelter near Tooele, a distance of 3½ miles. The Utah Apex mine, in the same district, is well-developed, has over 100,000 tons of lead-silver ore available, and has a mill which is being remodeled. The United States S. R. & M. Co. has mined and shipped ore on a considerable scale at the Old Jordan and Galena mines in upper Bingham, while its other mine, the Old Telegraph, has been operated successfully by the Utah Leasing Co., all three being principally lead producers. The Bingham Mines Co. has mined and shipped 600 to 700 tons per month of copper, lead, and silver ore from the three veins of the Dalton & Lark group, access to which is gained through a level driven from the Mascot tunnel that leads into Ohio ground. The same company is also operating the Commercial mine, lying southwest of the Ohio group, from which ore shipments at last accounts amounted to 100 tons per day. The North Utah M. Co., owner of the Butler-Liberal and other partly-developed mines on Markham gulch, has done considerable exploring, has mined and shipped some lead ore, and recently remodeled the Red-

wing mill. The Bingham & New Haven, situated on Carr fork, above the Highland Boy, has been well opened by adits which intersect several orebodies, and during the year has mined copper, silver, and gold ore of both milling and shipping grades.

Some of the best examples of successful mining in Utah are to be seen in the Tintic district, where there are about 20 shipping properties whose output has been running close to 125 cars of ore per week. The United States S. R. & M. Co., which owns the Centennial-Eureka and Bullion-Beck, at Eureka, mines copper, silver, lead, and gold ores, shipments amounting to 50 to 60 cars per week. During the year this company's new work consisted of establishing an electric-pump station at 2200-ft. depth in the Centennial-Eureka shaft; the driving of a 2200-ft. tunnel from the level of the railroad track to the 600-ft. level of the same shaft, to serve as a haulage-way and as drainage for water discharged by the pumps; also, the building of a steam-electric power-plant close to the portal of this tunnel, the machinery for which was housed in a steel structure. The Chief Consolidated, one of the newer mines of the district, belongs to Michigan operators, and within the year its shaft has been sunk from 1000 to 1800 ft., and extensive development has been done, resulting in opening profitable bodies of silver and gold ore on the 1400, 1500, 1600, and 1700-ft. levels. It is now a dividend-paying mine. The Eagle & Bluebell M. Co., whose mine adjoins the Chief, has sunk its 200-ft. shaft 800 ft. deeper, connecting the 1000-ft. station with the old workings, which formerly were entered through an adit and incline. The new shaft is well timbered and so equipped that all ore is hoisted through it. This property is a regular ore shipper. On the opposite side of a mountain spur are situated the Grand Central, Mammoth, and Lower Mammoth, all deep mines and productive. The Grand Central has been producing several cars of ore per week, running well in copper, silver, lead, and gold. The ore mined is taken from all levels from the 600 to the 2100, inclusive. Some shipments have run as high as 4% copper, 10% lead, and 30 oz. silver. The Mammoth is opened to a depth of 2200 to 2300 ft., and while not a heavy shipper, is noted for the high grade of its ore, which contains silver, gold, copper, and lead. The Lower Mammoth, having an extension of the original Mammoth ore-zone, is developed from a 2000-ft. shaft; the principal vein, as shown by the open stopes on the 1700 and 1800-ft. levels, is 15 to 20 ft. wide and yields silver-lead and copper ore. A considerable tonnage of ore has been shipped during the year. The property is equipped with a double-drum electric hoist by which cages are run in two compartments of the shaft. The Opex and Emerald are being developed and explored at a depth of over 2000 ft. The Gemini, one of the oldest mines of Tintic district, has installed electric pumps at the 1600-ft. station, the water-level being at 1700 ft., and the plan is to unwater the mine to the 1900-ft. level. Oxidized silver-lead ore was found to extend to a depth of 1600 ft., below which it is mostly sulphide. The opening of the sulphide bodies was accomplished during the year. The Gemini is a steady ore shipper. The Uncle Sam and May Day, at the north end of the district, both under the same management, have produced steadily, the former shipping ore that sampled about $30 per ton; the latter has the only active mill in the district, by which most of its ore has been concentrated. The Yankee Con. Co., operating in the same neighborhood, has been directing its energies to development. The property is well equipped and has extensive workings. Some shipments of silver-lead ore of good grade have been made each month. The Colorado, Iron Blossom, and Beck Tunnel, all under one control, are on the east side of the range, have yielded a big tonnage of ore during the year, and paid $400,000 in dividends. The Iron Blossom has produced heavily from its 400 and 500-ft. levels, and recently ore has been found on the 800-ft. level, the ore running high in lead-carbonate and chloride of silver. Other producers of the district include the Dragon, Sioux Con., Ridge & Valley, Iron King, Gold Chain, Opohongo, and Scranton, with the Tintic Standard and others undergoing deep development. Practically all the deep mines of the district are in limestone, in which water-level has been found at depths ranging from 1700 to 2200 ft. below the surface. There is some development in the adjacent porphyry areas where a strong flow of water is found at 300 ft., notably in the mines south of Silver City.

Park City district, which holds a high place in the mining history of the State, has had a large amount of development the past year, though the production of lead, silver, and other metals has hardly been up to the normal. The reduced output of the Silver King Coalition Mines Co. for the year was due principally to litigation in which it was involved, and to the fact that the 400 men employed have been engaged mostly on development and in making changes in surface and underground equipment. These consisted in providing for electric haulage on the surface and in the main levels, putting in ventilating pipes and installing a Worthington centrifugal pump, direct-connected to an electric motor, by which part of the volume of water flowing from the Alliance adit is delivered to the concentrating mill; and in arranging for electric power in the machine shop. All workings, including those first tributary to the Alliance adit, are now connected with the main Silver King shaft, through which ore from all parts of the mine is hoisted. The mine is undoubtedly in condition to increase its production of ore greatly in 1911. The Daly West's output of milling ore has been kept up to 300 to 350 tons per day, from which has been obtained one class of concentrate running 40 to 45% lead, 35 to 38 oz. silver per ton, and another class containing 40% zinc, 4 to 5% lead, and 15 oz. silver. The shipment of crude ore of a smelting grade has been lighter than formerly. Ore has been mined on the 800, 900, 1500, and 1700-ft. levels, the most extensive stoping having been between the 1600 and 1700. The 1800-ft. level has been established through a winze sunk from the 1700; and a 1900-ft. level is being opened by cross-cutting 1400 ft. from the shaft, which is probably accomplished before now. The depth of the shaft is 2100 ft., from the bottom of which a connection is made with the Ontario drainage tunnel. A haulage-level extends from the 1200-ft. station out to the surface at Park City. Within the last six months a system of leasing has been in vogue here. The Daly-Judge mine produces a milling ore which assays 4 to 9 oz. silver, 6 to 9% lead, 6 to 12 zinc, and 10 iron, which is concentrated in the ratio of 3 to 1, resulting in making a lead-silver concentrate which is shipped to the smelters, and a zinc-iron product. The first-grade ore runs approximately 25% lead, 33 oz. silver, and 4% copper. The output of the mine has been close to 175 tons per day. Prior to the year 1910 the mine production had for some time been confined to levels at and above the 6600-ft. adit-level, which connects with the 1650-ft. shaft at the 1200-ft. station. But during the past 12 months the Daly-Judge M. Co. has gained access to the 1500 and 1600-ft. levels which



Nevada-Utah.

had been submerged for a number of years. This was accomplished by pumping water up to the 1200-ft. level where it was discharged and drained out of the mine through the adit; this work was lately supplemented by a connection which was made with the Daly West and Ontario drainage system. Stockholders of this company are identified with the Snake Creek Mining & Tunnel Co., which is driving a 14,000-ft. adit from the opposite side of the range into Daly-Judge ground; this will enter the ore-zone 200 ft. lower than the 1600-ft. level. About 2500 ft. of this adit has been driven. The Ontario is in the hands of lessees, mainly, who are mining and marketing about 50 tons of ore per day.. The Little Bell has become a producer and dividend-payer within the last six months, the greater part of its ore being concentrated in its new mill.

Mining operations in Beaver county have been advanced materially during the year. The Red Warrior and Burning Moscow mines, in the Star district, have been well developed, are shippers of lead and silver ore, including some copper. They are adjoining mines, under different ownerships, and have been developed to a depth of 500 to 600 ft. The Utah M. M. & T. Co. has developed large bodies of iron, lead, and silver ore in a vertical vein and of cuprite in bedded veins, shipments of both kinds having been made. Other development in the Star district has proved important. The South Utah Mines & Smelters resumed operations at the Cactus mine and mill at Newhouse, in September, and has since then been mining and concentrating 600 to 900 tons per day of chalcopyrite-bearing ore; the concentrate, assaying about 13% Cu, 30% Fe, and high in silica, is shipped to the International smelter. The Majestic Copper Co. has been active during the year in developing the Harrington-Hickory group near Milford, resulting in exposing a big tonnage of silver-lead and copper ore, the workings extending now to a depth of 600 ft. The Utah United Mines Co. has made good progress in development. The Horn Silver mine, which has been a producer for over 35 years, is to be provided with a new concentrating mill in which to treat its zinc-lead-silver ore, of which there are large reserves.

An important achievement during the year was the building of the plant of the International Smelting & Refining Co., at the mouth of Pine canyon, near Tooele. Operations began in August, and by November there were five reverberatory furnaces in use, smelting copper ore and concentrate, first calcined in the McDougall roasters by which the sulphur is reduced to 6%. The matte turned out by the reverberatories runs 20 to 30% Cu, the slag close to 40% SiO_2, 48 FeO, and 4 CaO. The Garfield plant of the A. S. & R. Co. has both lead and copper furnaces in operation; included among the latter are six reverberatories. This plant and that of the International are the only two in the State at which copper smelting is in progress. At the plant of the A. S. & R. Co. at Murray, and that of the United States S. R. & M. Co. at Midvale, the lead furnaces only are being operated. The smelting plant built by the Knight people in Tintic district, which was equipped for both copper and lead smelting, was not operated during the year. The United States company has operated a milling plant at Midvale during the year, in which 250 tons per day of zinc-lead-iron ore has been treated in a manner that attracted much interest. First, a lead-concentrate is made on jigs and tables by the usual methods of wet concentration; this concentrate amounts to 65% of the product of the mill. A zinc-iron concentrate and the zinc middling, produced also by wet concentration, are passed through driers to eliminate the moisture. They contain 21 to 24% iron, 4 lead, 20 to 23 zinc, 5 silica, 2 lime, and about 30 sulphur. The material is then sized by impact screens for electrostatic machines; the coarsest of the grades thus made, running 32% iron and only 7 zinc, is sent to the smelter. The finer grades are passed through five units of the Huff electrostatic plant, by which the zinc and iron are separated, giving one product running 52% zinc, 4 iron; and another of iron containing about 9% zinc. The ores treated at this plant are shipped from this company's mines in Bingham canyon.

WYOMING

By H. C. Beeler

Mining in Wyoming was quiet during the year of 1910. In the Sunlight district, northwest of Cody, Wyoming, continuous development has been carried on with gratifying results. The Winona Gold-Copper Mining Co. has recently built a complete steam and electric plant. The adit has now reached a length of 750 ft. and has cut four veins, that at about 600 ft. being the first of the series of fissures to develop which this tunnel was projected. The ore is from six to ten feet wide and of smelting grade. This company has also acquired adjoining ground to cover a huge low-grade copper deposit which is exposed by glacial erosion for a length of about 2000, a width of 1000, and a depth of 250 ft. This exposure has been systematically sampled during the past season and shows a remarkable average gold and copper content, with a number of veins of richer mineral. The Winona company is considering the establishment of a smelting plant, and possibly the building of a railroad through the Clark's Fork Canyon country during the coming season. Purchase by the Copper Belt Mining Co. near Hartville of the Michigan mine is reported and a matte smelter projected at a point midway between the properties. In the central part of the State activity has been greatest in the asbestos fields near Casper in Natrona county. The International Asbestos Mills & Power Co. of Denver, which entered the field about a year ago, has been most active and its efforts have resulted in placing the Wyoming asbestos fields in the shipping class. The internatioual company has taken a bond and lease on the mill and property of the Wyoming Consolidated Asbestos Co. and has completed a mill equipment to handle the rock from the quarries to the mill. Within the season seven cars of fiber were shipped. A great deal of the preliminary work of the mill has been confined to the adjustment of the machinery to the new conditions of rock and fiber of this field and to grading the products according to the standards already established in the asbestos trade. The international company has also leased the grinding plant of the Colorado Iron Works of Denver and is now supplying the trade with a low-grade asbestos plaster and cement material from this plant. A series of experiments on this material were conducted in person by the officers of the company and has met with unexpected success. This company will be in position within a short time to supply the local and Western trade with this material, as well as higher grades of fiber and crude asbestos. The management reports that trade has opened up in a most gratifying manner. The first dividend will be paid January 16. The Northwestern Asbestos Co. of Denver has leased the holdings of the North American Asbestos Co. on Casper mountain and is now engaged in completing its fiberizing mill, which should be in operation about the first of February. A tramway is projected from the quarries and mill to the foot of Casper mountain to handle fiber and rock and facilitate shipments during the winter season. This product is shipped to the International company at Denver, as this company has the preferred right to purchase the product of the North American mill and is aiding the enterprise in every way possible. The Casper vicinity is also attracting a great deal of attention because of being the headquarters of the various companies now in operation and negotiating for territory in the Salt Creek oilfields some fifty miles north of Casper. Drilling has been active in this field by a number of companies, a pipe-line to Casper is projected, and every effort is being made by those in charge of these enterprises to increase the production of the field and open up new territory. Recently the oil men of Wyoming met at Cheyenne, Wyoming, in convention in answer to a call from the Governor and formed the Wyoming Oil Men's Association, the object being to open up the oilfields and to advertise the oil resources of the State. Representatives from nearly all the oilfields were present and formed a permanent organization with B. B. Brooks, the Governor, as president. The coal production for 1910 is estimated at this time to be about equal to that of the previous year.

Personal

Professional men are invited to send news of their engagements and travels. Such news is interesting to friends.

C. H. MUNRO has gone to London.

R. H. RAINSFORD was in San Francisco.

ALBERT BURCH has returned from Alaska.

WILLIAM FORSTNER has gone to Bakersfield.

COURTENAY DE KALB has been at Tucson, Arizona.

W. S. WADE, of Salt Lake, is at the Palace, San Francisco.

E. CLAPP is at the Santa Gertrudis mine, Pachuca, Mexico.

BERTRAM HUNT has returned to San Francisco from Mercur, Utah.

WILLIAM F. BOERICKE, of Mineral Point, Wisconsin, has been in San Francisco.

LLEWELLYN E. HUMPHREYS, of Salt Lake, was in San Francisco, returning from Arizona.

JOSEPH H. PLAYTER, of Golconda, Nevada, is in Sinaloa, Mexico, on examination work until March.

ALGERNON DEL MAR, manager for the Fort Bidwell Gold Mining Co., has closed the mine for the winter and is at his home in South Pasadena, California.

H. N. TAYLOR is the new president of the Illinois Coal Operators' Association, with W. L. SCHMICK, vice-president, F. C. HONNOLD, secretary-treasurer, and C. L. SCROGGS, commissioner.

CURRENT PRICES FOR CHEMICALS

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

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

	Min.	Max.
Acid, sulphuric, com'l, 66°, drums, 100 lb.	$0.90	$1.25
Acid, sulphuric, com'l, 66°, carboy, 100 lb.	1.00	1.50
Acid, sulphuric, C.P., 9-lb. bottle, bbl., lb.	0.13	0.18
Acid, sulphuric, C.P., bulk, carboy, lb.	0.09½	0.12
Acid, muriatic, com'l, carboy, 100 lb.	1.60	2.00
Acid, muriatic, C.P., 6-lb. bottle, bbl., lb.	0.15	0.20
Acid, muriatic, C.P., bulk, carboy, lb.	0.10½	0.15
Acid, nitric, com'l, carboy, 100 lb.	5.25	6.50
Acid, nitric, C.P., 7-lb. bottle, bbl., lb.	0.16	0.22
Acid, nitric, C.P., bulk, carboy, lb.	0.12½	0.15
Argols, ground, bbl., lb.	0.20	0.25
Borax, cryst. and conc., bags, 100 lb.	2.75	3.85
Borax, powdered, bbl., 100 lb.	3.00	4.00
Borax glass, gd., 30 mesh, cases, 100 lb., tin lined	10.00	13.00
Bone ash, 60 to 80 mesh, bbl., 100 lb.	4.50	5.50
Bromine, 1-lb. bottle, lb.	0.55	0.65
Candles, adamantine, 12 oz., 40 sets to case	3.50	4.15
Candles, adamantine, 14 oz., 40 sets to case	4.00	4.55
Candles, Stearic, 12 oz., 40 sets to case	4.95	5.50
Candles, Stearic, 14 oz., 40 sets to case	4.65	5.20
Clay, fire, sack, 100 lb.	1.50	2.00
Cyanide, 98 to 100%, 100-lb. case, lb.	0.20¾	0.24¾
Cyanide, 98 to 100%, 200-lb. case, lb.	0.20	0.24
Cyanide, 125 to 127%, 100-lb. case, lb.	0.27½	0.28½
Cyanide, 125 to 127%, 200-lb. case, lb.	0.26¾	0.27½
Lead acetate, brown, broken casks, 100 lb.	8.75	9.00
Lead acetate, white, broken casks, 100 lb.	10.00	10.25
Lead acetate, white, crystals, 100 lb.	11.75	12.25
Lead, C.P., test., gran., 100 lb.	13.00	15.00
Lead, C.P., sheet, 100 lb.	15.00	18.00
Litharge, C.P., silver free, 100 lb.	10.50	13.00
Litharge, com'l, 100 lb.	7.50	9.00
Manganese ox., blk., dom. in bags, ton	20.00	25.00
Manganese ox., blk., Caucasian, in casks, ton (85% MNO_2—¾% Fe)	45.00	50.00
Nitre, double ref'd, small cryst., bbl., 100 lb.	7.00	8.00
Nitre, double ref'd, granular, bbl., 100 lb.	6.50	7.50
Nitre, double ref'd, powdered, bbl., 100 lb.	7.25	18.00
Potassium bicarbonate, cryst., 100 lb.	12.00	15.00
Potassium carbonate, calcined, 100 lb.	15.00	18.00
Potassium permanganate, drum, lb.	0.11	0.12½
Silica, powdered, bags, lb.	0.03	0.05
Soda, carbonate (ash), bbl., 100 lb.	1.50	1.75
Soda, bicarbonate, bbl., 100 lb.	2.00	2.50
Soda, caustic, ground, 98%, bbl., 100 lb.	3.15	3.50
Soda, caustic, solid, 98%, bbl., 100 lb.	2.65	2.85
Zinc shavings, 800 fine, bbl., 100 lb.	10.75	11.75
Zinc sheet, No. 9—18 by 84, drum, 100 lb.	9.75	10.75

Market Reports

LOCAL METAL PRICES.

San Francisco, December 29.

Antimony	12—12¾c	Quicksilver (flask)	44½—45
Electrolytic Copper	14½—15¾c	Tin	41—42½c
Pig Lead	4.75—5.70c	Spelter	7—7¾c

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

METAL PRICES.

By wire from New York.

Average daily prices in cents per pound.

Date.	Electrolytic Copper.	Lead.	Spelter.	Silver, per oz.
Dec. 29	12.50	4.50	5.45	53⅞
" 30	12.47	4.50	5.45	54⅛
" 31	12.47	4.50	5.45	54⅛
Jan. 1	Sunday.	No market.		
" 2	Holiday.	No market.		
" 3	12.45	4.50	5.47	54⅝
" 4	12.45	4.50	5.50	54⅝

ANGLO-AMERICAN SHARES.

Cabled from London.

	Dec. 29. £ s. d.	Jan. 4. £ s. d.	
Camp Bird	1 13 0	1 12 6	
El Oro	1 6 9	1 5 6	ex. div.
Esperanza	1 19 3	1 18 6	
Dolores	1 5 0	1 5 0	
Oroville Dredging	0 6 3	0 6 3	
Mexico Mines	8 0 0	7 13 9	ex. div.
Tomboy	0 15 6	0 15 6	

(By courtesy of W. P. Bonbright & Co., 24 Broad St., N. Y.)

COPPER SHARES—BOSTON.

	Closing prices, Jan. 4.		Closing prices, Jan. 4.
Adventure	$ 6½	Mohawk	$ 45
Allouez	38	North Butte	28½
Atlantic	4	Old Dominion	37½
Calumet & Arizona	48	Osceola	124
Calumet & Hecla	535	Parrot	11½
Centennial	14½	Santa Fe	1¼
Copper Range	68	Shannon	11¼
Daly West	3⅜	Superior & Pittsburg	13¾
Franklin	9¼	Tamarack	48
Granby	40	Trinity	4¾
Greene Cananea, ctf	6¾	Utah Con	13⅜
Isle-Royale	16	Victoria	2
La Salle	4¾	Winona	8¼
Mass Copper	7¾	Wolverine	116

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

MINING STOCK QUOTATIONS—NEW YORK.

(By wire from Catlin & Powell Co., New York.)

	Closing prices, Jan. 4.		Closing prices, Jan. 4.
Amalgamated Copper	$ 63⅛	Miami Copper	$ 19⅝
A. S. & R. Co.	74½	Minea Co. of America	5⅞
Braden Copper	3⅞	Montgomery-Shoshone	⅛
B. C. Copper Co.	7⅛	Nevada Con	18⅛
Butte Coalition	18⅛	Nevada Utah	¾
Chino	21⅞	Nipissing	10⅜
Davis Daly	1⅝	Ohio Copper	1⅝
Deleres	6⅛	Ray Central	2⅛
El Rayo	4	Ray Con	18⅝
Ely Central	1/16	South Utah	1
First National	2⅛	Superior & Pittsburg	13¾
Giroux	6⅞	Tenn. Copper	34½
Guanajuato Con	⅛	Trinity	4¾
Inspiration	8⅞	Tuolumne Copper	4⅞
Kerr Lake	6⅞	United Copper	4¾
La Rose	4½	Utah Copper	46
Mason Valley	9⅞	Yukon Gold	3⅞

SOUTHERN NEVADA STOCKS.

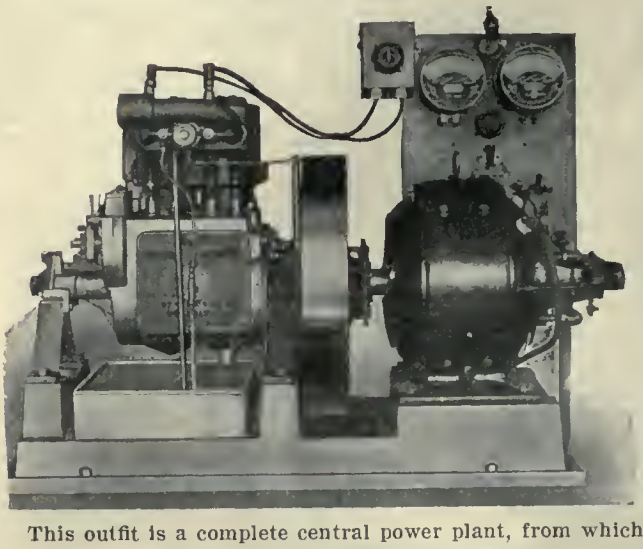
San Francisco, January 4.

Atlanta	$ 13	Mayflower	$ 4
Belmont	5.05	Midway	16
Booth	8	Montana Tonopah	86
Columbia Mtn	3	Nevada Hills	2.30
Combination Fraction	18	Pittsburg Silver Peak	61
Fairview Eagle	35	Rawhide Coalition	3
Florence	1.37	Rawhide Queen	——
Goldfield Con	7.65	Round Mountain	40
Gold Kewenas	6	Silver Pick	6
Great Bend	2	St. Ives	16
Jim Butler	25	Tonopah Extension	1.02
Jumbo Extension	26	Tonopah of Nevada	7
MacNamara	19	West End	57

(By courtesy of San Francisco Stock Exchange.)

THE BRUSH ELECTRIC GENERATING SET

Many of our readers are familiar with the difficulties encountered in making a steady electric light with the ordinary type of gas engine. The makers of the Brush balanced, two-cylinder, vertical engine claim to have overcome all trouble, and to furnish an electric generating plant in which the current developed is as steady as that obtained by any of the better types of steam-engines, the variation on voltmeter showing less than 2% from no load to full load, and on constant load practically nothing.



This outfit is a complete central power plant, from which light and power may be conveniently transmitted to distant points. In the mining field, especially for prospecting and light development, its small weight, together with its compactness and portability, will appeal to many. The fuel used may be gasoline, kerosene, or distillate. The catalogue of the Brush electric generating set consists of about 100 pages of interesting reading matter and illustrations. The Chas. A. Strelinger Co., Detroit, Michigan, offers to send this catalogue free to anyone desiring it.

CORNISH DRILLS IN AMERICA

Holman Bros. of New York, a newly formed American corporation, are introducing the Holman rock-drill in the United States for the first time. They have issued a well compiled and handsomely illustrated catalogue descriptive of the drill, its special features, and the claims made for it. The firm manufacturing this drill, Holman Bros. of Camborne, Cornwall, England, was established in 1839, and has turned out over 30,000 rock-drills from its works. The size of the manufacturing plant, its equipment, number of hands employed, and yearly output rank the firm among the largest in the line. The Holman drill deserves more than passing attention. It was only recently awarded a $12,000 prize from the Transvaal Government and Chamber of Mines in the stope-drill contest in competition with over 18 American, German, and British competitors. This contest extended over a period of practically a year and cost $84,000. Known as an 'all-steel' drill, a few of the special features of the Holman machine are the self-tightening chuck for unshanked steels, crucible-steel ball-valves, and bushed front head without bolts. The valve motion is unique, being a combination of the independent valve and tappet. It seems like carrying coal to Newcastle for a Cornish drill manufacturer to enter the American field, and requires courage to face such a heavy handicap as the present duty of 45% imposes. It certainly bespeaks confidence on the part of the manufacturer in the excellence of his machine.

CATALOGUES RECEIVED

The Denver Fire Clay Co., Denver and Salt Lake City. Bulletin No. 40, 'Case Gasoline Furnaces.' Illustrated. 12 pages. 4½ by 7 inches.

The Wm. Powell Co., Cincinnati, Ohio. 'Especialidades para la Ingeniería.' A catàlogue in Spanish of engineering specialties. Illustrated. 56 pages. 5¼ by 7¾ inches.

Eugene Dietzgen Co., 18 First St., San Francisco. General Catalogue. Ninth Edition. A complete and attractive catalogue of drawing materials and surveying instruments. Illustrated in colors. 555 pages. 5½ by 8½ inches.

Dodge Mfg. Co., Mishawaka, Indiana. Booklet called 'Five and One-Half Miles per Minute.' Gives details of a test wherein a wood-rim pulley was run at a rim speed of 29,200 ft. per minute. Illustrated. 16 pages. 3½ by 6¼ inches.

The Marion Steam Shovel Co., Marion, Ohio. Catalogue No. 50. 'Marion Steam Shovels.' A wonderfully interesting catalogue of steam shovels. Complete details of the various models are given as well as numerous reproductions of photographs showing Marion shovels at work. Bound in limp morocco with gilt edges. Handsomely illustrated and decorated. 141 pages. 9 by 6 inches.

The American Well Works, Aurora, Illinois. Catalogue No. 117, 'Centrifugal Pumps.' An unusually attractive book, showing in detail more than 50 styles of centrifugal pumps, both volute and turbine. Twenty pages of useful information in the form of tables and diagrams make it valuable as a book of reference. Illustrated. 128 pages. 8 by 11 inches.

COMMERCIAL PARAGRAPHS

The Ajax Gold Mining Co., at Cripple Creek, Colorado, has contracted with The Moore Filter Co. for use of the Clancy cyanide process.

The Sullivan Machinery Co., has moved its San Francisco office to 308-309 Sheldon building, 461 Market street. H. T. Walsh is local manager.

A large contract for pumping machinery has been awarded to the Alberger Pump Co., New York City, by the Bureau of Yards and Docks, the total sum involved being slightly over $323,000. The contract covers pumping equipment for the three new dry docks to be constructed by the Government at New York, Puget Sound, and Pearl Harbor Navy Yards, and includes all told eleven 54-in. vertical volute pumps, each direct-connected to a 550-hp. induction motor, and seven 15-in. vertical volute drainage pumps, each direct connected to an 85-hp. induction motor; also all necessary suction and discharge piping, electrically operated gate valves for the same and all electrical controlling apparatus for the motors. Three of the 54-in. units will be located at New York, while four are required for each of the other docks.

DIVIDENDS OF UTAH MINES, 1910

The following is a list of the dividend-paying mines of Utah, together with the amount paid by each one during 1910.

Bingham-New Haven	$45,000
Boston Sunshine	6,008
Cliff	30,000
Colorado	300,000
Daly West	162,000
Dntchman	4,010
Grand Central	60,000
Iron Blossom	200,000
Little Bell	45,000
Lower Mammoth Ex	2,000
Silver King Coalition	187,500
Sioux Consolidated	89,448
Uncle Sam Consolidated	45,000
United States	2,770,500
Utah Consolidated	150,000
Utah Copper	4,647,907
Utah Mine	2,000
Victoria	10,000
West Mountain Placer	2,500
Total	$8,758,873

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EDITORIAL

CHICAGO, and the Illinois Coal Operators' Association want to entertain the American Mining Congress next fall, according to report. It would be an excellent thing for the Congress to meet in Chicago and to secure the co-operation of coal men and of the mining men of the Lake Superior region. The Congress has held but two meetings in the East, at Joplin and Pittsburg, and to realize fully its ambition to become the general organization of mining men, it needs to cultivate the districts east of the Rocky Mountains. At the same time, there would be benefits accruing to the Eastern men from closer acquaintance with the work of the Congress.

OPPORTUNITY presented itself the past week to read a report on a mine situated in California, in which the statements made indicate an available block of ore containing 40,000 tons proved by mill runs to be worth from $9 to $20 per ton. Strange to say the mine is idle, and has been for some time, although operated at various times during the past forty years. It has been developed to a depth of over 600 feet and is in a district containing many good mines. In fact, the report calls attention to this circumstance, and mentions the mines. Needless to say, the object of this report is to interest capital for its further equipment and incidentally to supply the owner with some ready cash, but the strange thing is that the writer of such a report apparently expects anyone to believe that the statements made by him would be verified upon examination.

IN this issue we publish the third and last of a series of interesting articles on the Clifton-Morenci district of Arizona, by W. L. Tovote. These articles form a valuable contribution to the knowledge of mining and metallurgical methods of the Southwest. They also show to what refinement concentration is necessarily and successfully carried in the treatment of the low-grade ores. Still, notwithstanding all the care exercised, a certain percentage of the copper sulphide continues to escape, in this district six-tenths to seven-tenths per cent. The same may be said of the efforts to concentrate the sulphides in all of the copper districts of the West—Bingham, Ely, Butte, and Bisbee, including the large operations at Cananea and Nacozari, Mexico. This loss is equal to about $1.75 per ton of ore, at present copper prices. Closer saving than this, while perhaps mechanically possible, is not thus far commercially feasible. Here is a metallurgical problem which, if it can be solved so as to afford additional profit, should be worth a great deal to the engineer who can successfully accomplish it. Even the small ad-

dition of half a dollar per ton of ore would mean millions of dollars annually to the great copper producers of the country.

THE operation of paternal laws, as they affect mining in Burma are well described in a readable contribution by Mr. C. D. Clark, to be found elsewhere herein. Paternal laws, in some of their phases, particularly those intended to stimulate and aid the prospector, as in Australia, are to be commended, even though they are unknown in the United States, but laws which in their operation place a handicap on the prospector would quickly result in killing all ambition on the part of the pioneers of the mountains and the desert to discover a new mineral district. Notwithstanding there has been much fault found with the mining laws of the United States, yet they have been proved to be liberal, practical, effective, and beneficent. Under them has been developed the vast mineral wealth of the West. Men who were poor in everything but energy and courage have gone into the wilderness, found mineral, and made millions. Thousands have profited, directly or indirectly from these discoveries and their subsequent development. Great cities have grown up, in fact, the unprecedented development of the Western United States is due directly to the work of those Western pioneers of civilization, the prospectors. Who will say that similar results could by any possibility have been accomplished under Burma's system of mining laws?

PROGRESS demands sacrifice, but seldom has the world seen men so willingly risk and lose their lives to the benefit of knowledge as may now be observed at the aviation fields. It is true these men are not taking these fearful risks in their desire to advance the world's scientific knowledge, though incidentally each disaster adds somewhat to the common fund of data. Within the past few days some astonishing flights have been made. Two of the most noted and daring of the airmen were killed on December 31, both by falls from relatively moderate heights. Archibald Hoxey, who had won the world's record for elevation and had driven his biplane to a height of over 11,000 feet above the sea only a few days previous, was killed at Pasadena, California, by a fall of 225 feet. John B. Moisant, famous for his flight from Paris to London, fell to his death from his machine at a height of only 50 feet, near New Orleans. Notwithstanding these evidences of the risk involved, other aviators undauntedly mounted into the air in their frail aeroplanes on the day following. Undoubtedly many more lives must be sacrificed before all the weak points in the construction and manipulation of aeroplanes are learned. Aviation can never hope to become even relatively safe, either as a sport or as a business enterprise, but the airship has come to stay. Experiments in aerial navigation have been carried on for many years, but knowledge increases according to a geometric rather than an arithmetic ratio, and the greatest advance has been the result of the work of 1910.

The Calumet & Hecla Consolidation

It is only forty-five years ago since the outcrop of the Calumet mine was discovered in the woods on Keweenaw Point, in Michigan. The first five years of its development were comparatively slow, and although the work done at that time was sufficiently reassuring, it gave little presage of the phenomenal development of the future. Nothing indicates this more clearly than the modest capitalization of the incorporated Calumet & Hecla Mining Company, organized in 1871, with a capital of only two and a half million dollars. Since then the great property has paid dividends exceeding one hundred and thirteen million dollars; an amount greater than that paid by any other mining company in the world. But even the 'great and inexhaustible' Calumet & Hecla has, in recent years, shown unmistakable signs of approaching exhaustion, and in order to perpetuate the great industry, to reduce cost of production, and to employ a thoroughly organized staff to the best possible advantage, Calumet & Hecla has absorbed, wholly or in part, a number of its neighbors, including Osceola, Tamarack, Ahmeek, Superior, Isle Royale, Centennial, Allouez, La Salle, Seneca, Laurium, and Gratiot. This called for a large cash investment by the Calumet & Hecla company, but in view of the purpose of the great merger, there are few, if any, who doubt the wisdom of the consolidation at this time.

Re-Location v. Resumption

In our issue of December 24, last, appeared a reference to the laws regarding the performance of annual labor on unpatented mining claims, and relocation of claims on which the labor had not been performed nor improvements made, to the extent of one hundred dollars, as required by the Federal law. In that editorial the following statement was made: "As to assessment work, all unpatented claims upon which the annual labor has not been performed in the year 1910, except such as have been located within that year, are open to re-location at midnight, December 31, 1910, to anyone except the original locator. The latter may go upon the ground at the last minute, so to speak, and by the resumption of work, and continuing it until the one hundred dollars worth has been actually completed, save his claim from being appropriated or 'jumped' by others. This point in law has been passed upon by the courts of several States, and by the Supreme Court of the United States."

This statement appears to have given rise to some doubt in the minds of certain miners who have written to enquire if it is a fact that the original locator is not permitted to re-locate his own claim, and one of our correspondents asks for legal decisions sustaining this statement. As far as we are aware the matter of the right of an original locator to re-locate his own claim has never been passed upon as a separate question; the decisions relate to the right of the original locator, by resuming work before the intervention of another, to continue his legal title

to the claim. However, he must complete the hundred dollars worth of work or improvements, for if he discontinue work before it has been finished, the claim is still subject to re-location by another. There is a long line of decisions on which this statement is based, one of which is that of Honaker *v.* Martin, 27 Pacific, 397.

The theory of the law is that the title to a mining location rests in the locator, whether he perform the annual labor or not, so long as no third party intervenes and re-locates the claim because of such failure of the original locator to perform the work required by the law. Up to that time it is a matter entirely between the original locator and the Government, which will not question his right of possession, but the moment another re-locates the claim for failure of the former locator to perform the work, title passes to the new locator.

The law is very simple. It merely requires the performance of one hundred dollars worth of work annually on all unpatented claims. If the original locator fails to perform this work, his title holds good until some one else, because of such failure, deprives him of it by re-location. To allow the original locator to hold his claim year after year by simply re-locating the ground is absurd, as such course would completely defeat the purpose and intent of the law. The original locator having failed to comply with the law's requirements has forfeited his right and the claim is then open to location by any person willing to comply with the law, except the original locator. He may resume work and thus save and continue his title to the claim, but he cannot perpetuate that title by simply re-locating the ground—he must do the work required by the law. The California legislature in 1909 passed a law forbidding the re-location of a claim by an owner who has failed to perform his annual labor within three years after the date of location.

Mining and the Government

National legislation inevitably touches mining at many points, and the attitude of Congress and the Executive Departments is far from being a matter of academic interest to Western mining men. It is fair to say that Washington officials are usually friendly but occasionally uninformed. In 1910 there were numerous clashes. The laws and regulations governing mineral lands are being revised little by little to bring them into closer conformity with modern conditions and the principles of conservation. Any such change involves incidental hardship, however necessary and well-considered each step may be. In California the principal friction arises in regard to petroleum-bearing lands. The matter has already been reviewed at length, and it is sufficient at this time to say that an *impasse* seems to have been reached as regards future disposition of the lands. Eastern sentiment, with which in this case the President is in accord, favors introducing some form of leasing. Western sentiment, at least so far as it is active and effective, is opposed. It is not likely that any change will be made this year, and the lands will probably remain withdrawn from entry. Whether relief will be afforded operators caught in the process of change, is not certain, though remedial legislation is probable, since it would be but carrying out the intention of Congress when the present withdrawal act was passed. The principal legislation enacted within 1910 and important to miners, was the act defining the power of the President to withdraw lands from entry, the act separating surface titles from mineral rights in the case of coal lands, and that establishing the Bureau of Mines. All these have met with general approval, and they evidence the fact that when public sentiment becomes sufficiently concordant and strong to induce Congress to legislate, good laws are apt to be the result. The Bureau of Mines was established in July and Mr. J. A. Holmes appointed Director in September. While there was some friction over the appointment, it has disappeared and everyone is now working cordially to assure the success of the new Bureau. So far, the work has been largely confined to investigations relating to coal mining and, quite properly, the main emphasis has been placed on improvement of conditions as regards health and safety of the men. The Bureau has equipped a number of demonstration cars and is carrying on a campaign of education at the mines themselves. At the same time the cars are available for mine-rescue work and as temporary hospitals in case of accidents. Apparently the new work is producing quick results, as accidents during the last year have been less serious than before. It is inevitable that some will occur, as in the operation of the best conducted railroads, but the number can and must be steadily decreased. It is hoped that this service may be rapidly extended so as to benefit the metal as well as coal miners, and it is further expected that systematic technical investigations of mining and metallurgical methods will shortly be undertaken. The readiness of Congress to support good work when well done has been shown by the growth of the appropriations for the United States Geological Survey, and a cheering sign of the times that came just at the close of the year was the appropriation, without any opposition, of $100,000 for the work of the Geological Survey in Alaska during the next year. Mr. A. H. Brooks and his associates have done well and it is good to know that the fact is so well appreciated. The sum now appropriated for this branch of the Survey work just equals the amount given Clarence King for the whole, when the Survey was organized. This and more is required, however, if information, evidently much needed, regarding the great northern country, is to be placed before the public. The most bitter controversies that have arisen regarding conservation matters have centred on Alaska, and it would evidently be economical to collect as rapidly as possible, full and authoritative data regarding its resources. Change in the methods of disposing of mineral found on public land is inevitable and desirable. It is of the utmost importance, however, that such be based on full information and that rights acquired prior to the change be fully protected.

The Clifton-Morenci District of Arizona—III

By William L. Tovote

Machinery.—As far as mining machinery goes, Morenci is rather an uninteresting camp. The country, on account of its rugged character and steep hillslopes, lends itself splendidly to mining through adits. The few shafts of the district hardly exceed 400 or 500 ft. in depth, with the exception of the Coronado, which is 700 ft., and the Copper King, 900 ft. deep. There is one good steel head-frame at the Clay shaft of the A. C., but the hoist there is little used, the main shaft for the lower workings being the Humboldt. The head-frames at the Humboldt and Coronado are rather spectacular, the constructions being old wooden affairs which were patched and built up higher when new and heavier hoisting engines were installed, these being set farther back than the original machines for which the frames were built. The new Coronado hoist is the best in the district. It was installed about a year ago, after years of uncertainty with the old one, during which time it was feared that the old hoist would break down when most needed. The fuel used is now generally oil at the A. C., while the D. C. still continues to use coal for some of its boilers. Besides coal, wood was used as fuel at the Coronado until recently. The compressors are mostly good and of modern construction, but rather small, as little machine-drill work is done, considering the size of the mines. The biggest plant is at the Humboldt, of the A. C. Gas-engines furnish power for the D. C. power-house, operating electrical and smelting machinery at Morenci, and the D. C. concentrator. Gas-engines are also used at the A. C. power-plants, at Clifton, and at the foot of the Longfellow incline. The D. C. power-house is considered one of the most complete in Arizona.

Concrete for supporting heavy ground in the mines is being employed more and more by the D. C. and has proved economical. The usual mixture, I think, is 1 wheelbarrow of cement to 3 of sand, and 8 of pebbles. The A. C. has used concrete for a sort of bottom plate on which to stand the heaviest obtainable round timber in their Humboldt adit and filled the space behind with dry rock-wall. The result is an ornamental wall which costs probably about the same as the solid concrete pillars of the D. C., but lacks the strength and durability of the latter. The A. C. has an electric-haulage system operating through the Humboldt and Clay mines on the adit level, and connecting with the concentrator and head of the Longfellow incline. Otherwise mule haulage and hand tramming is employed underground. The D. C. has a narrow-gauge steam railroad connecting the mines with the concentrator and smelter. The mines of the district are all well ventilated naturally, but the caving methods tend to obstruct the air circulation, as they cut off the connection upward ra.was formerly kept open by raises to the waste of thdriving the high raises preparatory to caving also works some hardships on the men through poor air and powder gas. Some of the caving stopes have become rather hot lately, owing to lack of ventilation. Water is practically absent in these mines and a great deal of dust results from mining operations, which is, perhaps, the worst feature of the mines; especially where the ore is dropped down a great distance in the main chutes to the tramming levels.

The term 'ore' in the Clifton-Morenci district is a very flexible one, and is determined often by economic conditions, since disseminated copper sulphide and oxides are to be found throughout wide areas that do not produce paying grades of ore under present methods of extraction. In Copper mountain it is difficult to find any part of the porphyry that does not carry at least 0.5% copper. The tenor of the ore is kept at present a little above 3% copper (about 3.15%). A large amount of lower grade is mined, the average being made up by mixing with richer ores. Any change in prices of copper or improvement in concentrating would affect the result of present operating methods and conditions. Concentration is necessary and a number of large plants are in operation in the district. The D. C. concentrator at Morenci was built in two units of estimated capacity of 550 tons per 24 hours each, but is now treating an average of from 1400 to 1450 tons per day. There are 130 to 135 men employed. The engine-power is nearly 1000 hp. available, of which 800 to 850 is in constant use. The sample-mill absorbs 20 hp. The loss in tailing is between 0.6% and 0.7% copper. Concentration is at the ratio of about 6 or 7 into 1, at a cost of about 60c. per ton treated. The A. C. concentrator No. 6 is at Morenci. The older, No. 5, is idle. Built for 750 tons per day, No. 6 is treating 950 to 1000 tons in 24 hours, employing about 100 men and between 600 and 700 hp. Loss in tailing is about the same as at the D. C. mill, or slightly higher (0.7% copper). The cost is about the same. These two plants are probably the best in the district and represent somewhat different features, as the D. C. plant carries classification to a high degree before concentration is undertaken, while the A. C. plant avoids this. Sizing-trommels at the D. C. mill are ⅝-in., ½-in., 7-mm., 5-mm., and 2½-mm. The A. C. mill has one trommel screening to ⅝ in., 1 in., and oversize. The D. C. concentrator was the first of a type that has since been duplicated at Cananea and Nacozari. The A. C. plant was designed in the offices of the company by C. D. Clark and D. L. H. Forbes. The Harz jig is favored at the D. C., while the Hancock jig is preferred at the A. C. mill. For the treatment of sand and slime, Wilfley tables and Frue vanners were put in originally, the number having been increased since in both mills, with addition of Deister machines. Hand picking of first-class ore follows crushing in gyratory crushers, but facilities for this are limited in the A. C. plant. The amount of sorted ore per month in the D. C. mill is about 600 tons; in the A. C. mill, 100 tons. Water is a very important item, and it is being pumped from Eagle creek, a tributary of the Gila.

over five miles distant, against a head of about 1500 ft. A new pumping plant with Nordberg pumps has just been finished, doing away with pumping from the San Francisco river. Rigid economy is exercised. The water is run to numerous settling-tanks, neutralized, clarified with lime, and re-used. Another important item is the disposing of the mill-tailing that formerly, and occasionally still, finds its way back into the Gila, causing litigation. It is disposed of now in arroyos among the Gila foothills below Morenci canyon behind dams built largely

Packing Fuel.

of the tailing itself. The D. C. piereed the ridge west of Chase creek and constructed flumes for over three miles to carry the tailing there. Other concentrating plants are those of the Sh. C. and the A. C. (No. 1 to 4) at Clifton. The A. C. mill, at Clifton, was not built according to any systematic plan, but has grown from a small beginning. It is not considered modern and the loss in tailing is said to be about 1% copper. It includes a leaching plant for treating low-grade oxide ores. The process employed is guarded with the utmost secrecy, but is, if my information is correct, merely a system

Morenci, Arizona.

publicly outlined by Karl Schnable, an eminent German metallurgist, and consists of the application of dilute sulphuric acid and steam to oxidized copper ores. The resulting copper sulphate is precipitated on iron scrap in the usual way. The sulphuric acid required for the process is made at Clifton in the A. C.'s sulphuric-acid plant; pyrite for that purpose being mined from the Joy blanket-vein at Morenci.

Of reduction works, there are three in the district. The D. C. at Morenci, the A. C. and Sh. C. at Clifton. The Sh. C.'s smelter is considered the most modern in the district and is noted for the great length of its campaigns. The A. C. smelter is considered antiquated, even after expending over $200,000 recently in remodeling. Before the renovation was decided upon, its removal to a new site in the Gila valley was strongly urged, as its present situation in the narrow bottom-land of the San Francisco river is congested, and the haulage of concentrate, mostly down grade, would balance the up-grade haul of coke, and other supplies. The D. C. converter plant, while somewhat lacking in up-to-date mechanical appliances, makes the cheapest blister copper of any of the Phelps-Dodge plants in the Southwest, probably on account of the availability of an exceptionally favorable converter-lining, consisting of a porphyritic ore mined close to the Copper mountain fault, where a dike surrounded by shale has been almost completely kaolinized, consisting now of granular quartz, with chalcocite, pyrite, and native copper, in a mixture of clay, the

Concentrator Canyon.

ore ranging well over 4% copper. Besides this, flue-dust briquetted with clayey ore is also used for converter-lining.

The district is connected by the Arizona & New Mexico railroad (A. C.) with the S. P. at Lordsburg, N. M., and with the E. P. & S. W. at Hachita, N. M. The A. & N. M. is standard gauge, Clifton being one terminal. The Morenci Southern railroad (D. C.) connects at Guthrie, on the Gila. It is narrow gauge, like the rest of the local railways of the district. Its course through the Gila foothills up to Morenci is, perhaps, without parallel, making the steep ascent in a series of curves that culminate in four loops in the last half-mile of Morenci canyon. The Coronado railroad (A. C.) connects Clifton with Metcalf; the Shannon railroad connects Clifton with Shannon hill. Local tram and yard railroads are the A. C. steam trams from Metcalf to the foot of Coronado incline, and fr[illegible] the top of the incline to the mine; its electric [illegible] is

road at Morenci, and the D. C. steam-tram and yard railroad at Morenci. The production of the district in 1909 was 74,000,000 lb. copper, of which the A. C. produced about 34,000,000 lb., the D. C. 22,000,000 lb., and the Sh. C. 18,000,000 pounds.

The social-economic features of the district are somewhat exceptional for an American mining camp of this size. Clifton, with its reduction works, is an 'open town,' recently incorporated, with a population of about 7000, but Morenci, with between 5000 and 6000 people, and Metcalf-Shannon hill, with between 2000 and 3000, are 'closed' camps, where the companies hold, as mining claims, all the ground upon which the towns are built, as well as a large area beyond their limits. The companies run the only stores and hostelries, and control the traffic with their railroads. Only a few small fractions have been overlooked in locating claims, and these have been seized upon as sites for stores, saloons, and other enterprises typical of Western mining camps. The camps themselves, because there are no saloons, are called 'dry.' The working force is mostly Mexican with some Spaniards and Italians. The 'white' population consists of Scotch families from Nova Scotia, and Cornishmen. Of native Americans there are few, except in Clifton, where also a number of Scottish families are to be found, as the A. C. is a Scotch company. The wages of the district are, Mexican, including Spaniards and Italians: timbermen, $2.50; miners, $2.25; laborers, $1.75; piston-machine men, $2.50; hammer-machine men, $2.25. 'White': timbermen, $2.75 to $3.50 (stope-boss); machine men and miners, $2.50 to $3; foremen, $4.50; shift-bosses, $3.75 to $4.25. These wages are low in comparison with other camps in Arizona, where a flat rate of $3.50 for all underground work is the standard, and where timbermen and shaftmen draw $4 and $4.50 per day. Notwithstanding the low price, the Mexican labor is extremely efficient, if properly supervised; it is also easily handled and plentiful. In spite of the low wages, the cost of living is fully as high as in other mining camps in Arizona, or rather, if one compares the store prices at Douglas and Bisbee with those of the same company (Phelps-Dodge) at Morenci, it will be found, as a rule, the latter are slightly higher. However, the service in the D. C. store, at Morenci, is thoroughly good. A large stock of goods, first-class both as to quality and variety, is carried and it affords much better buying facilities than would be expected in a mining camp having only a few hundred white people. Besides the store, the D. C. keeps a first-class hotel, with table board at $30 per month, a pleasant clubhouse with library, reading-room, and gymnasium, and also contributes liberally to the upkeep of church service. All the companies afford free medical attendance and hospital service; paying, in case of accident, half wages, and of death, $750 insurance, provided from small monthly deductions from wages. The A. C.'s stores at Clifton, Morenci, Metcalf, and Coronado are, in spite of the same prices, far inferior to the D. C. stores as far as arrangement, [illegible]liness, and service are concerned. The former of the

company's boarding and rooming-houses are in charge of Chinamen, and are inferior to many similar institutions elsewhere, even in small Western mining camps. Board is $25 per month. The A. C. has long had, in professional circles, the reputation of being backward, but, aside from that, the visitor seems to see everywhere a lack of interest on behalf of the company in the welfare of its far-away place of business. The lack of sanitation and cleanliness, and the congestion of houses, compare very unfavorably with the conditions at the D. C. mine, which supports an efficient scavenger service and has established a 30-ft. space between houses. It is usually easy to tell by the appearance of the town where D. C. ground ends and A. C. ground begins. Frequent typhoid epidemics have occurred in the past, though the last year or two have shown some improvement in that direction. The sale of the A. C. to either Cole-Ryan or Phelps-Dodge interests, that has been pending lately, even if it should, in the latter case, make the greater part of the district a one-company affair, would certainly prove a blessing for the camp and insure for it a brighter and happier future.

As to the future of the district, it may be said that the mines of the D. C., at Morenci, have evidently a limited lease on life, should future development not disclose a workable zinc and copper deposit below the barren pyrite zone. However, the great holdings of the company along the porphyry belt between Morenci and Metcalf, and in the granite area to the north and west, have developed promising features since prospect work has been carried on more vigorously. The A. C. is more favored by the richness of its ore than in the extent of its properties, but has been less progressive in every respect. The one exception is that part of the property at Metcalf, where P. B. Scottland has done everything in his power to make an up-to-date mining camp out of a neglected assortment of mines, but even here his efforts are limited by an over-cautious board of directors. The A. C., with its richer, greater, and deeper ore deposits, has been outstripped by the smaller D. C. in everything but production. T. Colquhoun, the former president and general manager of the A. C., was the first to put this company on a paying basis, and, ably assisted by Paul Nicholas, made it a factor in the copper market. Under his administration most of the existing modern improvements were made, including the electric-haulage, concentrator No. 6, at Morenci, the leaching of low-grade oxide ores, and many other things. In later years he appeared to rest somewhat on his laurels and great things were expected from the new management. While this has accomplished much in the way of improvements in smelting, concentrating, and in improved surface appearance, the mining end is not faring well under it. For example, there are the two great deposits of the Coronado and the Longfellow veins. The first can be tapped with an adit slightly over a mile in length at a depth of 1300 ft. and more, 700 ft. of which has been proved workable by shaft sinking, as the ore continues

down. The ground between is mineralized, including several branches of the same Coronado fault-vein, that splits in its eastern part and has been successfully prospected by the Sh. C. in the Little Coronado mine. The A. C. has the Pyramid and other veins along the probable course of such an adit as here proposed, and could have had all the ground between for almost nothing. The adit has been advised by nearly every superintendent in Metcalf, but it never has been started. Instead, the ore is hoisted through the Coronado shaft from depths ranging from 500 to 700 ft., dumped in bins, drawn into cars and trammed by steam railroad for over a mile, sent down 3200 ft. on the Coronado incline, dumped into bins, drawn into other railroad cars, carried about a mile into Metcalf, dumped again in bins, and from there transported by the Coronado railroad six miles down to Clifton, to be handled by an old-style concentrator. A deep adit would avoid much of this expense.

Tertiary Lava Cliffs.

The Longfellow vein is formed by the union of the Yankie lode with the Quartzite fault. The fault is pronounced and repeats the features of the Coronado in strike, being nearly east-west, with dip steep to the south, and followed on its north wall by an irregular diabase intrusion. The Yankie lode changes its dip to the north, conforming to the dip of the fault at the juncture. The course of the fault is plain and can be followed on the surface from the Yankie mine (D. C.) across the deep trench of Chase creek, to where it disappears under the Gila conglomerate. This vein was opened from the old Longfellow inclined shaft, and adits driven for the exploitation of metasomatic orebodies to the south. Near the bottom of Chase creek, and close to the Coronado railroad level, it was found strong but leached, as was to be expected near the surface, in the underground quarries that had been worked there by the A. C. for converter-lining. Higher up on the slope, it was cut by an assessment adit driven nearly parallel and just outside of a great north-south cross-vein, that made a good orebody near its intersection with the fault. This adit was driven through the vein, which was strong but leached, through the diabase, here exceptionally wide, and into the quartzite foot-wall, and still they were looking for the vein farther ahead. Instead of following this vein from any point on the slope of the hill with an adit, a vertical shaft was sunk through quartzite and granite for over 500 feet.

Mining Laws of Burma

By C. Dawes Clark

In these times, when government ownership of natural resources has become a live question; when centralization, reservation, and reclamation are the ever recurrent topics of the day, and when the word 'conservation,' sung to various tunes and cadences has become the battle hymn of a political faction, it may be worth our while to pause a moment and observe the effect of some of these tendencies elsewhere. This may help us to discover to what extent the extension of a centralized, paternalistic control of our natural resources may be beneficial to the nation; whether these conceptions work out well in practice; how governmental ownership of mines may affect the development and utilization of natural resources; and finally, if our American economic ideals could exist and thrive under a really paternalistic government.

The Government of India represents probably the highest development of a strictly paternal government. Its comparatively few but broad and far-reaching laws, dealing frequently with the most delicate and intricate social and religious problems, are efficiently and painstakingly administered by that highly trained corps, the Indian Civil Service and its allied branches. Burma, that is upper Burma, has only been administered by the British since about 1890. The country was annexed in 1886, after Mandalay, its capital, had been seized by the troops. This was followed by several years of 'dacoity,' or brigandage, which was gradually but efficiently suppressed. The natives then settled down to a most peaceful and contented condition, and their rights and privileges have been most sedulously cared for by the administration ever since. The mining laws of Burma are thus interesting in that they represent the latest work of the Indian Government and sufficient time has elapsed—twenty years—to enable the observer to mark what progress in mining an entirely new country has made since being thrown open to civilization.

All minerals, ores, coal, oil, and precious stones are held to have become the property of the Crown. No exclusive permanent rights to any such property can now be obtained. Various classes of privileges and concessions leading up to leases can be obtained by those presumably able to do the work, under which leases the valuable natural products may be extracted on payment of royalties to the Government. This paper will deal principally with the rules governing metal mining. The forms of privileges listed below may be granted at the option of the local authorities.

The Exploring License.—This may be obtained by practically any person on application to the Deputy Commissioner of the District, and on payment of Rs. 10 ($3.33). It gives the holder the right for one year to explore and prospect within an indefinite area, as applied for, included in the district. No rights, however, accrue to the holder on any ores or minerals or valuable deposits which may be thus found, nor is

any other person prevented from exploring or prospecting the same area or deposit. The only real privilege attached to the license is the statement that in the event of two parties asking for further rights over the same deposit or area, the one holding an exploring license would receive more favorable consideration on that account. As might be expected, this rather useless license is seldom, if ever, applied for.

The Certificate of Approval.—Before any more definite prospecting rights may be granted the applicant must obtain a certificate of approval. This is granted by the Revenue Secretary of the Province acting for the Lieutenant Governor, to those presumably able to properly prospect and finally to develop and work deposits which may be found. It is good for one year and for one district only and for the particular metals sought for as stated. One of these certificates must accompany each application for prospecting license and is surrendered if the license is granted. The avowed intention of the Government in requiring such a certificate is to prevent rights to mineral wealth getting into the hands of those financially or otherwise unable to develop them properly. The effect of this restriction is not wholly that intended by its authors, and it has resulted in more harm than the reverse, in retarding the development of the mineral resources of the country, for, it not only most effectually bars out the real prospector, as we know him in America and Australia, but it causes useless delays and sometimes futile inquiries into the standing of legitimate small companies which might be fully able to prospect and develop a property with a view to transferring it to a more powerful organization if its development proved satisfactory, and yet not possess at the outset sufficient means to carry on large mining operations. At the same time, too, in spite of the intention of the laws to keep out undesirable applicants for prospecting licenses, various 'experts,' 'mining engineers,' and others, do at times succeed in blarneying certificates of approval from the government officials; and thus a species of wild-cat finds a habitat in Burma as well as elsewhere.

The Prospecting License.—These are granted over definite limited, but not necessarily surveyed, areas by the Deputy Commissioner of the District to parties possessing a certificate of approval. The application must contain a map and a suitable description of the boundaries of the property; the shape of the tract may not in length exceed four times its width. The area which may be taken up varies with the metals sought, and in the case of the precious metals cannot exceed one square mile without special sanction of the Government of India. The prospecting license is granted for one year only and may be renewed at the option of the Government for one or more successive years. A deposit of Rs. 100 ($33.33) is required. This deposit is returned on the expiration of the license if its provisions have been observed by the licensee. The grantee of such a license may enter upon the land and conduct any sort of mining operations. He may extract minerals, or metals, and remove them provided he pays the stipulated royalties to Government. These royalties vary with the value of the metal contents. In the case of iron the royalty is the absurdly low figure of one-half anna (1 cent) per ton, in the case of lead, copper, etc., the royalty is 2½% of the net value of the contents, while in the case of gold and silver the royalty is 7½% of the net recovery of the metals. The royalty for precious stones is 30% of the net profits of the company. There are other restrictions attached to the license. The licensee must pay suitable compensation to any agricultural interests injured by his operations at prices adjusted by the Deputy Commissioner; he may not cut any tree over 8 in. diam. without first obtaining permission from that overworked official, and at the expiration of his license must fill up or fence in all excavations and working places. The rights conferred by the license may not be transferred without first obtaining the sanction of Government. The prospecting license, if its provisions are observed, gives the grantee the right to a mining lease on the property, subject, as always, to the approval of the local government as to the fitness of the owners financially and otherwise to conduct more permanent mining operations.

The Mining Lease.—This may be granted by the local government (that is, the Lieutenant Governor of the Province and his staff) over the same areas for which prospecting licenses are granted and on reference to the Government of India the area may be extended to 10 square miles. In special cases, on reference to the Secretary of State for India, certain concessions have been granted over still larger areas. The mining lease may be drawn up for any period up to 30 years and subject to the same royalties the lessee may conduct any mining operations needful, subject to the additional rules covering accidents, inspection, etc. A fixed ground rent of 8 annas (16c.) per acre is levied annually and a further rent for such land as is actually occupied by mining operations or otherwise used and improved. These rents are, however, deducted from any royalties paid, so that when the royalty exceeds the ground rent, no rent, as such, is paid. Two recent leases covering the metals, lead, copper, etc., read that the royalty paid should be 2½% of the net value of the ore at the pit mouth, said value to be computed from the current London prices for the ore less the cost of its transport to London. In the case of gold and silver, the royalty may, at the option of the lessee, be changed to become 7½% of the net profits of the mining company. The lease stipulates the metals covered by it and it is conceivable that two or more lessees might be working in the same area for different metals. Bi-annual statements of tonnage and assays are required of the lessee and the property itself or the company's books are at all times subject to government inspection.

Laws Referring to Explosives.—With the Los Angeles *Times* disaster so fresh in memory, it will be of interest to note that the laws governing the sale, transportation, and possession of explosives in Burma are very strict and are stringently enforced. No explosives may be bought, transported, or possessed without a special license covering the particular

purchase, shipment, and use of the definitely designated quantity. These licenses are obtainable from the Deputy Commissioner of the District wherein the explosives are to be used. They can only be obtained by parties known to the officials as suitable and proper persons really conducting operations requiring the use of explosives. The explosives must be kept in standard magazines scientifically designed to minimize risk of accident, or theft. These licenses are rather difficult to obtain, and may cause delay in conducting operations, and the multiplicity of rules covering the safe transport of the explosive make the freight a very heavy item; yet it would seem that greater precautions in limiting the ownership and use of explosives might well be advisable in the United States.

How the Laws Work in Practice.—Whatever may be the merits of the above methods of handling a country's mineral wealth, it must be admitted by any impartial observer that the mining laws have had the effect of retarding the mineral development of the country. Burma, with its 239,000 square miles, spreads through a considerable range of latitude and longitude, being over 1200 miles long, in a north and south direction. It presents a great variety of topographical conditions, and rocks of numerous geological ages are exposed. Ores and minerals are widely distributed, as proved by the numerous and varied samples brought in by the natives. But as yet very little is known of these ores as prospective mine-makers. Two gold-dredging companies, one of which is paying well, and two lead-silver prospects undergoing development, and some alluvial tin workings represent the sum total of the metal-working activities of the country at the present time. I do not claim that Burma is remarkably rich in ores, or especially alluring to the mining world, but merely that little is now known of its possibilities, and under the existing laws it is probable that very little will be known for a long time. There is not, to my knowledge, a single real prospector in the country, and there is no place left for him and no inducement to draw him thither. Nor can prospecting of a general and inceptive character be either economically or intelligently done by a mining company; nor is the usual technical man who might be in charge of such operations best fitted for conducting prospecting operations. What is needed to open up the country is the hardy, alert prospector, who puts his own time and work, and usually his own fortunes and hopes into the ground, showing up the leads, usually on the verge of starvation, yet somehow managing to exist and to turn up at intervals showings that are worth buying at a reasonable price on the chance of further work developing a paying property. Thus, while losing the services of the prospector, no commensurate advantage is gained in the attempt to restrict the possession of mineral rights to those possessed of sufficient capital to work them. Indeed, such a precaution seems quite unnecessary, for judging from results in the United States under our policy of *laissez faire*, the properties of merit gravitate capitalward quite fast enough. Nor are failures by any means wholly useless; indeed, they are one of the most patent factors in developing the mining industry of any region. In most cases the good properties are made out of several successive expensive failures, each one bringing the property more nearly into the condition in which its work can be finally undertaken with confidence on a proper scale with approved appliances and an assured success. If it is true that mines are not found, but made, then it is also true that most of them are made out of the bones of several earlier companies, each one of which has contributed in its hopeful, futile way its all to the making of the property. To attempt to legislate as to who shall own mining rights will always be an economic crime, and as such will speedily be corrected by the inexorable economic laws to which any nation and country is more surely subject than to those in the statute books. In operating under this leasing system, there are uncertainties and difficulties which the investor must, if he is wise, take into consideration as well as the usual labor and climatic drawbacks inseparable from tropical work. Leases can not be made to cover every conceivable contingency, and their interpretation is left to a somewhat autocratic and arbitrary government. As an example of one of the many difficult questions to handle under a leasing system, I will note the case of one lead-mining company working in ore containing about 40% Pb as well as 19% Zn, the latter in a form not separable from the lead by any known mechanical process. As the ore was smelted the zinc was not only lost, but was a detriment to the ore to the extent of $5 or more per ton; yet the Government demanded that royalty be paid on the zinc content. This brings up a whole series of nice questions as to what is metallurgically or economically possible. It illustrates some of the difficulties that arise when rather general laws are left to the enforcement of well-meaning but technically ignorant officials. A still more serious question to handle under the leasing system is the waste of ore; how much may be left in the mine? By what method must the mine be worked? Who can prescribe the right balance between working costs, extraction, safety, and losses, but the one who is not only the operator but the real owner of the property? All this tends to decrease the value of a Government-owned property and must be allowed for by the wise investor. By all means, let our mines be privately owned and handled as the conditions demand. If the Government must have a royalty from its mineral wealth, it will be better to take it in the form of a tax on profits.

The deepest gold mine in the world not long since was that of the New Chum Railway company at Bendigo, Australia, down 4120 ft., but this has now taken second place, the shaft on the Victoria Consolidated, also at Bendigo, having reached 4600 and going to 5000 ft. This is deeper now than that of the deepest gold mine in America, the Kennedy, at Jackson, California, by more than 1000 feet.

The Petroleum Industry in California

By Ralph Arnold

*Santa Maria District.—The Santa Maria district lies in the northwestern part of Santa Barbara county and comprises the Orcutt or Santa Maria field proper, the Cat Canyon field, and the Lompoc field. The first mentioned furnishes a large percentage of the refining oil of the State, its yield ranging from 24 to 27° Baumé in gravity and from 20 to 1000 bbl. per day in individual production. The Cat Canyon field yields 12 to 16° Baumé oil, the individual daily production varying from 75 to 8000 bbl. The Lompoc field yields oil of 14 to 35° Baumé gravity, the individual production varying from 20 to 600 bbl. per day. Two pipe-lines of the Union Oil Co. and one of the Standard Oil Co. connect the field with Port Harford, while a line of the Associated Oil Co. runs to Gaviota. The Palmer Oil Co. is now considering the extension of its recently acquired line to some point on the tide-water.

Attention in the Santa Maria district has been centred mainly in the Cat Canyon field, which came into prominence over two years ago through the advent of Palmer well No. 1. The Palmer company is still the most important producer, its well No. 2, which came in during June of this year with a production of from 5000 to 8000 bbl. per day, of 15° Baumé oil, being the best producer yet recorded for the Cat Canyon area. In addition, wells No. 3 and 4 of the same company are being finished with every prospect of becoming good producers. Las Alamos Petroleum Co.'s well No. 1, a mile north of the Palmer, has found promising sands and has flowed at times, assuring a good production when the 'sanding up' caused by heavy gas pressure has been remedied. The oil coming from this well at present is a little heavier than that of the Palmer, but a better grade will probably be found after the well has produced for some time, as has been the case with all of the wells in the field. About two miles east of the Palmer, the New Pennsylvania and Brooks oil companies have each brought in producers, the former's yielding very heavy oil that has made its recovery difficult, the latter's yielding oil of 14 to 15° Baumé gravity at the rate of 500 to 600 bbl. per day. The Brooks well is the farthest east of any of the producers in this district. Other wells varying in capacity from 150 to 1500 bbl. per day have been brought in or increased in capacity by the Dome and Union Oil companies, near the Palmer. The Summit well three miles north of the Palmer, the Carpinteria well three and one-half miles east, and the Princess and Dome wells seven or eight miles southeast of the developed part of the field are prospects that offer varying degrees of evidence of success. A well is being started in the region of Tepusquet creek that should test the possibilities of the region northeast of the Cat Canyon field. Other drilling wells that will materially extend the limit of the same field, are being drilled north of the New Pennsylvania and Brooks wells. Drilling in the region of the Santa Ynez has not been attended by any marked success. The wells south of the Santa Ynez river known as the Las Cruces and Micaela, have been abandoned and the San Lucas, four miles southeast of Santa Ynez, is still drilling at over 3000 ft. with only remote chances of success. The wells in the eastern end of the Purisima hills west of Santa Ynez have so far failed to encounter commercially productive sands.

The Orcutt, or Santa Maria field, has been extended only slightly to the southeast, the extension being due to the bringing in of several wells by the Western Union Oil Co. along the eastern border of its property. The wells, though not large producers, have yielded a good quality of oil in fair quantities. The well of the Los Flores Oil Co. to the east of the new Western Union wells, and between the Santa Maria and Cat Canyon fields, have not shown oil at the depths at which they were expected to produce. Some new wells have been put down in the proved area of the old field, but not as many as would have been, had not the Union, the holder of a major portion of the field, largely transferred its activities to the Midway district during the early part of the year.

Considerable territory was added to the proved area of the Lompoc field by development during the year. Toward the east the field was extended by the Federal well which found the light oil-sands originally penetrated by the famous 4400-ft. well of the Los Alamos Oil & Development Co., a mile or so west. Still farther east and south of the Federal well, the Lompoc Oil & Development Co. has succeeded in securing oil at about 4400 ft., while west of the latter a 150-bbl. daily production is secured from a well 2800 ft. deep by the Gem Oil Co. Development at the western extremity of the Purisima hills has resulted in the bringing in of several good wells on the Effson lease of the Union Oil Co. and several other properties. Little development has taken place in the main part of the Lompoc field, especially since the Union Oil Co. has been bending its energies toward developing its properties in the Midway and Sunset districts. One or two wells are being drilled in the region of Casmalia west of the main Santa Maria field with, as yet, undetermined results. The old Southern Pacific well north of Casmalia is still the only producer in this part of the district.

Santa Clara Valley District.—Considerable development has taken place in Ventura county owing to the fact that the light-gravity or refining oil is obtained in several of the different fields of this part of the State. The greatest development has probably been in the Upper Ojai valley, where the Bard, Pyramid, and two or three other companies have been bringing in some good wells. Development has also been quite active in the Little Sespe country, where the Cosmopolitan Oil Co., D. L. Peters, and several other interests have drilled productive wells into the light formation. Some 100-bbl. wells of 34° gravity oil have been reported among those

*Continued from *Mining and Scientific Press*, page 76.

drilled. Development is being carried on in practically all of the fields along the south side of the Santa Clara valley. One well in particular, that of the Montebello Oil Co., just east of the Bardsdale wells of the Union Oil Co., has attained a depth of about 2400 ft. and has found a considerable thickness of what is believed to be producing sand. Other new wells are being started just east of here and also south of Santa Paula. In the region of Sulphur mountain two or three holes are now going down with the prospect of securing more or less oil from the Monterey or Modelo shale formation which comprises the greater part of this prominent ridge. There is also some new development in the canyons immediately in front of and to the south of Sulphur mountain, where the Union Oil Co. and E. E. Henderson are endeavoring to increase their production of light-gravity oil. One new well of importance has been completed in the Simi valley, south of the Santa Clara Valley district. This is the well of the Search Oil Co., which has brought in a 250-bbl. well of 18° gravity oil at 1800 ft. This showing in a new field is encouraging and indicates the possible addition of another in Ventura county.

Los Angeles and Puente Hills Districts.—Little new work has been done in either of these districts during the year, a slight southward extension of the Olinda field and the bringing in of one or two exceptional producers at the western end of the Brea Canyon field being most important. A well which gives more promise of success is being drilled on the Fundenburg ranch near Spadra, north of the Olinda field. The success of this will mean the continuing of exploratory work on the north flank of the Puente hills. A few new wells were brought in in the Sherman field west of Los Angeles, but nothing that can be considered of importance transpired in this part of the district. East of Los Angeles and near the city limits the Dollar Oil Co. is said to have found favorable indications in its prospect well.

Other Districts.—In addition to the developments mentioned above, there have been prospect holes put down in the vicinity north of Fresno, with negative results to 1800 ft., where the hole was abandoned. Two or three wells have been drilled or are being put down in the Cholame district in southeastern Monterey county. Developments in the Lone Oak district of eastern Monterey county have been abandoned after several wells reached the granite formation which underlies this district without finding commercial quantities of oil. On the west side of the Salinas valley there have been one or two wells drilled, but so far without positive results, although the wells are still drilling and show some indications of ultimate success. Some development has taken place in Humboldt county. One well, drilled on the Bonanza ranch of Z. Russ & Sons Co. on Bear River, has been temporarily abandoned after striking small amounts of gas and oil. Drilling at another well, that of the Mattole Development Co., near the town of Petrolia, has also been temporarily suspended, although good indications of oil are found on the surface. Still a third well, three and a half miles northwest of Petrolia, attained a depth of 700 ft., and it is reported that sufficient gas to run the engine was found. Operations are being continued. Two wells were drilled during 1910 in the Los Gatos field, but it is impossible to secure definite information. It is believed that they were not especially successful. Development is just beginning in the Valleeitos district, forty miles northwest of Coalinga. A limited area in this district is believed to reproduce the conditions of the Coalinga field on a miniature scale, and some fairly good producers will probably be brought in here. Work on the Carrizo plains is confined to one well which is now being drilled by Honolulu capital, two miles southeast of White's camp. Drilling here has not progressed far enough to indicate anything as to the possibilities of the territory. Two or three wells are now being put down in the San Emidio district due south of Bakersfield and twenty miles east of the Sunset district. Surface indications here lead to the belief that a limited area may furnish some fairly good producers of fuel oil. In the vicinity of Petaluma one or more wells have been put down, but it is difficult to obtain authentic information with regard to results obtained. It is believed, however, that with the exception of moderate quantities of gas, nothing of importance has been found. No work of importance has taken place in the Summerland field, and the wells in this old and well-known district are fast becoming unproductive owing to drainage of the oil and the increase of the amount of water. Considerable activity is being displayed by prospectors in San Diego county. Among the most active are the Otai Valley Oil Co. and the Otai Segunda Oil Co., both in the Otai valley. A showing of oil is said to have been found in the well of the first-named company. The Beaver Oil Co. is also drilling east of San Diego. In the region of Tia Juana, the Tia Juana Oil Co. and the Lotengo Oil Co. are either drilling or preparing to drill. North of San Diego the Pacific Laguna Oil Co. has a well down 500 ft., while the San Elijo, which owns 6000 acres between Encinitas and San Diego is preparing to start operations. No commercial wells have yet been brought in in the county. Development in the vicinity of Newport has not been followed by any successes. The Kellerman, Balboa, Tidewater, and Clyde Jackson Oil companies have suspended or abandoned their holes. The Newport Bay Oil Co. has drilled two holes, which have been abandoned, but is working on the third.

Frost contributes more to the disintegration of rocks than any other one agency. If the rock be at all porous and water be present in the small interstitial spaces when the temperature is above 32° F., the moisture freezes when the temperature goes below 32° and the disrupting force of the ice formed is tremendous.

Few of the dredges working in the auriferous gravel beds of California are mining on the original bedrock, but are excavating gravel from the surface down to the 'false bedrock', generally volcanic tuff. The original bedrock is usually either greenstone schist or slate—sometimes granite.

Copper Production in 1910 by States

Statistics and estimates received by the United States Geological Survey from all plants known to produce blister copper from domestic ores and from all Lake mines indicate that the copper output from mines in the United States in 1910 will fall considerably below the output of 1909, but will exceed the production of any other previous year. The production by States follows:

Arizona.—For 1910 Arizona again takes the lead among the copper-producing States with an output slightly above the production of 1909, which was 291,110,298 lb. The Bisbee district was the largest producer, with an output of approximately 145,000,000 lb., as compared with about 130,000,000 lb. for 1909. Developments during the year in the old mines of the district were encouraging, especially in the deeper workings. The output of the Morenci-Metcalf district for 1910 will show little change from the production of 72,000,000 lb. in 1909. The Globe district made an output of about 27,000,000 lb. as compared with about 33,000,000 lb. for 1909. In the Miami portion of this district there was great activity throughout the year in development and construction. The Miami Copper Co. practically completed its mill and will begin production early in 1911. The concentrate will be smelted at Cananea, Mexico. Considerable ore was added to the reserves in blocking out the ore for extraction. The Inspiration Copper Co. was actively engaged in development, and it is reported as having, on October 20, developed ore amounting to 12,396,000 tons, and 5,604,000 tons of partially developed ore averaging 2% copper. An experimental mill was operated during the later part of the year. The Live Oak, Black Warrior, and other mines of the district have been developing ore during the year. At Jerome the United Verde mine was operated throughout the year and the output will probably show but little variation from the 36,700,000 lb produced in 1909. The Sasco smelter of the Southern Arizona Copper Co. was closed for the later part of the year and the output of the Silver Bell district will not exceed 6,000,000 lb., as compared with 10,500,000 lb. for 1909. The Humboldt smelter of the Consolidated Arizona Copper Co., Yavapai county, and the smelter of the Clara Consolidated Copper Co., Yuma county, were in operation the later part of the year. In the Mineral Creek district development and construction were active. The Ray Consolidated and Gila Consolidated companies were merged during the year. The first units of the concentrating plant at Hayden will be ready for operation early in 1911, and work on the smelter is well advanced, though the smelter will be completed considerably later than the mill. The Ray Central mine is reported to have 10,000,000 tons of ore developed. A small experimental mill was in operation on this property for a part of the year, but construction of a permanent mill has not been started.

Montana.—The copper production of Montana will probably not exceed 285,000,000 lb. for 1910, as compared with 314,858,291 lb. for 1909.

The most important event in the Butte district during the year was the consolidation of the Amalgamated companies as the Anaconda Copper Mining Co. and the purchase by this company of W. A. Clark's copper interests, including the Butte Reduction Works, which were closed. This consolidation was desirable to avoid the numerous controversies that arose concerning the ownership of orebodies, and also to reduce the cost of production by bringing the companies under one management.

Michigan.—Michigan, ranking third as a copper-producing State, made an output of refined copper of about 220,000,000 lb. in 1910, as compared with 227,005,923 lb. for 1909. The most important developments of the year were those carried on at the Lake and neighboring properties.

Utah.—Utah, ranking fourth among the copper-producing States, made a marked increase in production over that for 1909, which was 101,241,114 lb. The production was mainly from the Bingham district. The most important event in this district during the year was the consolidation of the Boston Consolidated and Utah Copper properties. During the year the mills of the Utah Copper Co. at Garfield have been remodeled and their capacities greatly increased. The Yampa smelter was closed for the later part of the year and the mines previously furnishing ore to this smelter shipped their output to the Garfield smelter. The Tooele plant of the International Smelting & Refining Co. was completed and in operation the later part of the year. This smelter was operated mainly on ore from the Utah Consolidated Copper Co.'s mines and concentrate from the Cactus mine, Beaver county.

Nevada.—The production of copper in Nevada for 1910 was about 64,000,000 lb. as compared with 53,849,281 lb. for 1909. The output was mainly from the Ely district, the ores coming entirely from the Copper Flat pit. During the later part of the year the Liberty area was being stripped preparatory to mining. The Giroux Consolidated Mining Co. continued development of its ores and the preparation for extraction, but made no production during 1910.

California.—The output of copper from California will show a decrease in 1910 from the output of 53,568,708 lb. produced in 1909. The decrease is due to the necessity of controlling the smelter fumes in the Shasta County district. An agreement was made between the Mammoth and Balaklala companies and the farmers, by which the smelters were to be provided with fume-controlling devices. The Mammoth company constructed a bag-house similar to that previously operated at the Midvale, Utah, plant of the United States Smelting, Refining & Mining Co. This plant is reported to be operating successfully, but has not been able to handle the fumes from all the furnaces previously operated by the company. The Balaklala company installed the Cottrell process and this is also reported to be operating successfully, but like the Mammoth

smelter the Balaklala has not been operated at full capacity. The Bully Hill Copper Co. has not installed a fume-controlling plant and the smelter at Winthrop was closed and the output of the mines shipped.

Tennessee.—Tennessee will also show a decrease for 1910 from the output of 19,207,745 lb. for 1909. This decrease is due to the fact that the sulphuric-acid plants operated by both companies in the Ducktown district were not able to handle the fumes produced by the smelting plants when they are operated at full capacity. The capacities of the acid plants are being increased and the output of the district should show an increase in 1911. The successful recovery of acid at these plants of the Tennessee Copper Co. has added greatly to the value of the ores mined in the district.

Colorado.—Colorado contains no important copper district, its main output of copper being incidental to the recovery of other metals. It will probably show no great change from the output of 11,485,631 lb. in 1909.

Idaho.—The copper output of Idaho in 1910, as in previous years, was mainly derived from the Snow Storm mine, of the Coeur d'Alene district. The copper smelter of the Lost Packer Mining Co. at Ivers was idle in 1910.

New Mexico.—In 1910 the chief activities in New Mexico consisted of development. In the Santa Rita district the Chino Copper Co. developed a large deposit by churn-drill and during the latter part of the year a portion of this deposit was being stripped preparatory to mining by open-cast methods. Late in the year it was estimated by the company's officials that more than 30,000,000 tons of ore, with an average copper content of 2.6%, had been developed. The company's mill at Hurley was in process of construction during the later part of the year and the company should be producing late in 1911. In the Burro Mountain district active development was carried on, especially by the Phelps-Dodge interests.

Alaska.—According to estimates made by the Geological Survey the production of copper in Alaska in 1910 was about 5,600,000 lb., as compared with 4,057,142 lb. for 1909. The increase was principally in the Prince William Sound district. The Copper River railway was completed as far as Chitina at the end of September. This should reach the Bonanza mine in time to permit the shipment of considerable ore during 1911.

Outlook for 1911.—So many factors enter into the determination of the output of copper that a forecast of the probable production for 1911 is of little value. During the later part of 1910 several of the large companies were reducing their output and it is probable that this policy will be continued into 1911. Two large companies, the Miami Consolidated and the Ray Consolidated, will begin production early in the year, and the Chino Copper Co. and probably the Bonanza mine of Alaska will be producers late in 1911, so that unless there is a decided curtailment by the older companies the output for 1911 will exceed that of 1910.

Coal Mining in 1910

By E. W. Parker

According to reports received by the United States Geological Survey from coal-mine operators and others familiar with the industry, the production of coal in the United States during 1910 was between 475,000,000 and 485,000,000 short tons, a considerable increase from the output of 459,715,704 short tons in 1909 and approximately within 1% of the previous maximum record of 480,363,424 tons produced in 1907. The most important factor influencing the coal-mining industry in 1910 was the prolonged strike in Illinois and the Southwestern States. This strike or suspension, which started on April 1 pending an adjustment of the wage scale, was not finally settled until September 15, and after that date much time was lost in putting the mines into condition for operation, so that the period of idleness in the mines affected was fully six months. The settlement was a practical surrender of the operators to the demands of the miners, with an increase of 5.55% in wages. A similar increase was granted in a number of other States, either before the strike was called or during the suspension or subsequent to it. During the idleness many of the miners who were on strike in Illinois obtained employment in the mines of competitive States and helped to increase the output of those States, which offset the shortage in the States affected. Notable increases in production were made in the western counties of Kentucky, in western Pennsylvania, and in Ohio, West Virginia, Alabama, Colorado, New Mexico, and Montana. The States whose production was reduced by the strike were Illinois, Kansas, Missouri, Arkansas, and Oklahoma. It was claimed by the miners' organization that on June 1, 1910, 70,000 miners were idle in Illinois, and 35,000 in the Southwest—that is, in Kansas, Missouri, Arkansas, Oklahoma, and Texas. About the middle of May the operators of two important districts in Illinois seceded from the Illinois Coal Operators' Association, which was in contest with the miners' union, accepted the miners' terms, and went to work. Other mines which were not represented in the association were also operated during the strike, so that from 25 to 30% of the normal output of the State was being produced at the time the strike was ended, and this continuous production was a potent factor in bringing the operators to terms with the miners. Of the total production in 1910 the anthracite mines of Pennsylvania contributed nearly 83,000,000 short tons and the bituminous mines between 390,000,000 and 400,000,000 tons.

The influence of the strike in the coal-mining States of the Mississippi Valley region was felt as far west as the Rocky Mountain States, especially in Colorado and New Mexico, whose coal was sent considerable distances east and southeast in order to make up the deficiency caused by the strike. An increased production in Colorado was obtained notwithstanding the fact that the strike on April 1

also affected the lignite or sub-bituminous producing districts in that State. The tonnage from the lignite fields in 1909 was artificially large and low prices prevailed accordingly. The coal produced in 1910 sold for a much higher price, and since April 1, when the strike was declared by the United Mine Workers of America, has been largely produced by non-union labor.

Colorado.—Colorado's coal production in 1909 was 10,722,746 short tons. The increase in 1910 was about 20%, so that the output in that year was approximately 12,000,000 tons. The unusually large demand for Colorado coal in 1910 was for the use of the railroads running between Colorado and Missouri river. There was also a better domestic demand during the summer months, and a larger quantity of coal for winter use was stored during that time. There was an unusually large number of mine disasters in Colorado during the last months of the year, most of them being due to mine fires, sometimes accompanied by and sometimes free from explosions. The explosions which occurred in the gaseous mines were responsible for the large death list. In the fires that were unaccompanied by explosions the men were suffocated.

New Mexico.—In New Mexico the coal trade was brisk throughout 1910, resulting in an increased output of 30% over the preceding year. The operators attributed three-fifths of the increase to the closing of the mines in other States and two-fifths to the normal growth and to the requirements due to improved business conditions. One of the benefits accruing to the coal-mining industry of New Mexico in 1910 was the reduction in the freight rates on foreign coals by the Mexican railroads. J. E. Sheridan, United States Mine Inspector for New Mexico, gives the total production of coal in New Mexico in 1910 at 3,684,627 short tons. He also reports that there were 15 persons killed in the mines during the year—9 by falls of rock, 5 by falls of coal, and 1 by picking into a missed shot. Mr. Sheridan calls attention to the fact that all but one of these accidents were due to the negligence of the miner in not properly timbering his working place.

During 1910 great improvements were made in the methods of operating the mines. Each of the three larger operating companies has employed mine inspectors whose duty it is to look after the safety of the men employed. In addition to these mine inspectors the fire bosses and shot firers must also report any unsafe conditions in their respective districts, and when an accident occurs whereby any person is injured in the mine, the circumstances and conditions are immediately investigated to discover if the workmen were allowed to go into an unsafe working place, and if so, the fire boss or shot firer who neglected to report such unsafe condition is held responsible. The larger mines employ shot firers or explode the shots by electricity, and all shots are exploded after the miners and others (except the shot firers) have left the mine.

Utah.—J. E. Petit, the State coal-mine inspector of Utah, reports that the coal production of that State in 1910 amounted to 2,526,093 short tons, as compared with 2,269,481 short tons in 1909. The increase was normal, as the production in Utah was not at all influenced by the strike conditions in the Middle States.

Montana and Wyoming.—As Montana and Wyoming are more distantly removed from the scene of the labor troubles in 1910, the increased coal production in these States was not so large as in Colorado and New Mexico, although some Wyoming coals were sent to points in the Eastern plains regions that had been supplied by Illinois, Kansas, or Missouri fuels. As far as Montana was concerned, the most interesting developments are those following the completion of the Chicago, Milwaukee & Puget Sound railway. These developments were in the Bull Mountain field, in Yellowstone county. This field did not produce any coal in 1908, but in 1909 its output amounted to 188,837 short tons, and at the close of 1909 the mines of the field had a combined capacity of 2000 tons per day. At the close of 1910 the daily production in the Bull Mountain field was about 3000 tons.

The total production of coal in Montana increased about 500,000 tons in 1910 over 1909. The announcement by the Chicago, Milwaukee & Puget Sound and the Great Northern railways of their intention to use oil exclusively in their locomotives from the Pacific Coast as far east as Butte, Montana, will if carried out have some influence on the production of coal in both Montana and Wyoming in 1911.

Pacific Coast States.—Washington is the only one of the Pacific Coast States in which coal mining is an industry of importance. The total production of California, Alaska, and Oregon in 1910 did not amount to much more than 100,000 short tons. There was in Washington, however, notwithstanding the renewed and increased aggression of fuel oil, a decided increase in the production of coal at the commercial mines. The railroad mines, or those operated by the railroads or subsidiary companies for the exclusive use of the railroad companies themselves, showed about the same production in 1910 as 1909. Outside of the railroad mines, however, the production in some mines increased as much as 50%. The total production of the State was between 4,500,000 and 5,000,000 tons, as against 3,576,406 tons in 1909. To what an extent the coal-mining industry of Washington will be affected by the increased use of fuel oil on the railroad locomotives is a problem. During 1910 the Northern Pacific railway equipped 30 oil-burning locomotives for yard and switching purposes and for its fast passenger service. The Chicago, Milwaukee & Puget Sound and the Great Northern railways have announced their intention of using oil exclusively throughout their mountain service.

The lack of coal production in California is made up by the enormous increase in the production of petroleum, most of which is used for fuel. The production of petroleum in California in 1910 aggregated between 65,000,000 and 70,000,000 bbl., which, on the basis of 3½ bbl. of oil for each ton of high-grade coal, would be equal to a production of nearly 20,000,000 tons of coal in that State in 1910.

Discussion

Readers of the MINING AND SCIENTIFIC PRESS are invited to use this department for the discussion of technical and other matters pertaining to mining and metallurgy. The Editor welcomes the expression of views contrary to his own, believing that careful criticism is more valuable than casual compliment. Insertion of any contribution is determined by its probable interest to the readers of this journal.

State Mineralogist

The Editor:

Sir—An editorial in the issue of the *Mining and Scientific Press* of December 31, mentions my name, among others, as having been suggested for the office of State Mineralogist. I must say my health would not now permit me to undertake the responsibility, and I am not a candidate for the office. In my opinion, there is some serious work required to make the Mining Bureau an institution to represent, in a worthy manner, the industry which first gave to this State its world-wide reputation. I believe the appointee should be a somewhat younger man, who, in addition to the qualifications of technical training and ample experience, has a good store of energy left over and available for strenuous effort.

Ross E. BROWNE.

Oakland, January 1.

Surface Indications of Ore-Shoots in Depth

The Editor:

Sir—I am pleased to note that my contribution to this subject in the issue of October 22 has attracted some attention, and brought forth comment from several gentlemen. There seems to have been somewhat of a misunderstanding as to what was meant in the latter part of the fourth paragraph, marked No. 2, in which the following occurs: "Should the fault or flexure have a dip, one way or another, from the vertical, the ore-shoot may take a similar trend or pitch along the fissure in which it occurs, but eventually the shoot will be found to terminate when the region of disturbance is reached, whether it is vertically beneath the break, appearing on the surface, or in depth, at some distance to one side of it."

It must be remembered that the condition described contemplates that the fault or flexure crosses the vein, and that this fault or flexure may have a dip as well as the vein itself, and that an ore-shoot occurring in the vein may have a 'pitch' or 'rake' along the plane of the vein. It is the result of my observation that shoots of ore usually come to an end at the surface, upon reaching a depression, ravine, or gulch crossing the strike of the lode (which is generally due to the occurrence of a flexure or fault), and that, as the mine workings are carried down to depth the disturbance caused by the flexure or fault will be found to be continuous and that the ore will not pass through the region of disturbance, or if it does, will generally be of much lower grade, although the vein may continue. Charles Janin, in the issue of November 19, presents two longitudinal sections of mine workings to prove that the theory advanced in my original contribution is weak, and not substantiated by facts. Concerning one of these mines I know nothing and am willing to admit it as negative evidence; of the other, I am told by the manager that considerable stoping was done beneath the gulch that was not justified by economic results, proving at least that the workings of a mine do not always sharply define the limitations of profitable ore. An inspection of the longitudinal maps of a mine is not sufficient in arriving at conclusions regarding this matter. Maps of mine workings are not always a safe index as to what has actually been discovered and removed from all parts of the vein, unless accompanied by figures showing width of vein and assay-value of the ore throughout. To judge correctly, one must actually learn what ore was found at any particular place in the mine. Stopes are frequently carried beyond the limit of profitable operation, but mine maps do not always convey this desirable information.

A fault occurring subsequent to the formation of a vein will, of course, displace the vein to the extent of the throw of the fault. In such cases the continuation of the vein may usually be discovered on the opposite side of the fault. Moreover, a fault may pass directly through an orebody or shoot, and in such case the ore will be found to terminate when the plane of the fault is reached. This phase of the discussion may not therefore be considered, as it is more particularly the discontinuance of an ore-shoot upon reaching a gulch, or depression, that was referred to. I have found that many gulches and depressions are due to a flexure in the strike of the rocks, particularly where these rocks were slaty or schistose. In massive rocks they are probably often due to similar causes, though a flexure would perhaps not be so apparent as in a schistose or slaty rock, in which any torsion of the rocks may usually be plainly seen. Gulches may result wholly from erosive agencies, and have no connection whatever or be influenced by flexure or fault. Such instances are found in regions where glaciers exist, or have existed, the ice in many places cutting channels in the rocks regardless of their structure.

On the Mother Lode of California, ore-shoots are very seldom found to cross depressions or gulches *at the surface*. There may be exceptions to this rule, doubtless there are, but I do not happen to know of them. I am aware of many other places, as well as those on the Mother Lode, where the same condition is found to obtain. I am merely stating the fact; the reasons for it may, perhaps, be learned by careful observation. Following are a few instances where ore-shoots terminate upon reaching a gulch or depression crossing the strike of the lode or vein: the ore-shoots of the Kennedy mine do not extend north of the gulch crossing the Lode, north of the north shaft of that property—this gulch is on a fault line; the ore-shoots worked in the Oneida mine do not extend southerly across the east-west valley crossing that mine; the South Eureka ore-shoot does not cross the shallow gulch that lies between it and the Central Eureka; a surface depression occurs between the Central Eureka and

the famous Badger-Eureka shoot, and the rich Eureka ore-shoot does not cross it, nor does this latter continue north of a low saddle between the Eureka and the Wolverine, north of it. The ore-shoot of the Lincoln mine is terminated on the north by a gulch and on the south by a depression; the payable ore-shoots of the Keystone mine do not cross Amador creek on the north; the extension of the Bunker Hill ore-shoots north and south is limited by gullies crossing the vein; the Plymouth Consolidated ore-shoots occur under a nearly level surface, the principal orebody being under a rounded knoll. The great ore-shoot of the Angels-Lightner-Utica group at Angels does not pass Angels creek on the south; the limitations of the Rawhide mine in Tuolumne county are defined by surface depressions; no ore of consequence occurred in the vein of the Gwin mine at the surface where crossed by a gulch; and the Eagle-Shawmut ore-shoot terminates at a gulch on the south, as determined by considerable exploration at that point. The App-Heslep mines occur on a hill known as Quartz Mountain; the Golden Rule-Jumper ore-shoot is limited by depressions; the Pine Tree mine, in Mariposa county, ends at the Merced river; the Princeton mine also is confined between the crossing of two depressions on the surface; the Yellow Aster hill, in Kern county, California, is cut in two by a gulch, the ore being mostly found on either side of it, but little under it. In the vein of the Home Mining Co., near Rosamond, Kern county, California, are several ore-shoots, each of which is limited by gulches crossing the vein—the formation is rhyolite. The ore-shoot of the McCabe mine, Arizona, ends similarly. These instances are sufficient to make it evident that the theory is one at least worthy of investigation.

W. H. Storms.

San Francisco, January 9.

Proposed New Mining Method.

The Editor:

Sir—I have been rather doubtful about writing further as to the cost of channeling and its possibilities for mining work, because anything I have to offer would be of a negative nature. You will find in *Engineering-Contracting*, in one of the November numbers, a cost statement covering a number of months of channeling work on the New York Barge Canal. I think the cost per square foot of channel cut for about eight months, was 26c.; this is mostly in broken limestone. The contract price for channeling on the Government Canal at Sault Ste. Marie, covering about 85,000 sq. ft., was 30c. per ft. Channeling work has been done in New York City for as low as 17c. per sq. ft. Of course, this is entirely open-cut work under conditions more favorable for the machine than could possibly obtain in mining work. The gravest objection to the use of channelers for driving tunnels, or sinking shafts, is the character of the rock, which in many cases would be too difficult to be cut by such a machine.

Channelers have never been used for quarrying granite. When deep cuts are to be made in granite, the quarry bar and rock-drills are used, drilling a series of holes in a straight line and then broaching the cores between the holes with a special flat bit. This theory of putting in a channeled undercut or shearing cut in a tunnel heading has been advanced a number of times in the engineering press, but I believe has never received a test which showed it to be of practical value. As a means of excavating rock rapidly, channelers can hardly be compared in efficiency with the rock-drill. Their economy would come from the character of the wall-cut which they make, the walls themselves being left smooth and true instead of rough and jagged as in the case of the drilled and blasted working. The material in the walls and behind them is not weakened or shattered by explosives, so that retaining walls are seldom required. It might be that channelers could be used advantageously in large shafts to avoid weakening the walls of the shaft, and to reduce the amount of timbering needed. These machines were used on several different occasions to cut wheel pits at the Niagara Falls power plant. These pits were nearly 200 ft. deep, upward of 300 ft. long, and 21 ft. wide. No timbering was required to hold the walls in place and these were practically vertical, there being an offset of 6 in. on each lift or cut of 6 to 9 ft. in depth. Channelers have also been used to cut the walls of a tunnel bench in railroad work when it was desirable not to shake or jar the roof material in the heading. It seems to me that for the varying conditions of ordinary mining work and the size of the workings, it would be difficult to design a machine working on the channeling principle, which would be small enough, and at the same time powerful enough, to perform the work required of it with the necessary rapidity and economy. A machine known as the 'Post Puncher' is manufactured which is used in coal mines for both undercutting and shearing. It is designed on principles similar to those of the rock-drill and is mounted on a column with provisions for channeling horizontally or vertically, as desired. This machine is not intended to operate in rock, however, nor in any material hard enough to spark when struck by steel. The most reasonable suggestion for a channeling device for tunnel work would be, in my opinion, a type of quarry bar such as is used in one of the great marble quarries. This bar has a standard at each end, so that the bar can be raised or lowered. It carries two or more drills which can drill horizontally, or at any angle. A carriage like this may be made in any length and would enable a line of holes to be put in at each side of the heading, across the bottom of the heading next the floor, and at any point or direction desired in the face of the heading. The carriage is on wheels and the whole apparatus can be pulled back out of the way when necessary to blast. The application of such a device would, no doubt, result in the use of smaller quantities of explosives.

S. B. King.

Chicago, December 22.

Concentrates

Most of these are in reply to questions received by mail. Our readers are invited to ask questions and give information dealing with the practice of mining, milling, and smelting.

Copper melts at about 2000° F., a much higher temperature than that necessary to melt most of its ores.

The temperature in deep mines of California's gold belt ranges from 75 to 100° F., the perfection of ventilation being an important factor.

The mines of California have produced since 1848 over $1,600,000,000 in gold. The largest output for a single year was in 1862, when it reached $81,204,873.

Quicksilver is consumed largely in the manufacture of the various kinds of percussion caps, blasting detonators, and similar explosives employing mercury fulminate.

There are few, if any, idle gold mines in California in which there is blocked out immediately available for stoping large bodies of $7 to $10 ore, notwithstanding promoters' reports to the contrary.

Slate deposits are seldom uniformly valuable. Some portions are found cracked, or seamed, or otherwise unserviceable. It is only by development and testing that the value of a slate quarry can be determined.

Few tailing-piles remain in California that can be profitably treated by the cyanide process. Some years ago there were many thousand tons of this material available, but they have mostly long since been treated, some of them two or three times.

Gypsum crystals in the vats at chlorination works are due to the presence of lime in the ore under treatment. The concentrate probably was not wholly free from gangue minerals when sent to the roasting-furnace, and this gangue consisted in part, at least, of lime—probably as carbonate.

Straight pyritic smelting is only possible where the amount of sulphur present is sufficient to make the employment of carbonaceous fuel unnecessary, and it is not always possible even if the desired amount of sulphur be present in the ore unless the ore be self-fluxing or the proper fluxing materials are available.

A simple rule for ascertaining the number of feet board measurement in a piece of square timber of known dimensions, but larger at one end than at the other, like sawed telegraph poles, is: add the area of the two ends to four times the area of the centre section and divide by six. This gives its mean cross-section approximately.

Geysers spouting upon the addition of soap to the geyser basin is due to some cause that is not well understood. At most places where interesting geysers are found, this practice of 'soaping' is strictly prohibited, as it has been ascertained that the remarkable phenomena of geysers is soon terminated if discharged too frequently.

To ascertain the revolutions a driven pulley will make per minute when the diameter and number of revolutions per minute of the driving pulley are known, multiply the diameter in feet or inches of the driving pulley by its number of revolutions per minute and divide by the diameter of the driven pulley in the same terms, feet or inches, as was used for the driving pulley.

A mill or smelter should, wherever possible, be built at some point below the mine, and the ore transported to it rather than to haul all the fuel and supplies of every description up the hill, and pump water to the mill besides. Usually the expense of these operations can readily be arrived at by competent engineers, and if a mistake of this kind is made, there is usually small excuse for it.

Gold ores containing 3 to 20% sulphides may be too low grade to ship or even to concentrate profitably, but may be found to yield the gold to the cyanide process. All such ore should be thoroughly tested by an experienced metallurgist. When this is done it may be discovered that there are many mines that may be operated at a profit, that are at present deemed worthless under existing conditions.

The first cyanide plant erected in Montana was at the Revenue mine in Madison county. It was built by R. R. and F. B. Turner. Many schemes for working this ore had been tried, but without success, plate and pan-amalgamation, and concentration having failed, yet the cyanide process was found particularly adapted to the 'refractory' ore. An ore is only refractory so long as no process is known which will readily treat it successfully.

A miner cannot properly classify a rock—nor can anyone else—until he knows the essential constituents of the rock and is able to identify these constituents. Some insist that a certain rock is syenite when they do not know what minerals must be present to constitute syenite. For the particular edification of such it is stated that typical syenite requires but two minerals, orthoclase (potash feldspar) and hornblende; pyroxene and mica may be present, but these and quartz are not necessary.

Calcite in veins is usually indicative of the presence of lime in some form in the adjacent country-rocks, usually of a lime-bearing feldspar. The mines of Gilpin county, Colorado, contain little calcite, and lime-bearing feldspars are uncommon in that district. In the Mother Lode of California, calcite is of common occurrence, and so also are rocks containing an abundance of soda-lime feldspar, such as oligoclase, labradorite, and other feldspars of the basic rocks of the region. Calcite also occurs in veins in granite, in which case, in the absence of lime-bearing feldspars, it may have been derived from the hornblende or mica present. Calcite in a quartz vein is not indicative of valuable ore, nor is its presence objectionable.

Special Correspondence

MEXICO

Extensive Power Installations. — New Railroad Construction. — The Dry Placers of Altar.

The year has witnessed advances in power transmission to mining districts. The Mexican Light & Power Co. built into the Pachuca district, operating through a subsidiary concern, the Pachuca Light & Power Co. All power demands are being supplied from the great Necaxa plant. The Chapala Hydro-Electric & Irrigation Co., of Guadalajara, completed transmission-lines to the Hostotipaquillo and Etzatlan districts, and will soon start power delivery. The Guanajuato Light & Power Co., which is doubling its capacity by the installation of a third power-plant, on the Angulo river in Michoacan, built a transmission line from Guanajuato to San Luis Potosi, 87 miles. This company is supplying power to the San Felipe camp of Guanajuato, and extensions to the Pinos district of Zacatecas, and the San Pedro district of San Luis Potosi are planned. During the year arrangements were made for the transmission of power from the Copper Queen smelter at Douglas, Arizona, to the Lucky Tiger and other mines in the El Tigre camp of Sonora, and the line will be completed by the middle of 1911. Much has been accomplished by the Mexican Northern Power Co., the Canadian concern that plans an important hydro-electric installation on the Conchos river in the State of Chihuahua. A 17-mile railroad, from Santa Rosalia to the damsite, was completed a few months ago. The company contemplates transmitting power to Parral, Santa Barbara, Naica, Santa Eulalia, and other Chihuahua camps. The Mayo River Power & Land Co., a Denver concern that has ambitious plans for extensive power development and transmission along the west coast of Mexico, announced recently that funds had been raised for a power plant on the Mayo river, in the State of Sonora. Markets for power exist in Sonora and western Chihuahua camps. The Balsas Power & Irrigation Co. was organized some months ago to work under concessions covering the waters of the Balsas river. English and German capital is said to be interested. Late in the year the Durango government entered into a contract with Enrique Schoendube for the utilization of water-power in the northwestern part of that State. Transmission of current to the Indé, Guanaceví, and other Durango districts is planned.

Only a limited amount of railroad building was done in Mexico in 1910. The Mexico Northwestern railway has steadily pushed work on its connecting link from Terrazas to Madera, in the State of Chihuahua, and has practically completed a 25-kilometre branch in to the Cusihuiriachic mining district. The National Railways of Mexico built a branch into the Taviche district of the State of Oaxaca, and has commenced the construction of another to Tlacolula, in the same State. Good progress has been made in the building of the 105-kilometre line from Durango west to Llano Grande. In November the construction of a line through the State of Michoacan, starting from Penjamo, on the Guadalajara division, was commenced. This new merger system feeder will extend to Ajuno, on the Acambaro-Uruapan line. The work of the Southern Pacific has been confined to the Territory of Tepic, and its west coast line is being extended to the Tepic capital. During the year the Southern Pacific secured a concession for a line from Guadalajara to Mexico City, and arranged five and ten-year extensions of all pending concessions. Some work has been done by the Kansas City, Mexico & Orient toward closing its gaps in Mexico. Work on the Honey railroad, to extend from Pachuca to Zimapan, has been pushed. Plans made during the past year promise railroad construction of importance to the mining industry during 1911. A line of importance to Zacatecas and Durango mining districts, that will be built by the National Railways, is one projected for several years from Gutierrez, on the Mexican Central in Zacatecas, to the Durango capital. It is expected to add fully 2000 kilometres to the merger system within the next few years. Surveys for the Arizona, Mexico & Gulf of California railroad, which will cross the Altar district of Sonora from Sasabe to Port Lobos, have been completed. The Torres-Represo mineral railroad in Sonora, purchased during the year by the Mexican Union Railway Co. of London, is to be extended to open several mining sections.

The dry placers of the Altar district of Sonora have attracted much attention during the last year. Following news of success in treating the cemented gravel of the district in a crushing and pulverizing machine invented by Mitts Quenner, a Nogales miner, many placer denouncements were made. Several Quenner plants have been installed in the district, and others have been ordered. An automobile road has been built from Nogales to Altar. The Mines Company of America, operating at La Colorado, Sonora, effected a merger during the year with the Dolores Mines Co. and El Rayo Mines Co., both of Chihuahua, and the capital was raised to $9,000,000. The three concerns jointly purchased the La Dura mines and concentrating plant, in the Yaqui river section of Sonora. The Cananea Consolidated Copper Co. continued its improvement program during 1910. A second reverberatory furnace was added to the smelting plant, and six additional McDougall roasting-furnaces ordered. The improvements made and those yet to be made will total in cost fully ₱7,500,000. The Lucky Tiger Gold Mining Co. is doubling the capacity of its concentrating plant and building a large cyanide plant at El Tigre. Aerial tramways to carry tailing to storage ground were installed by the Moctezuma Copper Co. The development of the San Antonio copper properties in the Ures district by the San Antonio Copper Co. (Cole-Ryan) was carried on steadily. The workings aggregate over 30,000 ft., and a big tonnage has been proved. The Sonora Copper Co. is erecting a 100-ton smelter, and smelters have been ordered by the Chicago Exploration Co., Triunfo Mining Co., and West Coast Mining & Development Co. Several Sonora concerns established concentrating and cyaniding plants in 1910. Much diamond-drilling was done by the Transvaal Copper Co. The Ryall exploration concession expired in April, and approximately 1,500,000 acres were opened to denouncement. A great deal of copper ground in the Piedras Verdes division of the Alamos district was taken up by Seeley W. Mudd, the Lewisohns, and other American interests. In Parral district, two very complete cyanide plants have been built, one by the Palmilla Milling Co. and the other by the Veta Colorado Mining & Milling Co. Each plant will handle 300 tons daily. Late in the year the Palmilla company and the Alvarado Consolidated Mines Co. were merged into the Alvarado Mining & Milling Co. Control of the properties of the Hidalgo Mining Co., in Parral district, including the Parral & Durango railroad, was purchased by persons represented by A. J. McQuatters for $1,500,000. During the year the Exploration Co., Ltd., of London, invested more than ₱1,000,000 in the purchase of the mines of the Santa Eulalia Exploration Co., and the San Gregorio y Anexas and Esmeralda Anexas properties, all in the Santa Eulalia district. The Rio Tinto Copper Co., operating in the Terrazas camp, increased the capacity of its smelter to 600 tons daily, and installed a converter. The San Francisco del Oro Co., of London, operating near Santa Barbara, has started the erection of a 300-ton plant for the treatment of lead-zinc ores, and at the old Rosario mines at Guadalupe y Calvo the West Mexican Mines, Ltd., another London concern, is working on the first unit of a 500-ton cyanide plant. Much development has been carried on during the year by the Sierra Consolidated Mines Co., which took over the Ocampo properties of the Greene Gold-Silver Co. A concession for a hydro-electric plant has been secured. The Plomosas zinc mines of Jose Lago were purchased by French investors. The Dolores, Batopilas, El Rayo, and Rio Plata companies have continued to produce during the year. Heavy production of silver-lead ores was maintained in

the Santa Eulalia district in 1910. The compañia Minera de Naica abandoned its plan for a ₱1,000,000 smelter at Concho station, signing a contract with the Torreon smelter people for its output. English and Canadian capital entered the old Cusihuiriachic district.

The four big concerns of the El Oro district—Dos Estrellas, Esperanza, El Oro Mining & Railway, and Mexico Mines of El Oro—continued a large production in 1910. Dos Estrellas started the year with a dividend payment of ₱1 per share monthly on its 300,000 shares, and later increased it to ₱1.50. The quarterly dividend disbursement in October was ₱1,350,000. Esperanza averaged over $180,000 in production in the first nine months of the year. The average of El Oro Mining & Railway in the first ten months was over $200,000, and of Mexico Mines over $125,000. The Quimica y Anexas mines in the Suitepec district, State of Mexico, were taken under option by the Exploration Co., Ltd., of London. The Seguranza Mining Co., Zacualpan district, added a cyanide plant to its 100-ton mill and concentrating plant. French capital became interested in several promising El Oro properties. The Pachuca district of Hidalgo increased its silver production in 1910, and much was accomplished there in an industrial way. The Real del Monte y Pachuca Co. increased the capacity of its Loreto plant from 400 to 700 tons, and is raising the capacity of its Guerrero plant from 350 to 650 tons. La Blanca y Anexas completed a 300-ton cyanide plant, and San Rafael y Anexas increased the equipment at its new plant. Good progress has been made in the erection of a 600-ton plant for Santa Gertrudis, S. A. (Camp Bird), and a 200-ton plant is being completed by the Guadalupe-Fresnillo. The Santa Gertrudis, South, a strong English company, has taken over mines just south of the Santa Gertrudis, and the Santa Inez Carretera, of Pachuca, has started the development of properties east of La Blanca and Santa Gertrudis. English investors have contracted to buy the Cinco Señores. The construction of a railroad that will connect Pachuca, Real del Monte, and El Chico has been commenced. At El Chico a 100-ton custom plant is to be built by a Pachuca company. The production of the Guanajuato district in 1910 has been at a rate of over ₱1,000,000 monthly. The Providencia Mining & Milling Co. is completing a 40-stamp concentrating and cyaniding plant, and the Tula Mining Co. a 10-stamp plant of the same kind. Early in the year the mines and 300-ton plant of the Guanajuato Amalgamated company were taken over by the Oro Grande Mines Co. The Mineral Development Co. sank its Nueva Luz shaft to a depth of over 600 metres, and is now running a cross-cut to intersect the mother lode of Guanajuato. The old Cinco Minas, in the Hostotipaquillo district of the State of Jalisco, were purchased early in the year by people representing the Marcus Daly estate for ₱500,000. Several months ago the old Bolaños mines in the Bolaños district were taken over by the Bradbury interests of Los Angeles, California. The Ampara Mining Co., Etzatlan, has paid quarterly dividends of 3% on a little more than $2,000,000. The year will show a production of over ₱1,500,000. El Favor Mining Co. has a 20-stamp concentrating and cyaniding plant ready to be operated as soon as power reaches the Hostotipaquillo district. The Consolidated Mining Co. has been steadily developing and shipping during the year, and is assembling equipment for a reduction plant. The old Amajac reduction works in this district have been remodeled for custom work. French capitalists have become interested in Magistral-Ameca Copper Co., and its concentrating plant in the Ameca district is to be enlarged. During the year the Peñoles Mining Co., of Mapimi, State of Durango, purchased control of the San Juan Mining Co., of the same district. The Velardeña custom smelter of the American Smelters Securities Co. had a successful year. A number of Durango properties contributed ore supplies. In Zacatecas the old mines of the Cerro de Proaño were taken over by the Robt. S. Towne interests, and the Proaño Mining Co. has been formed to build a cyanide plant. A concentrating and cyaniding plant has been completed by the Zacatecas Mining & Metallurgical Co. at the San Cristobal mines in the Zacatecas district. A 50-ton custom reduction plant was built at the Zacatecas capital by a company in which the Zacatecas government is interested. In Sinaloa a 180-ton reduction plant was built by the Palmarito Mining Co., 15 miles from Casal station. Arrangements have been made by the San Lorenzo Mining & Smelting Co. for the erection of a 100-ton smelter in the San Lorenzo district of Sinaloa. The Copala mines, of the Butters Copala Syndicate, in Sinaloa, were shut down a few months ago. The Metates mines were purchased by Los Angeles men for $125,000. The option at ₱20,000,000 of the Exploration Syndicate, Ltd., of London, on the properties of the Reforma Mining & Milling Co. at Campo Morado, State of Guerrero, was surrendered. It is said that an offer of ₱13,000,000 was made and refused. The year has seen some activity in the old Taxco district of Guerrero. The rich San Juan mine in the Taviche district of Oaxaca was returned to the San Juan Mining Co., an American concern, by a decision of the Supreme Court of Mexico. Through legal action in a State court, the mine had been taken from the Americans by Juan Baigts, the former Mexican owner.

Pachuca, Mexico.

LONDON

Mechanical Devices for Diamond Deposits.—Gold Mining in Brazil.—The Mount Elliott Copper Mine, North Queensland.

The portable hand-jigs that are being sent to German Southwest Africa from the Humboldt works at Cologne for the purpose of prospecting and working the diamond deposits there, have served to attract interest once more to the mechanical methods of treating deposits containing precious stones. I suppose I am writing on a subject of no great interest in the United States. Literature relating to the recovery of diamonds and other precious stones from gravels or from clayey matrix is scanty, chiefly because, with the exception of the plant at the big mines in South Africa, no elaborate machinery has been used. At these mines the disintegrated earth, together with water, is passed through pans for the removal of slime and fine sand which constitute nearly 99% of the total, and the remaining portion is treated in jigs having coarse fixed screens bedded with lead and iron shot. The precious stones are recovered in the hutch product, and are afterward picked out by hand and caught on greasy tables. These installations are, however, only suitable for work on a large scale, and the design is of little use to the engineer who wishes to test a gravel or other deposit, or to an operator who desires something better than the native pans. The pioneer companies in German Southwest Africa have adopted jigs based on the principle of the oscillating sieve on which the diamonds and other heavy stones are deposited. Some of these jigs are adapted for hand labor and others are driven by power, but the notable feature is that they are either mounted on wheels, or can

be carried on wheeled trucks so as to be easily moved from place to place, or follow the particular deposit under treatment. The sieve is moved by a cam which causes a rapid downward motion and a slow return. The earth, after the removal of the slime and fine sand, is shoveled into a hopper and the waste is removed by a small bucket-elevator which is operated from the driving-shaft. The throw of the sieve can be adjusted according to the size of the material. If the machine is larger, or if there are many side by side, a petrol motor is used for driving; and if the work is on a large scale, the trommels, in addition to removing the finer portions, divide the coarser parts into three or four sizes to be treated by different machines. In these cases each jig is made with two compartments. It is the practice to use salt water in the jigs, as its higher specific gravity helps the separation of the diamonds, and the ironwork is given a coat of protective paint. The concentrate is removed usually once every day or two from the sieve, and this is done by the confidential man. The jig is covered at ordinary times so that no one else can gain access to the sieve. The concentrate thus obtained is found in layers of different sizes, and in removal from the sieve these sizes are kept separate. A further concentration is done by the confidential man in a small hand-jig.

There are two English companies working Brazilian gold mines on a large scale, both of them old-established businesses. There are many drawbacks incident to work in that country; the jealous attitude of the Government and the fluctuation in exchange are not the least of these. One of these mines is the deepest in the world. This is the St. John Del Rey, which started work as long ago as 1830. The orebody dips flatly and the lowest level is 4000 ft. vertically below the adit. The upper parts have caved, and operations are now conducted through vertical shafts which cut the orebody at the eighth level. Below this, hauling is done through a succession of vertical shafts and levels, necessarily adding to the cost, but unavoidable owing to the nature of the work to be done. During the six months ended August 31, 94,504 long tons of ore was mined, and 92,400 tons was sent to the 120-stamp mill. The total gold extracted by amalgamation and cyanide was worth £204,659, or 44s. 2d. per ton, of which 30s. 2d. per ton was obtained by amalgamation, and 14s. per ton by cyanide. The average assay value of the ore was 2s. lower than during the previous twelve months, but the ratio of extraction (93½%) being slightly higher, the extraction was only 1s. 7d. per ton less. As a set-off, the plant treated more ore, so that compared with the corresponding six months a year ago, the production of gold showed an increase of £7164. As regards expenditure, the extra cost of steam-power required on account of the failure of the electric supply was £6410, and the rise in the rate of Brazilian exchange added £6300 to the costs; nevertheless, other economies were effected, so that the profit for the half-year, £47,434, was only £1055 less than during the corresponding period of last year. The working cost in Brazil was £139,850, and £6063 was spent on development. Taxes in Brazil and London absorbed £11,119, and London expenses £1781. Debenture holders received £2712, preference shares £5292, and ordinary shares £19,271, being 8d. per share. The balance, £18,571, was transferred to capital account for new works. During the half-year an additional 10 stamps were erected, and the 120 stamps will be gradually overhauled without the output being curtailed. The Peixe hydro-electric station is well advanced, and 1000 hp. will be available from this source before long. The other company, the Ouro Preto Gold Mines of Brazil, was formed in 1884 to acquire the Passagem and adjoining mines in Minas Geraes, only a few miles from the St. John Del Rey. The management is in the hands of John Taylor & Sons, and A. J. Bensusan is the superintendent. The capital of the company is 100,000 ordinary shares, and 36,634 preference shares entitled to a 10% cumulative dividend. The preference dividend has been paid up to date, but the ordinary shares have only received 17½% since 1893. During the year ended June 30, 75,612 tons of ore yielded gold valued at £108,773, equal to a recovery of 7 dwt. per ton. The total expenses, including £3712 paid as tax on the export of gold, were £94,435, leaving a profit for the year of £15,814. Out of this, £8135 has been allowed for depreciation, £3663 has been paid as preference dividend, and a dividend of 2½% has been paid on the ordinary shares absorbing £2500. Owing to influx of water the amount of development has been curtailed, and the reserve on June 30 was 169,991 tons as compared with 202,030 tons a year ago. During the year an electrical pumping plant has been erected and the water in the mine is now fully under control. The Maquine and Santa Anna properties, situated three miles away from Passagem, have been let under option on favorable terms. These mines were purchased ten years ago and previously had produced large amounts of gold.

The Mount Elliott company was formed in London in 1907 to acquire the Mount Elliott copper mine, 72 miles south of Cloncurry, North Queensland. Eighteen months ago W. H. Corbould, the new manager, expressed his disapproval of the cramped position of the smelting works and decided to transfer the plant to a more convenient spot. The old smelter ceased work at the end of July last year, and the new plant was put in operation on September 1 of this year. Since the new plant began operating, the monthly reports for September and October show 9095 tons of ore smelted and 1085 tons of blister copper produced, containing 1803 oz. gold and 1249 oz. silver. The amount of development work done recently has not been great; it was considered better to concentrate operations on the reconstruction of the smelting plant, seeing that the ore reserve was substantial, amounting to 140,000 tons, averaging 10 to 12% copper, and 300,000 tons averaging 3%, all above the fourth level. Mr. Corbould prefers not to give estimates of any ore below this level, as the ore is of a different character from the lens of high-grade ore which has been worked so far. He considers the rich ore to be secondary, and the primary ore, of which there is evidence of large quantities, has to be developed and estimated from a different standpoint.

JOHANNESBURG, TRANSVAAL

Gold Output.— Deep Boring Continued. — Improvement in New Diamond Mining Affairs.

Although the gold mines of the Transvaal are still suffering from shortage of native labor, and despite the fact that over 2000 natives were lost to the gold industry during October, the output for that month made a new record. The total yield for the Transvaal province has been declared by the Chamber of Mines to be 653,147 oz. of fine gold, of a value of £2,774,390. This is £31,845 below the highest declaration ever announced by the Chamber (namely, for December 1908), but it should be pointed out that the output for the month was largely augmented by quantities of accumulated gold, and that if these accumulations are not reckoned in the comparison, the October output is a record by nearly 4000 fine ounces. In comparison with the preceding month of September, which had one less working day, the increase amounts to 6248 oz., or £26,537. Of the total return, the Rand contributed £2,665,216, the remaining £109,174 being produced in the Heidelberg, Barberton, Lydenburg, and Klerksdorp districts. Several of the Main Reef companies record substantial advances in output. Both of the leading producers, the East Rand Proprietary and the Crown Mines, which between them produced close on to half a million sterling during the month, record improvements. The East Rand Proprietary's return was £4388 higher at £264,629, and the Crown Mines output £5607 greater at £228,014. The largest increase for the month was declared by the Randfontein South company, where the output was £138,939, as compared with £133,239 declared for the September operations. Among the decreases the most noticeable is that of the Bantjes—£9672. A note issued by the head office states that owing to shortage of labor 2487 tons of ore from the dump was crushed. The Simmer & Jack company also announces a decrease amounting to £3522. Profits of several mines have been

much affected by labor shortage. The Durban Roodepoort Deep, Main Reef West, and Bantjes companies have suffered especially in this regard, and at one or two other mines abnormal conditions have affected the earnings. For instance, at the Ferreira Deep, the necessity of cleaning out low-grade ore from stopes preparatory to sand-filling resulted in a decreased recovery per ton, and also brought about abnormal working expenditure. At the Roodepoort United Main Reef mine, where a new plant is being started up, mining and milling conditions are not yet normal, and the tonnage milled during October included 7200 tons of low-grade dump rock. The profits earned by the principal groups declared in respect of last month's operations are as follows: H. Eckstein & Co. Rand Mines, £218,038; other subsidiaries, £188,973; Farrar-Anglo-French group, £127,094; Consolidated Gold Fields, £113,525; S. Neumann & Co., £70,241; Albu group, £56,884; Barnato group, £54,281; Goerz group, £23,656.

Boring operations continue on the properties of the New Rand company. The objects of this venture are the location and exploitation of the 'southern auriferous beds of the Main Reef series', and the whole structure of program and policy has been built up on a foundation which can only be described as presumptive in the extreme, namely, that at present Rand is but the northern counterpart or just one edge of a basin or trough, the southern rim of which lies in the vicinity of the Vaal river. It is with a view to locating this southern rim that extensive diamond-drilling operations have been carried on in the southern portion of the Transvaal and the northern area of the Orange Free State for some few years past, first under the auspices of the now defunct Orangia Main Reef Co. and later by the New Rand, Ltd., under the direction of A. R. Sawyer, an English mining engineer who has had many years experience in South Africa. From an economic point of view, the diamond-drills do not appear to have established much as yet, but the cores brought up have indicated ore of some value and have been of interest from a geological point of view. The investigation is based on geologic correlations, and the disclosures warrant a hope that some relations of much value may be established as between the New Rand company's sphere of operations and the Main Reef beds. More than this can scarcely be said at present. The venture is a highly speculative one, but the possibilities of reaping an immense reward have induced people to provide further funds for deep boring, and in the past three and three-quarters years nearly 21,000 ft. have been drilled. At the present time operations are being concentrated on the No. 13 bore-hole which is now at a depth of 1400 ft. or more. In a report recently issued by the company's consulting engineer, considerable stress is laid on the analyses of two sections of core from the No. 12 bore-hole, one being a piece of diabase and the other magnetic slate, the former being drawn from a depth of 898 ft., and the latter from 1076 ft. Qualitative and quantitative analyses have shown the presence in the diabase of small quantities of copper and traces of nickel and gold. The magnetic slate contains, among other elements, 12 gr. gold and traces of silver and nickel per ton. The crux of the whole question is: assuming the establishment of definite correlative values as between the West Rand proper and the New Rand company's area, what are the premises for believing that gold will occur in the latter in similar quantities as are found in the Main Reef beds? After all, a satisfactory assay plan is of far more value than whole volumes of correlative geology—a branch of science which has, if anything, been much overdone in South Africa.

There has been a distinct improvement in the affairs of the Roberts Victor Diamond Mining Co., which owns and is exploiting an occurrence situated near Boshof in the Orange Free State. Three or four years ago this company was one producing diamonds in considerable quantities, and the shares at one time stood at a premium of £14. The output of the mine for 1907 was 132,809 carats from 251,963 loads washed, or 52 carats per 100 loads—a high-grade return. Last year a serious contraction was found to occur in the central area of the No. 3 mine, and, owing to a large fall of reef, washing from the open ground was stopped in July 1909, pending development of the lower levels from the shaft. Extensive prospecting was then carried out, but for some time without result. Within the past four weeks, however, a discovery of much importance has been made, and the price of the shares has improved by about 150% in consequence. Bore-holes have proved 'yellow ground' to the southwest of the old workings covering a fresh area of at least 70 claims. The 'yellow' is stated to contain good deposits and the prospect is encouraging. Further exploration work is being carried out and, because of the likelihood of a new and extensive diamond-bearing area being proved, and also on account of improvement in the diamond market, the outlook for the Roberts Victor company is better than it has been for a long while.

KALGOORLIE, WESTERN AUSTRALIA

October Production. — Dividends Paid. — Bullfinch Stampede.— The Metallurgical Problems.

The October gold yield from the State was valued at $2,600,000, and dividends paid totaled $450,000. Returns from the chief producers were as given below:

Name.	Tonnage.	Yield.	Profit.
Associated	10,330	$ 75,000	$ 24,000
Associated Northern	2,445	23,500	10,000
Bullfinch	135	56,000	.....
Chaffers	4,340	28,500	20
Golden Horseshoe	23,908	165,000	350
Golden Ridge	2,460	32,500	14,900
Great Boulder Perseverance	20,131	129,000	22,000
Great Boulder Proprietary	18,497	248,000	125,000
Great Fingall	10,416	81,500	13,500
Hainault	5,580	36,000	5,000
Ivanhoe	19,501	206,500	100,000
Kalgurli	10,825	138,000	73,000
Lake View and Star	12,878	73,000	20,000
Oroya-Black Range	4,530	45,000	9,500
Oroya Exploration	21,904	27,000	15,000
Oroya Links	7,367	41,000	5,000
Sons of Gwalia	13,511	118,000	44,000
Sons of Gwalia South	2,308	21,000	6,500
South Kalgurli	9,212	61,000	10,000

The properties which paid dividends for September were the following: Golden Ridge, $34,500; Great Boulder Perseverance, $325,000; Sons of Gwalia, $107,000. Those paid for October were: Ivanhoe, $250,000; Kalgurli, $185,000;

The Bullfinch, Western Australia.

Sons of Gwalia South, $17,500. The Perseverance comes out with a record tonnage since the mine started crushing.

During the past fortnight the Bullfinch boom continued. Every day rich ore was unearthed anywhere between Southern Cross and Golden Valley, a distance of some 30 miles. Then there would be a wild rush to peg leases. (Leases here contain 24 acres each.) The Mining Registrar has received $15,000 as deposits on leases, and about 12,000 acres have been pegged. Men who had pegged then sat down and waited for 'experts' to examine their claims.

and arrange terms for an option. Anything within a few miles of the Bullfinch was sufficient for a large deposit on an option. The country has been flooded with prospectuses. There have been many flotations of companies in Western Australia, Adelaide, and Melbourne to work leases that had not yet been granted by the Mining Warden. Shares rose to absurd prices. Practically no work is being done on any of the leases. The Government surveyed a townsite—to be named Bullfinch—about a mile from the parent mine. The blocks were put up for auction with the provision that no licenses to sell liquor would be granted, the Government intending to erect a State Hotel similar to that at the Sons of Gwalia. The town blocks brought from $1000 to $4000 each, the total from 57 blocks realizing $125,000. Being 25 miles from the telegraph line, great delays occurred in business, so the Federal Government is running out a wire to Bullfinch. Water being scarce for the big population on the new field, the Western Australian Government is laying a temporary 3-in. pipe at a cost of $40,000, to connect with the Kalgoorlie water system. On account of the great inconvenience and cost to travelers, and the probable large amount of freight to be carried later on, a bill to construct a railway to the new field has passed Parliament after much discussion, as it seems to be rather premature. The Bullfinch has been floated with 500,000 $5 shares, the owners, Doolette, Shallcross, and Jones, taking 400,000 shares; 50,000 were offered to the public and 50,000 kept in reserve. Shares now stand at $14. The flotation cost practically nothing. The company has engaged C. Jibson, of the Western Australian Government, as member of its staff. The main shaft is to be deepened to 200 ft. Development work results in showing good ore, and the extent of the deposit—some people term it so—has not been determined, much to the chagrin of owners of adjacent leases. Treatment at the Recovery company's works continues, and the average value is about $440 per ton. The ironstone ore is being roasted, while the quartz is being treated by ordinary milling methods.

Apart from the Bullfinch, there have been other wild rushes; one of the most amusing being one 6 miles west of Kalgoorlie, where a few $10 crushings have been taken out of late. Another rush set in at Kunanalling, some distance north of Coolgardie, where specimen ore was found. There have been others, and no doubt these people did not wish the Bullfinch district to have all the money that appears to be fairly loose just now. The treatment of the Bullfinch ore, assaying from $120 to $440 per ton by our ordinary treatment here, rather explodes the old theory that high-grade ore should be shipped to smelters for the best results. The treatment of rich telluride ores in our mills is successful. The cost of shipping ore in the earlier days of this field ran up to $28 per ton, when it could have been done locally for $5, and at present for $2.50, per ton. Some interesting work was done last month at the Associated Northern mill, in treating a lot of concentrate containing over 20% arsenical pyrite, from the Transvaal mine, near Southern Cross. A Merton furnace was set aside for this ore, and it roasted the mineral at a rate of 9 tons per day. Directly it was fed into the furnace it started to burn strongly, little fuel being used. An excellent roast was obtained, and the roasted product was discharged into the conveyor that carried the company's own ore from the other five Mertons. S. Roberts, the metallurgist, informs me that the extraction was only affected to the extent of a drop from 93 to 90%. There being only about 40 tons in the lot, no attempt was made to save the arsenic. No fume was noticeable about the furnace. A very interesting point to notice was the tremendous quantity of white fume emitted from the 100 by 6-ft. stack. The fume was dissipated over the surrounding leases, but no complaints were made. The Kalgurli reports highly payable ore at 1650 ft., and the Ivanhoe is meeting with much encouragement in the winze below 2270 ft. As the ore reserves have been depleted and the value of the ore has steadily decreased the mining and metallurgical methods have been improved to meet the loss.

BUTTE, MONTANA

Interesting Data Concerning the Ophir. — A. H. Wethey Retires from the Clark Properties.—The Tuolumne-Anaconda Output.—Railroad to Georgetown.

The Butte Central Copper Co. is doing effective work in the Ophir mine, and by the time the new concentrator is ready next spring there will be an abundance of ore accessible. The work is confined to the 300 and 500-ft. levels, the drifts having been extended eastward from the main cross-cut 400 ft. On the upper levels are two veins, but on the 500-ft. there is evidence of juncture of the two veins, the country between them being well mineralized. Driving is in progress on the hanging wall of the south vein, and on the foot-wall of the north vein. An orebody 8 ft. wide is being opened on the latter, and on the south wall there is 10 ft. of shipping ore. This ore assays from $5 to $40 per ton. The drifts will be extended to the east boundary of the Ophir claim, and probably within 200 ft. the Rarus vein will be opened. This fault-vein, one of the two cross-fissures in the district, has been highly productive of copper ore at places where it intersects the east and west veins. The other cross-fissure is known as the Blue vein. It strikes through the district in a northwest and southeast direction. The Rarus fault runs northeast and southwest—goes through the Rarus, Tramway, Pennsylvania, and Belmont groups, in which some of the greatest orebodies in the district are being mined. The apex of the Rarus fault is traced southwest to the eastern end-line of the Ophir, and in its descent it dips to the west, so that it is believed it will first appear in the Ophir ground on the 500-ft. level. The Ophir has another smaller fault-fissure vein having a northwest-southeast strike, and it is the opinion of W. L. Creden, consulting engineer of the Butte Central, that this fault and that of the Rarus united in the Ohpir at a depth of 1000 to 1200 ft., and at the intersection large copper deposits will be found. The future development of the Ophir will be in following out that theory.

The retirement of A. H. Wethey, as general manager for the Clark interests, on the closing day of the year, was the occasion of a banquet tendered him at the Country Club by his associates, at which Mr. Wethey made a notable speech, reviewing the great growth of the city in the last 23 years. He also took occasion to refer to the decline of Butte as a smelter centre in the past few years. He spoke of the Pittsmont as the only smelter left; it belongs to the East Butte company, which treats its own ore and that from two or three small mines. He spoke of the development of the zinc industry in this district, and said that in the sale of the Butte Reduction Works to the Anaconda company, W. A. Clark had reserved the privilege of concentrating zinc ores there until December 31, 1913. Mr. Wethey stated that over 400 tons of zinc ore per day were being concentrated at those works, the product amounting to 125 tons of 50% zinc concentrate, shipped to the zinc-smelting plant at Bartlesville, Oklahoma. Mr. Wethey and his family will now make their home in New York. He has purchased bronze manufacturing works in New Jersey, to which he will give his personal attention.

The Tuolumne company declared a 15% dividend at the last meeting of the directors. The sum thus disbursed amounts to $120,000. The company is shipping 250 tons per day of ore which samples about 10% copper, and is sinking and developing. The original intention was to sink to a depth of 2000 ft., and it is possible that the shaft may be sunk 200 ft. below that. The latest advices are that the new steel head-frame, hoist, and other equipment will be put in position in May. The production of copper by the Anaconda company for December amounted to 21,500,000 lb., of which 15,900,000 lb. was turned out by the Washoe smelter, and 5,600,000 lb. by the Great Falls smelter. In the production of the Washoe smelter is included the output of the Tuolumne and North Butte companies. In addition to the output of those two smelters, about 1,000,000 lb. was produced at the East Butte plant.

A body of rich ore has been opened in the mine of the Corbin Metals Co. at Corbin. The ore was found by driving from the 500-ft. station in the shaft. It consists of a 5-ft. vein, the ore assaying 20% lead, 2½% copper, 12% zinc, and 14 oz. silver per ton. An effort is being made to extend the tracks of the Butte, Anaconda & Pacific railway from Anaconda to the Cable and Georgetown, so that the ores of that district may be moved direct to the Washoe smelter. The length of the branch required would be 12 to 15 miles.

NEW YORK

The Calumet & Hecla Merger, and the Apportionment of Shares of the New Company.—Comment on Granby.— Extension of Jerome Area.—The International Smelter.

The year of 1910 held much in promise and yielded much in disappointment so far as mining markets go. Coppers have grown in public favor, but the situation in copper has not cleared as rapidly as expected. The development of each large property makes more apparent the necessity for effective action; and, possibly the most encouraging feature is the frank recognition of the necessity for the control of production; and the longest step toward the eventful merging of interests is the recently announced consolidation of the copper properties controlled by the Calumet & Hecla. A new corporation, to be known as the Calumet & Hecla Mining Co., is to be formed with a capital of $10,000,000, divided into 400,000 shares of a par value of $25. Given below are the names of the companies absorbed in the merger, and the basis of exchange agreed upon.

	Present share issue.	Allotment of new shares.	Rate per 100 shares old for new.
Calumet & Hecla...	100,000	240,000	240
Osceola	96,150	48,075	50
Tamarack	60,000	13,200	22
Ahmeek	50,000	40,000	80
Superior	100,000	18,000	18
Isle Royale	150,000	10,500	7
Centennial	90,000	5,400	6
Allouez	100,000	17,000	17
La Salle	302,977	6,059	2
Seneca	20,000	6,000	30
Laurium	40,000	4,000	10
Gratiot	100,000	500	0.5

The total outstanding stock of the new Calumet & Hecla company will be 337,393 shares. The present move has caused much discussion concerning the past history of the company. It has been but a short time since the great producer of the lake region stood alone in the leadership of the copper world. As a deep-level mine it is probably without an equal. In making comparisons therefore with any of the newer properties it is natural to consider Utah Copper as the leader of the porphyry group and as presenting the most complete contrast in mining methods. The output of the Calumet & Hecla for 1910 was 72,108,000 lb., as against 122,000,000 lb. produced by the Utah Copper. Copper costs were 8.43c., as against Utah's 8c. The average market price in 1910 for the Calumet & Hecla property on its $2,500,000 capitalization was $54,000,000, while Utah Copper has $15,400,000 stock out, the average market price on which in 1910 gave the Utah a valuation of $69,000,000. More important, perhaps, is the parallel in dividends, the Michigan property disbursing $2,900,000, Utah Copper $4,667,000; and of still greater importance is the fact that the Lake company is about at its limit of production in turning out 70,000,000 to 72,000,000 lb. per annum, while Utah will probably output 150,000,000 lb. per annum. While this move of the Calumet is taken to mean a preliminary getting into line for further consolidation of the great coppers, the fact remains that the next six months will test many of the producers. It is admitted on all sides that dividend reductions must follow if the producers are asked to curtail, and at the same time take lower prices for metal. Anaconda, Utah Copper, and Nevada Con. are earning more than a safe surplus above dividend requirements. The Granby statement was rather disappointing. The shareholders and the public had hoped that a policy of publicity would be inaugurated, but the report was carefully noncomittal. Diamond-drill operations are stated to "have disclosed a considerable body of ore," which is not explicit, and as the future of the property is dependent upon the results of exploratory work the matter is one in which the stockholder is vitally interested and of which he deserves to be informed. The Granby management seems not to have profited by the sensational performance of some months ago. However, in the endeavor to secure some profitable ores for the reduction plant, the management recently obtained an option on the Cliff Con. and St. Elmo, at Rossland. Utah Con., which recently had a decline almost equal to that of the Granby, is holding well around 13, from which it is evident that there are some friends of the property who think Channing and Berger were too pessimistic in their estimate of the property's future. The International Smelting & Refining Co.'s plant at Tooele is declared to be unaffected by the conditions at the Utah Consolidated. Contracts are stated to have been secured from various mines in Utah, Nevada, and Idaho which will keep the plant running at its capacity during the current year. The plant has been in operation for four months and the management states that every detail is working smoothly. The developments at Jerome, Arizona, are attracting some attention. The United Verde Extension is enlisting some Eastern support and begins to look as though it would make more than a one-mine camp of Jerome. The company now states that it has $50,000 as a development fund in the treasury, which will carry it through the current year, and the issue is being compared with some of the other low-priced coppers, such as First National, Davis Daly, and Ohio. Not all of the various copper consolidations are viewed with equanimity by the shareholders. Calumet & Hecla registered a decline of $30 per share on the publication of the news of reorganization. There is great dissatisfaction among the shareholders of the Butte Coalition on account of the terms upon which the property was turned over to the Anaconda, especially in view of the rich orebodies now being exposed, and stockholder's protective committees are being freely talked of. There is beginning to be some activity in Porcupine, while there is little known regarding the specific properties, the incorporation of the Hollinger has made a starting point and Porcupine stocks are being quoted on the Toronto Exchange.

SALT LAKE, UTAH

Comment on the Estimates of Utah Con. Ore Reserves. — Bingham Mary Brings Suit Against the Utah-Apex.

Some light has been thrown on the wide discrepancy between the recent report on the Utah Consolidated and that issued by the company in its last annual report. The latter was made by J. B. Risque, then manager for the company, and his estimates were practically concurred in by J. W. Finch. Mr. Finch stated that, owing to the limited time allowed him, he was unable to make a complete report from personal inspection and that he plainly stated that his report was largely based on mine records. Mr. Risque states that his report was based on the tonnage reported as developed when he took charge of the property and that he arrived at his figures of developed ore by adding that developed under his management and deducting that which had been shipped. Taking the company's earnings for the present year as a basis, and considering that the cost of tramway construction was included in the operating account, and that for the greater part of the year the ore was subjected to a freight charge of 40c. per ton and an unfavorable smelting contract, there is reason to believe that the price to which the stock has fallen is lower than is justified by actual conditions.

Suit has been filed by the Bingham Mary against the Utah-Apex and request made for an order directing that a survey be made by the Utah-Apex on the ground that the property lines have been transgressed.

General Mining News

ALASKA

(Special Correspondence.)—The Mt. Andrew mine, situated on Prince of Wales Island, is to be opened at a depth of 400 ft. by an adit which is being driven. Mining operations are to continue through the winter, and ore-shipments will be made at regular intervals. Several new orebodies have been discovered on the Jumbo group near Sulzer by means of diamond-drill work. In one instance the drill cut through 120 ft. of ore. A. E. Roberts of New York has been making an examination of this property. The It mine is to have a 1300-ft. adit that will tap the ore at a depth of 400 ft., and drain the workings above it. Another shipment of ore is soon to be sent out from the Rush & Brown mine.

Ketchikan, January 2.

ARIZONA

COCHISE COUNTY

The Lowell shaft of the Copper Queen Co., at Bisbee, which is to be the principal supply-shaft of the group, is being sunk from 1400 to 1600 ft.; at the latter depth a connection is to be made with No. 1 winze.

GILA COUNTY

(Special Correspondence.)—While it was the intention of the Miami Copper Co. to have its concentrator finished and one unit in operation by January 1, 1911, there yet remain so many details to be attended to that it seems improbable that operations will start before February 1. Delays in the shipment of machinery, and the other troubles incidental to the construction of a plant of this size, have been encountered. In the underground workings new timbers have been put in the main drifts, the track laid, and electricians are installing trolley wire on the 420-ft. level. A number of chutes extending from the 'ore-rooms' on the 370-ft. level to the ore-bins on the 420-ft. level have been finished. The initial run of the mill undoubtedly will be made on ore from the dump at No. 4 shaft. Two raises have been made from the 420-ft. level through this dump. Chutes have been placed in the raises and the ore will be passed to the bins and then hoisted to the surface bins. This dump at one time was too low grade to be handled at a profit, but by mixing it with ore of a nigher grade, practically the whole dump can be worked profitably. It is estimated that there is enough ore on this dump to keep the concentrator running for several months, so that no great amount of mining in the main orebody will be necessary for some time. At the pumping-station, two miles from the concentrator, the balance of the electrical equipment has been received, and a force of men is installing it and making all arrangements for the turning on of the water. The company has had 33 churn-drill holes driven to explore ground in the northwestern part of its holdings, the drills having reached an average depth of 600 ft. This work is still in progress. On the claims belonging to the Orphan Copper Co., adjoining the Miami townsite on the west, and contiguous to the ground of the Inspiration and Live Oak companies, preparations are being made to explore the property. C. M. Clark, the manager, has purchased a churn-drill to be used for this purpose. An inclined shaft has been sunk on the eastern end of the claim to a depth of 550 ft.; and about 600 ft. of cross-cutting was done both east and west at this depth, which resulted in finding considerable ore, some of which assayed as high as 8% copper.——The Boston-Miami Copper Co., that owns the group of claims one-half mile west of Miami, did extensive churn-drilling on the southern end of the claims during last winter and spring, and has now moved its camp to the northern end of the property, where drilling is to be commenced soon. It is thought that ore will not be found at a depth of less than 500 ft., this belief being based on the developments of the Live Oak company. The drill-hole nearest to the Boston-Miami line is 200 ft. east, and in this hole ore was found at a depth of 475 ft., and continued down to where drilling was stopped at 700 ft. This exploration work will probably demonstrate to what distance the deposit of low-grade ore extends in a westerly direction.——The recent developments on the property of the Superior & Boston Copper Co. have been the most important for some time. The work on the eighth level in the drift paralleling the Great Eastern vein has resulted in making a favorable showing. Two weeks ago a vein from 6 to 8 in. wide was opened, the ore in which assayed from 4 to 6% copper. During the past week the face of this drift has been in ore, the last round of holes showing the full face of the drift in a rich iron ore containing some copper glance and cuprite. The indications are that with further development this vein will lead to a strong body of ore. The drift in which this ore is being found is directly beneath the place where the high-grade ore was found on the level above.——The Inspiration Copper Co. is sinking at the Joe Bush and Colorado shafts. The Joe Bush is down to 490 ft., and the Colorado has reached a depth of 475 ft., the last few feet in the latter having been in ore. The Joe Bush, Colorado, and Scorpion shafts have all been connected on the lowest level. Most of the development thus far has been in the vicinity of the Bush shaft; but practically nothing has been done in the way of blocking out the ore around the Scorpion and Colorado shafts. In the 75-ton test mill, that was built a short time ago, tests are being made every few days to determine the concentrating quality of the ore, and the kind of machinery that will be best adapted to handle it. Experiments have been made in the last few days with the system introduced by the Utah Copper Co., and the results have been highly satisfactory. The company has increased the number of air-drills by three, making six now at work on the property; four are engaged in blocking out ore, and the other two are being used in doing prospecting work. In drill-hole No. 405, one of the last holes drilled, ore was found that assayed as high as 4% copper.

Globe, January 7.

MARICOPA COUNTY

The Arizona Gold Mines Co. is developing a copper and gold mine on Buckhorn gulch, Castle creek district, southeast of Wickenburg. The work is in the hands of Mark Bradley, who has prospected the cropping by trenches, and is now sinking a 2-compartment shaft, which is to have a depth of 600 feet.

MOHAVE COUNTY

Shipments of zinc sulphide ore from the Golconda mine, Cerbat district, amount to one car per day to zinc smelters in Oklahoma. A part of those shipments constitute zinc concentrate turned out at the mill. Information published at Kingman is to the effect that the United States S. R. & M. Co. has taken an option to purchase the Gold Road mine, and that the United States company's engineers are sampling the mine to determine the extent of ore-reserves, and the value of the ore. The Gold Road and Tom Reed mines have gold-bearing ore which is treated in cyanide plants. The product of a recent two weeks' run of the Tom Reed mill amounted to $70,000, while the weekly output of the Gold Road mill is about $20,000. The cost of mining and milling the Tom Reed ore is reported to be a little less than $4 per ton; that of the Gold Road is but a trifle over $4. Electric power is employed at both plants.

PIMA COUNTY

The Twin Buttes mine, 20 miles out from Tucson, has become a heavy shipper of ore, and the matter of providing smelting facilities is under consideration.

PINAL COUNTY

The development of the Ray Consolidated aggregates over 7000 ft. per month, and incidental to this work there is being mined about 1000 tons of ore per day. The supply of ore accumulated in this way amounts to about 120,000 tons, which will be drawn on for the concentrator, and two sections of that plant are expected to be in operation

in February. The smelting plant construction is in progress, two reverberatory furnaces of which probably will be ready for work in July.

YAVAPAI COUNTY

The Arkansas & Arizona Copper Co., operating in Jerome district, has sunk its shaft to a depth of nearly 800 ft. The Cleopatra Copper Co., mining in the same district, recently shipped two cars of ore to the Humboldt smelter, and it is stated that shipments are to be made regularly. A discovery of ore yielding high returns in copper, gold, and silver was made on the Michaels, Scanlon, and Hatch claims, situated four miles east of Humboldt. A small number of tons sent to the smelter sampled about $1000 per ton.

YUMA COUNTY

The Silent King group of claims, situated in the Shorthorn range, six miles north of the Kofa district, is being developed by Salt Lake men, among whom are W. H. Clark and Llewellyn Humphreys. Considerable development has been done, the result of which is to disclose a wide vein of quartz-porphyry, containing gold in commercial quantity. Hoisting equipment is now to be installed, to enable deeper development to be done. The shaft now has a depth of 140 ft. A stage-line is maintained between Vicksburg and Silent King camp, the latter having a population of 150 to 200 people. The claims in the group have been bonded to these people by Max Engasser, who has held and developed them many years. The Copper Basin M. Co., controlled by J. F. Curtis and T. M. Drennan, sank a 60-ft. shaft, at the bottom of which was found a 4-ft. vein of ore that assayed about 50% copper. The ore is mostly chalcocite. The property is in Copper basin, 18 miles north of Parker.——The Goodman mine, which was a rich producer in early days, now belongs to W. E. Scott, of Quartzsite, who has built a Nissen stamp-mill, to which he hauls the ore a distance of 12 miles. The gold extracted is sufficient to pay expenses of developing, mining, and milling. The mine is said to contain an 18-in. paystreak that mills $65 per ton in gold. A Lane mill is being operated on the Safford mine, near Vicksburg.

CALIFORNIA

CALAVERAS COUNTY

The Calaveras Copper Co., having mines at Copperopolis, with a concentrator and smelter nearly finished, was closed down January 1, except that the mine pumps are being kept in operation. The Lightner mine in Angels Camp is being re-opened under direction of Alex. Chalmers, who is having a 3-compartment shaft sunk, which is now at a depth of about 200 ft. This work is being done at the expense of recent purchasers of the property, who expect to have the mill started in April.

NEVADA COUNTY

(Special Correspondence.)—The Idaho-Maryland Co. has permitted several parties of 'tributers' to commence work on various pieces of ground. It is stated that several 'pitches' are showing good ore. At the Empire the new cyanide annex is operating satisfactorily. Development is in progress on the 3500-ft. level. Considerable rich ore has been recently extracted. The 40-stamp mill is operating continuously. At the North Star operations are confined principally to the Central workings, the upper levels of the mine receiving little attention. The vein continues 6 ft. wide, the ore averaging $12 per ton. At the Cincinnati Flat mine the company is developing with encouraging results. On December 31 the North Star Mines Co. declared a dividend of $275,000, which is at the rate of $1.10 per share. This makes a total of $575,000 paid during 1910. Since its incorporation in 1899, this company's dividends have amounted to 102% on its capital stock. At the Birchville mine, Graniteville district, large reserves of milling ore have been opened. The plant, which was destroyed by fire last summer, is being rebuilt, and the hoist will soon be ready for work. During the winter, work will be performed on the levels above the drain tunnel. Fifteen men are employed. At the Ancho, 15 men are working, and the mill is running steadily. George Mainhart is superintendent. At the Erie 40 men are employed on development, and a new compressor has been installed. The Sultana group, comprising the Sultana, Prescott Hill, and other mines, has passed into new hands, for whom Richard Barry is superintendent.

Grass Valley, January 9.

PLACER COUNTY

The Helester M. Co. has paid the balance of the purchase price of the Rawhide mine, situated six miles from Alta, on the north fork of the American river. A wagon-road has been built from Gorge station to the mine. Frank B. Keever is at the head of the company. The Pioneer mine, in the same locality, is being put in condition for operating.

PLUMAS COUNTY

The Gruss mine, situated in Genesee valley, which has been owned by the Gruss family for 30 years, has been leased for a term of seven years to Geo. H. Gruss and C. C. Kinsey, who are preparing to re-open the mine and operate the 15-stamp mill. The Gruss is a gold mine which has been much worked above the 100-ft. level. The purpose of the lessees is to sink 100 ft. deeper and establish a 200-ft. level. The vein is on the contact of grano-diorite and slate, has a dip of 45°, a width of 5 ft., has free-

Part of Northern California.

milling ore that assays $6 per ton. The property has a steam-hoist, and has water-power for the mill and mine pump. The mine is 22 miles from Quincy, and 15 miles from Keddie, a station on the Western Pacific. Santa Cruz people have taken an option on the Carr placer claims in Grizzly range, and have commenced drilling through the lava capping to the gravel. As soon as the latter has been explored and tested it will be opened by an adit.

RIVERSIDE COUNTY

The ore being mined at the Calzona, Sanborn, and Steece mines is attracting much attention to Riverside mountain, situated 17 miles westerly from Parker, Arizona. Ore sacked at the first two properties has been shipped to the Humboldt smelter, and the third named is to send out some ore this month. The Calzona attracts special interest by reason of the discovery in December of a 7-ft. vein of ore, samples of which assayed over $200 per ton in gold, besides the high copper content.

SHASTA COUNTY

(Special Correspondence.)—The Uncle Sam mine, six miles west of Kennett, has been bonded from Fred Dakin by the Big Seven Con. Gold Mining Co., controlled by F. W. Richards, H. D. Staley, and F. H. Caulke. It is understood that the consideration is $60,000 and that the Big

Seven will probably purchase the mine. A 10-stamp mill was recently erected and contracts have been signed for the delivery of electric power. Developments will commence at once. F. W. Richards is superintendent. The Square Deal Co. is arranging for the erection of a mill at the Clipper mine, where recent development has been satisfactory. The Noble Electric Steel Co. has resumed smelting at Heroult. About 15 to 20 tons of pig iron is being produced daily, at a cost of about $14 per ton. As soon as materials arrive from the East, the construction of five new furnaces will be commenced. The company has opened deposits of ore in its iron and chrome mines during the past few months. At the Gladstone the mill is running and a force of men is employed. The shaft is down 1700 ft. with good ore showing in the lower levels. At the Evening Star arrangements are being made for operating more extensively. This property recently passed into the hands of a German syndicate. George Bayha is manager.

Redding, January 7.

The United States S. R. & M. Co. is operating three copper furnaces at its Kennett plant, the fume and smoke from which are passed through the bag-house, in which most of the elements that would be harmful to vegetation are being precipitated.

SIERRA COUNTY

The Sovereign Mines Co. has opened the Nevada vein by driving a 661-ft. cross-cut; the depth at which the vein was tapped gives 350 ft. of stoping ground above that level. This vein has a width of 5 ft., the ore assaying $15.50 to $40 per ton. Ore-bins and other buildings are to be erected. F. O. Richardson, of Downieville, is the company's manager.

SISKIYOU COUNTY

The Scott Bar Hydraulic M. Co. has been incorporated to take over and operate several placer mines in this county. Los Angeles men are concerned in the company.

COLORADO

The metal production of Colorado for 1909 and 1910 is given below. The figures for 1909 were supplied by the State Bureau of Mines; those for 1910 are estimates based on data of the United States Mint, the A. S. & R. Co., Ohio & Colorado S. & R. Co., and Empire Zinc Co. The figures on tungsten are those of John R. Wood of the Boulder County Metal Mining Association:

1909—Gold, 1,061,663 oz., $21,946,684; Silver, 8,908,046 oz., $4,587,643; Lead, 64,720,646 lb., $2,765,512; Zinc, 41,728,107 lb., $2,295,046; Copper, 10,087,950 lb., $1,220,642; Tungsten, 1100 tons, $396,000; total value for 1909, $33,211,527.

1910—Gold, 982,581 oz., $20,311,944; Silver, 8,592,350 oz., $4,590,244; Lead, 74,966,344 lb., $3,365,989; Zinc, 62,651,021 lb., $3,376,890; Copper, 8,408,963 lb., $1,062,051; Tungsten, 1535 tons, $736,800; total value for 1910, $33,443,918.

CLEAR CREEK COUNTY

(Special Correspondence.)—Work has been resumed on the Edgarine mine, Seaton mountain. The shaft, now down 40 ft., is to be sunk 100 ft. deeper. The vein contains a streak of ore, samples of which assay $300 per ton. W. T. Chappell, owner of the Standard group of claims on Fall river, is developing the property. The Miller adit is being driven to intersect the veins. Owing to scarcity of water the mill has been closed down for the winter. Development is in progress at the Shafter mine on Believue, and shipments of both smelting and concentrating ore are being made. A. H. Rolier, of Idaho Springs, is manager. Ore is being shipped from the Humboldt mine, the adit in which is being driven. K. Seeman is manager. C. Howard has resumed work on the Ohio property, Kelso mountain. An 8-in. streak of galena is showing in the heading of the adit that mills $62 per ton in silver and lead. The production of upper Clear Creek district for 1910 amounted to $462,000, a gain of 30% over the previous year. The lower end of the county, near Idaho Springs, produced $1,250,000. Work will be resumed on the Charter-Raton property, Breckenridge mountain.

Georgetown, December 28.

GILPIN COUNTY

(Special Correspondence.)—Shipments of both mill and smelting ore are being kept up from the National mine. Shipments have been started at the Cashier, by Lampshire & Co. The ore is high grade, containing 4.72 oz. gold per ton. Work has been resumed on the Single Jack property by Stewart & Co., who are driving to intersect the series of veins. Heavy shipments are being sent out from the Perigo mine, operated by J. E. Lightbourn. A 6-in. streak of ore found in the Baker property, Quartz hill, assayed $80 per ton in gold and silver. The Lone Star mine, in Phoenix district, is shipping ore that samples $70 per ton in gold and silver. In the adit being driven on the San Juan vein a cross-lode has just been intersected that has a width of 12 ft. between walls.

Central City, January 6.

LAKE COUNTY

The 1910 metal production of Leadville, as compiled by the *Carbonate Chronicle*, was as follows: gold, 53,847 oz., $1,113,017; silver, 3,365,579 oz., $1,799,575; lead, 21,395,481 lb., $960,657; copper, 4,808,586 lb., $607,324; spelter, 47,381,760 lb., $2,553,876; total value of output, $7,034,450. The classification and amount of ore from which the metals were extracted are as follows: carbonate of lead, 14,369 tons; oxidized iron, 73,745; sulphide of lead and iron, 273,829; zinc sulphide, 82,608; zinc carbonate, 10,139; siliceous ore, 34,008 tons; a total of 488,694 tons.

One of the latest projects of the Leadville district is the driving of a deep tunnel from California gulch to Iowa gulch for the purpose of opening the Lillian ore-shoot. Driving on this adit has been in progress during the past year under direction of C. J. Hersey. The London mine, situated on the Mosquito range, east of Leadville, above timber-line, ten miles from Fairplay, has been operated most of the time during the last thirty years. It contains a vein of ore averaging about 3 oz. gold per ton. The mine has been under lease for some time to J. M. Kuhn, who recently secured an extension of his lease. Ore mined in the past was taken from stopes on and above the lowest adit-level, but now that the workings extend by winzes below this level the operations are hindered by a large volume of water. It is now proposed to drive a cross-cut which is to intersect the vein 600 ft. lower than the present deepest workings, thereby draining the mine and gaining access to stoping ground above that level.

PARK COUNTY

The Colorado Smelting Co., operating a 240-ton smelting furnace at Alma, has treated a considerable tonnage of ore that had accumulated on the dumps of various mines of that section, as well as ore being mined now. The product of the plant is a matte that is marketed. A force of 100 men is employed by the company at its smelter and mines.

SUMMIT COUNTY

Summit county's metal production for 1910, as compiled by R. J. A. Widmar, of Breckenridge, was as follows: gold recovered by three dredges, $612,476; gold nuggets and specimens, $17,588; gold from smelting ore, $86,400; silver $112,500; zinc, $128,607; lead, $117,630; iron as flux, $15,500; copper, $3127; aggregate value of output, $1,093,828.

TELLER COUNTY

Cripple Creek's output of gold ore for December 1910 was 74,240 tons, the value of the bullion extracted therefrom being $1,400,000. The ore mined and treated during 1910 amounted to 754,941 tons, the gold bullion extracted amounting to $15,835,937. The profits that accrued to company and individual operators, including lessees and lessors, are estimated at $2,100,000 for the year.

IDAHO

SHOSHONE COUNTY

The Stewart Mining Co., controlled by F. A. Heinze and associates, is mining 300 tons of ore per day at the Stewart

mine, situated in Wardner district. The ore is concentrated in a leased mill at Wallace. It is stated that the company's indebtedness has been reduced from $185,000 to $93,000 during the last half of the year, the payments having been from mine proceeds. The Snowstorm Mining Co., operating the Snowstorm mine at Larson, three miles from Mullan, is reported shipping 100 tons of ore per day, and the mine force has been increased. The most interesting development is on the level of No. 4 adit, which is intended to cut the orebodies several hundred feet below the main workings. The Copper King group, situated near Mullan, is being further developed by an adit which has been driven 3400 ft., by which the lead-silver vein is to be opened 1000 ft. below the former workings. H. W. Ingalls is in charge of this work.

NEZ PERCE COUNTY

The Wild Rose mine, near Pierce, owned by the Ozark M. & M. Co., has produced about $1,000,000 in gold since 1905. It is given out that a 200-ton concentrating and cyanide mill will be erected and put in operation by next August, to treat ore from both the Wild Rose anad Ozark mines. George S. Bailey, Joseph A. Muir, J. H. Bethel, and A. J. Parker are active in the control of the property. In developing the property a cross-cut, driven 1319 ft., intersected nine veins, the last being 32 ft. wide at a depth of 576 ft. A 16-in. streak of ore on the foot-wall assays from $20 to $140 in gold per ton. The body of the vein averages $9.40. The ore consists of white quartz, containing some petzite.

NEVADA

CLARK COUNTY

The Quartette mine, situated at Searchlight, has been in operation twelve years and has produced $2,500,000. It is opened by two shafts, 700 ft. apart; one of these, 900 ft. deep, serves only as an air-shaft; the other is a 1300-ft. incline and serves as the main working shaft, in which ore-skips are operated by a 60-hp. distillate hoisting engine of Fairbanks-Morse manufacture. There are nearly five miles of workings, and these are confined to one fissure vein in porphyritic andesite. In the main, the ores are gold-bearing and free-milling; on the hanging wall side of the vein are some lenses of chrysocolla, also some carbonate and sulphide of copper and lead, containing gold and silver. The copper and lead ores are hand-sorted and shipped to the smelters. The gold and silver ores are treated in the 40-stamp mill, and the metals recovered by amalgamation and cyanidation. According to official information supplied by the company the average heads of all ore milled since the Quartette company began operating was $16.45 per ton; the average value of ore shipped to smelters was $80 per ton. The cyanide plant has been operated to some extent on former mill-tailing, which, added to current tailing, brings the leaching heads up to $3.30 per ton. The stamp-milling cost is given at $1 per ton, that of cyaniding being $1.63; the high cost of the latter was due to the presence of copper in the tailing. This figure was only attained by the cyanide regeneration process as developed by R. P. Wheelock. Shipments of zinc ore from the Potosi mine at Good Springs are being made to St. Louis. J. B. Jensen is the purchaser, who has a contract with the Potosi people for the output of the mine, up to 500 tons per month. The ore-wagons are drawn by traction engines. A concentrating mill is being built at the Yellow Pine mine; some custom ore is to be treated, also, as soon as the plant is finished. The Yellow Pine has large bodies of zinc-lead ore, which have been opened to a depth of 500 feet.

NYE COUNTY

The ore-production of seven Tonopah mines for the week ended December 17 aggregated 8278 tons, of an estimated value of $206,950. The Tonopah company shipped 3500 tons; the Belmont, 2000; Montana-Tonopah, 1028; MacNamara, 320; West End, 400; Tonopah Extension, 980; Midway, 50 tons. The tonnage for each of the succeeding two weeks was practically the same. The Tonopah-Belmont Development Co., now in the ascendant among Tonopah operators, made a profit of $127,032.89 for the month of November. During that month this company mined 7615 tons of ore, of which 1531 tons was shipped to the smelters, and 6084 tons was milled at the company's plant. There was extracted from this, 3223.06 oz. gold, and 332,176.27 oz. silver; gross value of output, $241,188.04. The electric hoist and air-compressor at the new Belmont shaft are in use and the centre of mine operations has been transferred from the old Desert Queen shaft to the Belmont. The new shaft has a depth of about 1200 ft., and the intention is to sink farther. The Tonopah Extension M. Co. produced bullion and concentrate of the value of $22,000 during the first half of December. At the Desert mill of the Tonopah M. Co., 3362 tons of ore was crushed during the week ended December 16, the value of the ore averaging $24.34 per ton. Bullion shipped from this mill for the same week was valued at $45,078.79; besides, 40 tons of concentrate, valued at $20,072.78, was marketed. For the week ended December 31, this company milled 3350 tons of ore that averaged $24.50 per ton, and bullion shipments for the week amounted to $100,000. The *Tonopah Miner* of December 31, 1910, reports the ore-production of the district for the year at 362,898 tons, of an estimated value of $25 per ton, making a total of $9,072,325. Of this sum $2,721,696 was for gold, and $6,350,629 was for silver.

STOREY COUNTY

A Starrett pump, manufactured by the Starrett Pump Co. at Salt Lake, has been installed and put in operation at the 2450-ft. station of the C. & C. shaft at Virginia City, raising

Map of Central Nevada.

600 gal. of water per minute to the 2150-ft. station, a height of 300 ft. The water discharged at the latter station is lifted to the Sutro drainage level by Reidler pumps. A 4-stage turbine pump, of the Byron Jackson make, is being installed at the 2350-ft. station to replace other pumps that require repairing. The east cross-cut on the 1650-ft. level of the Con. Virginia workings is being retimbered and the stoping ground is being sampled. For the week ended December 24 the production of the Ophir was $15,706.45, and that of the Con. Virginia was $2399.40. The 185 mine-cars of ore taken from the Ophir had an average value of $84.89 per ton, the richer ore being taken from the Hardy vein. The 239 mine-cars taken from the Con. Virginia averaged $9.74 per ton. The Yellow Jacket mill crushed 865 tons of ore for the week, 548 tons having been received from the Yellow Jacket mine, and 316 tons from the Crown Point. The best ore from the former was mined on the 1400-ft. level; development work at this mine has been suspended for the present, awaiting pumping facilities to be supplied at the Ward. Of the Crown Point ore, 60 mine-cars assayed $8.88 per ton; 285 cars averaged $3.63; and 12 cars contained $5.60 per ton. The Belcher output consisted of 116 mine-cars, averaging $5.75; 106 cars, $7.84; 64 cars averag-

ing $3.25 per ton. Whitman Symmes, superintendent for the Mexican G. & S. M. Co., reports for the year ended October 30, 1910, having sunk a two-compartment winze 276 ft. to a point 12 ft. below the 2500-ft. level; also that east cross-cuts were driven on the 2400 and 2500-ft. levels at a speed of 50 ft. per week for several weeks; similar cross-cutting is reported having been done on the 2100, 2200, 2300, 2400, and 2500-ft. levels, with a considerable amount of driving in ore. This development resulted in exposing an additional supply of ore. Development work for the year aggregated 3870 ft.; ore shipped to the Charles Butters Co. mill, between August 25 and October 30, amounted to 2206 tons of the value of $43,564.15. The exploration work performed below the 2000-ft. level has been in the southern part of the mine, but the intention now is to extend such work into the northern part. The water-level is now at 2500 ft. in the Mexican mine, but as soon as the old drifts of the Con. Virginia and Ophir are opened it will be feasible to unwater the joint Ophir-Mexican winzes from the 2500 to the 2900-ft. level. The operating expenses of the Mexican company for the year were paid out of funds derived from the sale of ore mined.

NEW MEXICO

GRANT COUNTY

The concentrating mill of the Chino Copper Co., being erected at Hurley, nine miles from the Chino mines, doubtless will be ready to operate by July 1. The steel building is to be finished by February 1. In the meantime five steam-shovels are being kept operating at the mine removing overburden to expose the orebody. The first shipment of zinc ore was made in December by George H. Utter from Cleveland mines in Pinos Altos district, six miles from Silver City. The ore was shipped to Canon City, Colorado. Other shipments are being made to the various zinc-ore markets.

SOCORRO COUNTY

(Special Correspondence.)—The Socorro mine and mill, in the Mogollons, operated every day in December except on Christmas. The ore mined and crushed during the month averaged 120 tons per day; the product from this was in the form of silver and gold bars and concentrate. A contract has been let for sinking the 3-compartment shaft 140 ft. deeper. The Ernestine M. Co. produced 5686 oz. silver and gold bullion, and 50 sacks of concentrate for the week ended December 31, from 669 tons of ore. The mill at the Deadwood mines was to have begun operating January 2. The De La Vergne high-compression oil-engine has been thoroughly tried at this mine, the result of which is said to demonstrate that with crude oil laid down at Mogollon and used in this engine, power here will cost less than $150 per horse-power-year, and in this cost is included that of oil, labor, and depreciation. The Gold Dust Mines Co. has finished its office quarters and established telephone lines to Silver City and Mogollon. Its connection shaft has reached a depth of 80 ft., and the east and west drifts from the cross-cut have been advanced 150 ft. on the vein.

Mogollon, January 7.

OREGON

JOSEPHINE COUNTY

(Special Correspondence.)—The Almeda Consolidated Mines Co., operating in Galice district, has over 6000 ft. of development, whereby a strong vein of gold, silver, and copper ore has been opened 1500 ft. on its strike, and to a depth of 500 ft. The mine is opened by adit levels, and by a 500-ft. vertical shaft. The work of tapping the vein by a cross-cut from each 100-ft. station is now in progress. The orebody is made up of three distinct seams: the first containing 15 ft. of first-grade ore, the second having about 35 ft. of second grade, and a third seam of low-grade stuff. The width between the walls is about 100 ft. The ore is a sulphide, and is nearly self-fluxing. The mine is well equipped with gasoline engines, for hoisting and operating an air-compressor and dynamo; also one steam-engine. A plant for semi-pyritic smelting was recently finished. It contains a copper-matting furnace, ore-crusher, elevator, ore-bins of 3000 tons and coke-bins of 500 tons capacity. The installation of a basic-lined converter is contemplated, whereby the matte may be reduced to blister copper. The furnace has not been blown in; and this will not be done until the hard-surface auto-truck road is finished from Galice to Leland, a distance of 15 miles, thus enabling the company to haul in its coke supply at the cost of about $1 per ton. The property is under the management of John F. Wickham.

Galice, January 3.

UTAH

BEAVER COUNTY

The Red Warrior, in Star district, has a new orebody, which was found by driving a cross-cut from the 500-ft. level. Ore is to be stoped from this vein and shipped. It contains lead and silver. The Cedar-Talisman, in the same district, recently marketed two cars of lead-silver ore; besides, the mine has been for some time a producer of zinc ore which is shipped to Oklahoma. Ore being shipped from the Lady Bryan and Hub mines of the Utah M. M. & T. Co. amounts to about 8 cars per month. Much of the output is taken from the 300-ft. level of the former, and contains about 50% iron, 90 oz. silver, and about 6% lead. The shaft, which is more than 300 ft. deep, is expected to cut the vein on its dip at 500 ft. John Thompson has charge of the work. Shipments of ore from the Moscow mine for December amounted to 7 carloads, net returns from which were about $2000 per car. One lot sampled 26% lead, 3.8% copper, and 73 oz. silver per ton. The Moscow M. Co. has paid off its indebtedness of $30,000.

JUAB COUNTY

The Dragon, in Tintic district, is a big producer of iron ore. It is operated through a 960-ft. shaft, which will have reached a depth of 1000 ft. in a short time, after which levels will be driven to the orebody from the 800 and 1000-ft. stations. Ore shipped from this mine during 1910 amounted to 1025 carloads; the only mine in the district exceeding this was the Centennial-Eureka, from which 1630 cars were shipped. The ore shipments sent out from all the mines of the district in 1910 amounted to 7404 cars. A new orebody has been opened at 400-ft. depth in the Lower Mammoth, and two cars of ore taken from this part of the mine were shipped. The directors of the Utah Mine declared a dividend of two cents per share, which was paid December 21. This is the first dividend since February 1909. The mine is at Fish Springs, in the western part of the county.

UTAH COUNTY

A. W. Clemons and associates have developed a 6-ft. body of ozokerite on their claims near Colton. The material is said to contain 30% of this mineral wax. The property is under option to S. V. Shearer.

CENTRAL AMERICA

COSTA RICA

(Special Correspondence.)—The November report of S. F. Shaw, general manager for Montezuma Mines of Costa Rica, gives a detailed account of the month's development on San Rafael, Montezuma, and San Juan veins. It shows a mine production of 2735 tons of ore. There was treated in the mill 3251 tons of ore averaging $9.95 per ton; the mill-tailing assayed $1.26 per ton, the apparent extraction being $8.69 per ton, or 87.2%, and a total of $28,251.29. The consumption of cyanide was 4.34 lb. per ton of ore treated; that of lime, 6.43 lb.; lead acetate, 0.06 lb.; pebbles and lining, 2.31 lb.; zinc, 0.84 lb. Mining costs were $1.38; milling, $1.85; making a total of $3.23 per ton. The estimated profit for the month, based on 2735 tons of ore mined, and 3251 tons milled, was $5.46 per ton, giving $18,430.04. During December the survey was to have been made for the transmission line to the falls of the Barranca Guatusa river where the power plant is to be built. Development progresses at 10 headings.

Montezuma, December 6.

Decisions Relating to Mining

Specially reported for the MINING AND SCIENTIFIC PRESS.

OVERLAPPING CONFLICTING CLAIMS

A discovery shaft which bisected the west end line of a mining claim was sufficient to support a lode location; and a subsequent location which overlapped the west end line and included the discovery would be void, to the extent of the conflict. And in an action to determine the conflicting lode location, the burden was upon the last locator to prove by clear and convincing evidence that the first locator's claim was subject to forfeiture and relocation because of the failure to perform the required representation work.

Tiggeman v. Mrzlak, (Mont.) 105 Pac. 77. Nov. '09.

LOCATION OF MINING CLAIM—RECORDING NOTICE

The recorded notice of a mining claim need only be similar to that posted upon the grounds, and show that the person claims the land described and identified therein; and where a notice recorded was a copy of a posted notice, which was insufficient because it was not posted within the claim, and the fact that a valid notice was subsequently posted, which differed from the first notice only in omitting the name of a witness, but was not again recorded, was said to be immaterial as against subsequent claimants. In other words, a valid notice of location may be posted after the notice is recorded.

Green v. Gavin, (Cal.) 105 Pac. 761. Dec. '09.

RIGHT TO SUE FOR INJURY INCURRED IN MINING

Under the Pennsylvania statute giving the right of action to a person injured for failure to provide for the health and safety of persons employed in and about anthracite mines, and in case of death giving the widow and heirs the right to recover, it was decided that the word 'widow' did not include a non-resident alien widow, and that a widow who was an Italian subject, and was residing in Italy, was not entitled to recover under the statute for the death of her husband in a coal mine in Pennsylvania, notwithstanding such a right might be enforced under the laws of Italy.

Debituila v. Lehigh & Wilkes-Barre Coal Co., 174 Fed. 886. Dec. 1909.

LOCATION OF MINING CLAIM—DECLARATORY STATEMENT

The declaratory statement of the discovery of a lode mining claim sufficiently identifies it, if under any reasonable construction, in view of the surrounding circumstances, the description therein is sufficient to notify a subsequent locator that the particular part of the ground claimed has been located. On this theory a lode mining-claim location was declared void, where the discovery shaft was made within the boundaries of a prior location. The laws of Montana do not require the declaratory statement of a discovery of a lode mining claim to describe the claim by metes and bounds; and where the original monuments have disappeared the calls for distances in the declaratory statement will control over testimony as to the location of the original monuments, and a claim ascertained from bounds clearly fixed by such calls, such as discovery shafts, will prevail over a subsequent conflicting location; and any deviation from the calls in the declaratory statement filed upon the discovery of a lode claim in making a survey, would not prejudice an adverse claimant where such deviation reduced the length of the end lines of the claim where it conflicted with an adverse claim; as the lines of a lode claim could not be so fixed as to include ground not covered by the original location. The fact that a subsequent location overlapped the west end line and included the discovery, would not affect the validity of a prior location, where such location was supported by a discovery shaft which was bisected by the west end line of a claim.

Tiggeman v. Mrzlak, (Mont.) 105 Pac. 77. Nov. '09.

Company Reports

DALY WEST MINING CO.

The Daly West Mining Co., of Park City, Utah, has issued its report for the quarter ended September 30, 1910. The statement shows sales of 3760 tons of concentrate, for $138,789.67; 2302 tons zinc concentrate, for $31,605.53; and 607 tons, miscellaneous shipments, $6767.68; a total of $177,160.88. Other receipts, $9542.75; Little Bell Con. divldend No. 4, $3000, a total of $189,703.63. The cash on hand brought the available funds to $356,084.23. Disbursements were as follows: On general account, $154,969.46; dividend No. 52, $54,000; leaving cash on hand September 30, $147,114.77. Operating expenses for the quarter showed a profit of $34,734.17. Some additional ore was opened on the 1500-ft. level, the 1800-ft. level, and in various raises, but no large amount in any place. The vein was cut on the 1900-ft. level and ore of good grade found, but the shoot was shorter than on levels above.

LUCKY TIGER-COMBINATION GOLD MINING CO.

The Lucky Tiger-Combination Gold Mining Co. has issued a statement, dated December 15, 1910. It shows the payment of dividend No. 29, of $35,750, making a total of $910,000 since August 1908, distributed as follows: In last five months of 1908, $71,500; in 1909, $409,500; in 1910, $429,000. The net profit for the first nine months of 1910 was $444,608.91. Disbursements on account of new mill to December 1, 1910, approximately $175,000. Cash received from sale of ore and concentrate from January 1 to December 1, 1910, $927,009.04. Ore and concentrate in transit to smelter, December 1, 1910, $175,000. Cash from sale of ore and concentrate, December 1 to December 10, 1910, $68,291.18. The mine is reported as looking well. Ore milled during nine months period, ended September 30, 1910, 27,785 tons. Work is progressing rapidly on the new mill which will be completed during the coming spring. The work of building an electric transmission line from Douglas, Arizona, to the mine, a distance of 65 miles, is well under way. The annual statement for 1910 will be issued before the annual meeting march 20, 1911.

NEVADA CON. COPPER CO.

The fourth annual report of the Nevada Con. Copper Co. for the year ended September 30, 1910, has just been issued. It is an elaborate affair, the fine, large illustrations giving a comprehensive idea of the magnitude of mining operations and the methods employed. The report of the president states that, during the year covered by the report, 62,772,342 lb. of copper were produced at a net cost of 6.42c. per lb., or, including the funds set aside for improvements and depreciation, 7.05c. This was accomplished during a severe winter which greatly retarded open-air operations. During July 7,000,000 lb. of copper were produced at a cost of 6c. per lb. The ore reserves have been increased 50% during the year, the increase being estimated at the close of the year at about 14,000,000 tons, with a total available tonnage aggregating 41,000,000 tons. By introduction of improvements in the original plan of the concentration plant the capacity of the metallurgical branch was increased to 8000 tons daily, from 6000 tons as originally expected. During the year 2,237,028 tons of ore were milled and the concentrate, at a ratio of 10.6 to 1, smelted. The percentage of copper recovered was 69.59% of the assay value, a loss of more than 30% between the mine and the copper bars as they came from the converters. The recovery of gold and silver was less than 50% of the assay value, due to the small amount of these metals in the ore. However, the amount of gold and silver actually recovered amounted to 21.14 cents per ton of ore treated. It is expected to reduce the cost of converting somewhat by the introduction of basic-lined converters. All smelting was done in reverberatories, owing to the character of material treated—concentrate.

Personal

Professional men are invited to send news of their engagements and travels. Such news is interesting to friends.

Draper & Gross are now at 745 Equitable building, Denver.

T. Lane Carter, of Chicago, is examining mines in Arizona.

F. E. Youngs, of Seward, Alaska, is at the Palace hotel, San Francisco.

Henry B. Kaeding is now at the Candor mines, Candor, North Carolina.

Russell Yale Hanlon expects to open an office at Manila, Philippine Islands.

L. S. Cates is now mine superintendent for the Ray Consolidated, at Ray, Arizona.

Harold Rickard is now in charge of the laboratory of Sanford C. Prunty, at Guadalajara, Mexico.

N. S. Kelsey, who has been in the Black Hills on examination work, has returned to San Francisco.

E. W. Keith, of the Empire Zinc Co., of Denver, was at the St. Francis, San Francisco, on January 7.

J. Allen Veatch has opened an office as consulting mining engineer at 601 Balboa building, San Francisco.

John Dern, of Salt Lake, president of the American Mining Congress, was at the St. Francis, San Francisco.

J. M. Porter is consulting engineer for the Standard Con. M. Co., whose property is at Silverton, British Columbia.

Regis Chauvenet is spending some time at Mt. Franklin, near El Paso, Texas, where he is interested in a tin mine.

E. A. S. Wittard has gone to the Original Amador mine, at Amador City, California, as assistant to W. Deaner, the manager.

Charles A. Sulzer expects to spend several months in the East. His address will be 649 Madison avenue, Elizabeth, New Jersey.

M. K. Rodgers, of Seattle, visited the Nickel Plate mine, of which he was former manager, at Hedley, British Columbia, last week.

S. E. Bretherton is examining mines near Winthrop, California, and from there will go to Seneca, Plumas county, where he will be until January 22.

Edgar A. Collins, general superintendent for the Montana-Tonopah Mining Co., has opened an office in the First National Bank building, San Francisco.

J. L. Gross, of Draper & Gross, has returned to Denver from Mexico and will shortly leave for the San Juan. Marshall D. Draper has left Denver for California.

D. R. Muir has succeeded L. D. Godshall as manager for the Needles Mining & Smelting Co. Mr. Muir was formerly at the Kennett plant of the United States S. R. & M. Company.

OBITUARY

Robert Forrester, for twenty years identified with coal and metal mining in Utah as an engineer, died at Seattle in December 1910. He was born in Scotland in 1854, was graduated from the University of Edinburgh, and was a member of a number of engineering and scientific societies. He was a resident of Salt Lake, and is known especially for his work in getting together the properties of the Utah Fuel Co. Mr. Forrester was an excellent geologist, and as an operating man was not content with routine, but was constantly engaged in experimental work directed toward greater safety or economy. One of his achievements was that of perfecting a plan for using dynamite, with wood pulp tamping, in coal mining. Contrary to natural expectations accidents and percentage of fine coal were both decreased. He was one of the men who go to prove that a university education does not unfit men for practical work.

Market Reports

LOCAL METAL PRICES.

San Francisco, January 12.

Antimony	12—12¾c	Quicksilver (flask)	41½
Electrolytic Copper	14½—15¾c	Tin	42½—44c
Pig Lead	4.75—5.70c	Spelter	7—7¾c

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

METAL PRICES.

By wire from New York.

Average daily prices in cents per pound.

Date.	Electrolytic Copper.	Lead.	Spelter.	Silver, per oz.
Jan. 5	12.40	4.50	5.51	54½
" 6	12.40	4.50	5.51	54¼
" 7	12.40	4.50	5.51	54¾
" 8	Sunday.	No market.		
" 9	12.38	4.50	5.51	55
" 10	12.38	4.50	5.51	54¼
" 11	12.38	4.50	5.51	54¼

ANGLO-AMERICAN SHARES.

Cabled from London.

	Jan. 4. £ s. d.		Jan. 12. £ s. d.
Camp Bird	1 12 6		1 16 0
El Oro	1 5 6	ex. div.	1 6 3
Esperanza	1 18 6		1 17 3
Dolores	1 5 0		1 5 0
Oroville Dredging	0 6 3		0 6 9
Mexico Mines	7 13 9	ex. div.	7 12 6
Tomboy	0 15 6		0 15 0

(By courtesy of W. P. Bonbright & Co., 24 Broad St., N. Y.)

COPPER SHARES—BOSTON.

	Closing prices, Jan. 12.		Closing prices, Jan. 12.
Adventure	$ 6½	Mohawk	$ 45
Allouez	34	North Butte	27½
Atlantic	4	Old Dominion	38
Calumet & Arizona	45	Osceola	105
Calumet & Hecla	500	Parrot	11¾
Centennial	12¾	Santa Fe	1¼
Copper Range	67	Shannon	11
Daly West	3¾	Superior & Pittsburg	13¾
Franklin	8½	Tamarack	43
Granby	36	Trinity	4
Greene Cananea, ctf	6½	Utah Con	12½
Isle-Royale	14	Victoria	1¾
La Salle	4½	Winona	8½
Mass Copper	7¼	Wolverine	116

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

MINING STOCK QUOTATIONS—NEW YORK.

(By wire from Catlin & Powell Co., New York.)

	Closing prices, Jan. 12.		Closing prices, Jan. 12
Amalgamated Copper	$ 62¾	Miami Copper	$ 19⅜
A. S. & R. Co.	74½	Mines Co. of America	5⅞
Braden Copper	4⅛	Montgomery-Shoshone	1/16
B. C. Copper Co.	6¾	Nevada Con	18⅜
Butte Coalition	17⅞	Nevada Utah	¾
Chino	21¼	Nipissing	10⅛
Davis Daly	1½	Ohio Copper	1⅝
Dolores	6	Ray Central	2
El Rayo	4	Ray Con	17⅝
Ely Central	1/16	South Utah	¾
First National	1⅞	Superior & Pittsburg	13⅝
Giroux	6⅛	Tenn. Copper	32¼
Guanajuato Con	⅛	Trinity	43⅛
Inspiration	8¼	Tuolumne Copper	4
Kerr Lake	6¾	United Copper	4½
La Rose	4⅜	Utah Copper	46
Mason Valley	9⅞	Yukon Gold	3⅞

SOUTHERN NEVADA STOCKS.

San Francisco, January 12.

Atlanta	$ 13	Mayflower	$ 4
Belmont	5.35	Midway	17
Booth	8	Montana Tonopah	85
Columbia Mtn	3	Nevada Hills	2.35
Combination Fraction	17	Pittsburg Silver Peak	90
Fairview Eagle	38	Rawhide Coalition	3
Florence	1.60	Rawhide Queen	—
Goldfield Con	7.35	Round Mountain	42
Gold Kewenaw	7	Silver Pick	7
Great Bend	2	St. Ives	16
Jim Butler	25	Tonopah Extension	85
Jumbo Extension	25	Tonopah of Nevada	7.95
MacNamara	19	West End	5

(By courtesy of San Francisco Stock Exchange.)

OIL DIVIDENDS FOR DECEMBER, 1910.

From the Official Monthly Statement of Oil Securities of the San Francisco Stock Exchange.

Company.	Capital.	Shares issued.	Par value.	Acreage.	Location.	Dividend. Last date.	Amount per share.	Total to date.
Alma Oil Co	$400,000	380,000	$1.00	120	Kern River	12 15 '10	$ 3	$193,800.00
Amalgamated Oil Co	5,000,000	50,000	100.00	*	Salt Lake Field, L. A.	9 15 '10	1.00	1,600,000.00
Amer. Petroleum (pfd.)	2,500,000	25,000	1.00	*	Coalinga and Sherman	12 1 '10	66	308,670.60
Am. Petroleum (com.)	.....	.....	....	....	.....	12 1 '10	66	1,718,607.10
Apollo	500,000	200,000	2.50	40	Kern River	3 20 '10	1	4,000.00
Associated Oil Stock	40,000,000	400,000	100.00	*	Kern, Coalinga, McKittrick.	3 1 '07	1.50	1,548,368.54
Associated Oil Bonds 5s.	3,006,000	.....	....	*	Kern, Coalinga, McKittrick.	.....	....	.....
Bay City	500,000	100,000	5.00	200	Midway	10 15 '10	10	155,000.00
Blue Moon	200,000	189,759	1.00	20	Coalinga	.....	....	.....
Brookshire	500,000	500,000	1.00	933	Santa Maria and Midway	1 1 '10	1	442,500.00
California Midway	1,000,000	922,800	1.00	160	Midway	.....	....	.....
California Oil & Gas	1,000,000	900,000	1.00	80	Coalinga	.....	....	.....
Caribou Oil & Mining Co.	100,000	80,703	1.00	100	Coalinga	12 15 '10	2½	882,113.49
Chicago Crude	1,000,000	1,000,000	1.00	100	Kern	3 25 '07	0½	15,000.00
Claremont	500,000	500,000	1.00	280	Kern and Coalinga	12 28 '10	2	415,000.00
Coalinga Central	500,000	450,000	1.00	120	Coalinga	.....	....	.....
Coalinga Pacific	165,000	65,000	1.00	40	Coalinga	12 23 '09	10	107,250.00
Columbia	1,000,000	999,226	1.00	*	Fullerton and Whittier	12 25 '10	½-½	454,730.45
Cresceus	320,000	320,000	1.00	40	Midway	.....	....	.....
Dabney	1,000,000	1,000,000	1.00	120	Midway	.....	....	.....
Del Rey	1,000,000	785,490	1.00	40	Kern River	9 1 '10	0½	19,637.50
De Luxe	100,000	100,000	1.00	40	Coalinga	.....	....	.....
Eldorado	100,000	100,000	1.00	10	Kern River	8 31 '10	1	.....
Empire	200,000	200,000	1.00	80	Coalinga	12 31 '10	1	16,000.00
Enos	500,000	358,500	1.00	220	Kern and Santa Barbara	.....	....	.....
Esperanze	160,000	160,000	1.00	170	Coalinga	12 27 '09	9	49,450.00
Euclid	350,000	350,000	1.00	10	Kern and Coalinga	8 1 '10	1	141,500.00
Four Oil	300,000	300,000	1.00	20	Kern and Coalinga	2 25 '10	1	213,000.00
Fulton	1,000,000	100,000	10.00	120	Sunset	.....	....	.....
Globe	600,000	600,000	1.00	20	Kern River	10 1 '10	1	93,000.00
Graciosa	1,000,000	1,000,000	1.00	*	Santa Maria	.....	....	.....
Home	100,000	100,000	1.00	140	Coalinga	12 20 '10	2	492,000.00
Homestake	100,000	10,000	10.00	160	Coalinga	12 13 '10	10	81,250.00
Illinois Crude	200,000	200,000	1.00	10	Kern River	6 1 '10	1	94,000.00
Imperial	500,000	100,000	5.00	2,480	Kern and Coalinga	7 18 '10	8.00	4,000,000.00
Junction	250,000	250,000	1.00	80	Kern River	6 1 '09	1	20,000.00
Kern River	100,000	20,000	5.00	80	Kern River	12 1 '10	10	118,000.00
Linda Vista	.....	385,850	....	20	Kern River	10 19 '10	1	84,447.00
Lucile	50,000	26,704	1.00	40	Coalinga	12 20 '09	10	42,727.04
Mascot	500,000	500,000	1.00	225	Midway	12 20 '10	4	100,000.00
McKittrick	500,000	500,000	1.00	1,200	McKittrick	.....	....	.....
Mecca	500,000	422,500	1.00	120	Kern River	7 15 '09	3	71,825.00
Midway of Oregon	1,000,000	1,000,000	1.00	640	Midway	.....	....	.....
Monte Cristo	500,000	500,000	1.00	80	Kern and Maricopa	12 20 '10	10	840,000.00
Mountain Girl	350,000	350,000	1.00	*	Midway	8 4 '10	2	7,000.00
Mexican Petroleum	50,000,000	10,000,000	5.00	*	Mexico	12 1 '10	1⅓	3,762,578.97
M. & M.	1,000,000	1,000,000	1.00	140	Maricopa	.....	....	.....
Nevada County	250,000	250,000	1.00	30	Kern River	10 13 '08	4	40,000.00
New Penn. Petroleum	500,000	500,000	1.00	147	Santa Maria	12 15 '10	1	32,500.00
Palmer	2,000,000	1,802,010	1.00	880	Santa Maria	12 25 '10	1	412,541.50
Paraffine	300,000	300,000	1.00	40	Midway	12 15 '10	1	42,000.00
Peerless	1,000,000	100,000	10.00	160	Kern River	9 20 '09	6	801,000.00
Piedmont	500,000	389,000	1.00	10	Kern River	5 9 '10	1	26,877.30
Pinal	200,000	150,000	1.00	*	Santa Maria	12 30 '10	10	1,615,827.50
Premier	1,000,000	1,000,000	1.00	160	Coalinga	7 20 '10	1	40,000.00
Producers	500,000	80,000	5.00	600	Midway	9 22 '10	60	120,000.00
Radium	250,000	250,000	1.00	*	Santa Maria	.....	....	.....
Record	200,000	100,000	2.00	40	Coalinga	12 15 '10	7½	122,500.00
Republic	600,000	500,000	1.00	80	Coalinga	.....	....	.....
Rice Ranch	300,000	300,000	1.00	40	Santa Maria	10 10 '10	3	117,000.00
Rico	100,000	100,000	1.00	60	Midway	.....	....	.....
Royalty	20,000	20,000	1.00	20	McKittrick	9 20 '10	33⅓	29,400.00
S. F. & McKittrick	500,000	60,000	10.00	151	McKittrick	11 1 '10	30	460,000.00
Sauer Dough	100,000	199,500	0.50	270	Coalinga and McKittrick	12 21 '10	3	569,175.50
Section 7	400,000	400,000	1.00	65	Coalinga	.....	....	.....
Section 25	40,000	40,000	1.00	290	Midway	8 26 '10	25	60,000.00
Sesnon	100,000	100,000	1.00	35	Kern River	11 6 '10	5	157,000.00
Shawmut	500,000	500,000	1.00	*	Coalinga	.....	....	.....
Silver Tip	75,000	75,000	1.00	20	Coalinga	2 25 '10	10	30,000.00
Sovereign	500,000	500,000	1.00	20	Kern River	9 1 '10	1	100,000.00
S. W. & B.	400,000	377,000	1.00	40	Coalinga	9 10 '09	1	41,470.00
State	100,000	100,000	1.00	20	McKittrick	.....	....	.....
Sterling	250,000	250,000	1.00	160	McKittrick and Kern	3 15 '10	12½	776,250.00
Sunset Monarch	500,000	497,241	1.00	*	Sunset and Midway	.....	....	.....
Superior	500,000	500,000	1.00	40	Sunset	12 26 '10	1	67,500.00
Thirty-Three	500,000	100,000	5.00	160	Kern River	8 6 '10	4.00	1,090,000.00
Traders	1,500,000	15,000	100.00	410	Kern, Coalinga and Midway	5 15 '10	1.00	209,146.50
Turner	500,000	500,000	1.00	320	Coalinga	.....	....	.....
United	.....	80,751	....	*	Controls Union	12 20 '10	50	2,542,339.43
United Oil	2,000,000	1,283,131	1.00	1,010	Midway	12 10 '10	1	85,755.17
Union	50,000,000	249,626	100.00	*	All Fields of State	12 20 '10	50	7,491,612.15
Wabash	500,000	300,000	1.00	80	Coalinga	10 19 '10	1.00	489,000.00
West Coast (com.)	2,500,000	10,408	100.00	*	Los Angeles	.....	....	.....
West Coast (pfd.)	2,500,000	10,408	100.00	*	Los Angeles	9 1 '10	2.00	124,896.00
West Shore	100,000	100,000	1.00	80	Kern River	12 21 '08	5	235,000.00
Western Union	1,000,000	10,000	100.00	10,000	Santa Maria	4 15 '07	2.00	484,951.00
Hanford	.....	1,000,000	....	....	.....	1 30 '06	22	80,000.00
Kern Oil	.....	.....	.....	.....	.....	11 19 '09	24½	42,000.00
Pittsburg	.....	.....	.....	.....	.....	11 11 '07	42½	121,800.00
Reed Crude	.....	.....	.....	.....	.....	5 31 '10	....	1,167,500.00

Total dividends for December 1910, $539,580.70; total to date, $37,398,276.92. *Information unobtainable.

LEAD AND ZINC PRODUCTION OF THE JOPLIN DISTRICT IN 1910

Camps.	Blende—Pounds.	Blende—Value.	Calamine—Pounds.	Calamine—Value.	Lead—Pounds.	Lead—Value.	Total Value.
Webb City-Carterville, Mo...	215,713,555	$4,515,466	.....	.....	47,716,005	$1,258,799	$5,824,265
Joplin, Mo.	98,758,190	2,075,844	3,573,690	$42,744	14,426,465	379,608	2,498,196
Duenweg, Mo.	37,999,160	780,960	6,413,180	85,543	5,761,160	149,293	1,015,796
Galena, Kan.	38,589,230	801,557	287,220	3,364	4,136,710	108,729	913,650
Alba-Neck City, Mo.....	37,168,990	805,190	87,040	1,076	403,150	10,439	816,705
Miami, Okla.	20,311,390	332,250	.....	.....	6,775,025	176,489	508,739
Granby, Mo.	10,692,790	194,424	1 ,217,190	250,474	826,000	19,739	464,637
Oronogo, Mo.	16,828,545	347,059	.....	.....	2,576,050	70,828	417,887
Spring City, Mo.....	4,900,480	99,436	8,375,000	106,068	3,818,980	98,617	304,121
Badger, Kan.	12,982,930	273,589	.....	.....	925,630	25,673	299,362
Aurora, Mo.	8,368,320	171,379	6,615,475	79,642	454,475	11,530	262,551
Carthage, Mo.	11,111,170	238,611	349,450	4,288	36,620	866	243,765
Quapaw, Okla.	7,937,720	167,068	.....	.....	443,420	11,109	178,177
Cari Junction, Mo.....	6,680,480	143,210	.....	.....	48,370	1,151	144,361
Zincite, Mo.	6,314,860	133,829	.....	.....	242,880	6,212	140,041
Sarcoxie, Mo.	4,721,820	97,256	2,500,065	32,370	29,770	817	130,443
Cave Springs, Mo.....	3,511,500	73,124	.....	.....	18,370	408	73,532
Stotts City, Mo.....	1,678,855	35,444	.....	.....	30,320	780	36,224
Reeds, Mo.	681,490	13,781	173,670	2,146	.....	.....	15,927
Wentworth, Mo.	166,540	3,577	226,080	2,720	.....	.....	6,297
Seneca, Mo.	.....	.....	108,250	1,331	124,650	3,383	4,714
Greenfield, Mo.	.....	.....	273,710	3,325	37,000	962	4,287
Peoria, Okla.	.....	.....	111,320	1,228	.....	.....	1,228
Springfield, Mo.	10,510	210	.....	.....	.....	.....	210
Total shipments	545,129,025	$11,303,264	48,211,340	$616,319	88,831,050	$2,335,432	$14,255,015
Surplus in bins.....	9,000,000	180,000	2,400,000	27,600	2,100,000	58,800	266,400
Total production	554,129,025	$11,483,264	50,611,340	$643,919	90,931,050	$2,394,232	$14,521,415
Production in 1909.....	545,047,155	11,503,099	57,362,185	689,671	88,371,975	2,430,878	14,615,048

CURRENT PRICES FOR ORES AND MINERALS

(Corrected monthly by Atkins, Kroll & Co.)

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

	Min.	Max.
Antimony ore, 50%, per ton	*$20.00	$25.00
Arsenic, white, refined, per lb	0.02½	0.03
Arsenic, red, refined, per lb	0.07	0.08
Asbestos, according to length and quality of fibre, per ton	100.00	350.00
Asbestos, lower grades, per ton	10.00	100.00
Asphaltum, refined, per ton	15.00	20.00
Barium carbonate, precipitated, per ton	42.50	45.00
Barium chloride, commercial, per ton	42.50	47.50
Barium sulphate (barytes), prepared, ton	20.00	30.00
Bismuth ore, 10% upward, per ton	*75.00	upward
Chrome ore, according to quality, per ton	10.00	15.00
China clay, per ton	15.00	20.00
Cobalt metal, refined, f.o.b. London, per lb	2.50	
Coke, foundry, per 2240 lb	15.00	17.50
Diamonds:		
Borts, according to size and quality, per carat	2.00	15.00
Carbons, according to size and quality, per carat	75.00	100.00
Feldspar, per ton	5.00	25.00
Firebrick:		
Bauxite, per M	175.00	200.00
Magnesite, per M	200.00	250.00
Silica, per M	47.50	
Flint pebbles for tube-mills, per 2240 lb	15.00	25.00
Fluorspar, per ton	10.00	15.00
Fullers earth, according to quality, per ton	20.00	30.00
Gilsonite, per ton	32.50	45.00
Graphite:		
Amorphous, per lb	0.01	0.02½
Crystalline, per lb	0.04	0.13
Gypsum, per ton	7.50	10.00
Infusorial earth, per ton	10.00	15.00
Magnesite, crude, per ton	7.50	10.00
Magnesite, dead calcined, per ton	22.50	27.50
Magnesite, brick (see firebrick).		
Manganese ore, oxide, crude, per ton	10.00	25.00
Manganese, prepared, according to quality, per ton	40.00	120.00
Mica, according to size and quality, per lb	0.05	0.30
Molybdenite, 95% MoS_2, per ton	400.00	500.00
Monazite sand (5% thoria), per ton	150.00	200.00
Nickel metal, refined, per lb	0.45	0.60
Ochre, extra strength, levigated, per lb	0.02½	0.03½
Platinum, native, crude, per oz	*20.00	25.00
Scheelite (see tungsten ore).		
Sulphur, crude, per ton	15.00	25.00
Talc, prepared, according to quality, per ton	20.00	50.00
Tin ore, 70%, per ton	*400.00	450.00
Tungsten ore, 65%, per ton	500.00	550.00
Vanadium ore, 15%, per ton	*100.00	125.00
Wolframite (see tungsten ore).		
Zinc ore, 50% up, per ton	*15.00	20.00

COMMERCIAL PARAGRAPHS

H. G. Peake, for the past six years chief engineer for the Yuba Construction Co. and the Boston Machine Shop Co., and for three years previous to that time with the draughting department of The Bucyrus Co. at South Milwaukee, has entered into partnership with W. W. Johnson to engage in the designing and building of placer mining dredges. Mr. Johnson was formerly one of the owners of the Northern Dredge Building & Construction Co. and designed and built three dredges in Alaska last season. These dredges were built for the Sioux-Alaska Mining Co., The Arctic Gold Dredging Co., and the Alaska Gold Dredging Co. He has been engaged in the designing and building of dredges for the past five years. The firm name will be the Union Construction Co. and offices have been opened at 604 Mission street, San Francisco.

In the Portland Canal district the Red Cliff mine has put in a 250-hp. steam and compressor plant, and found the ore continuation. It now looks like a good mine. The Portland Canal Mining Co. put in a 20-drill compressor, and a new concentrator. It is probable that next year will prove these and the Stewart mine. A vast amount of prospecting and preliminary work was done in the district. The Ikeda mine, Moresby Island, has been acquired by Vancouver capitalists and a company organized with a capital of $850,000 to work it. The Babine-Bonanza Mining Co. has proved that it has a mine in its Dibble group of six claims in the Babine mountains. A tunnel was driven under the ore for 1000 ft., proving it to a depth of 275 ft. Work has ceased pending the arrival of the G. T. P. railway.

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EDITORIAL

APPOINTMENT of Mr. Frank W. DeWolf to the position of Director of the State Geological Survey of Illinois is announced. Mr. DeWolf has served as assistant geologist on the United States Geological Survey and as geologist and Acting Director of the Illinois Survey. His new appointment comes as a well-merited recognition of good work.

COPPER prices seem trembling in the balance. It is said that the American Smelting & Refining Company has been accumulating metal for two months and is likely to adopt the practice of the United Metals Selling Company of alternately holding back and deluging the market. Until recently copper was sold at market prices as fast as produced.

FOREIGN copper production in 1910 can not be accurately stated as yet, but according to estimates made by L. Vogelstein & Company, the world's production in 1910 was 865,000 long tons, compared with 844,100 in 1909. The consumption is estimated at 908,565 long tons of which America took 334,565, Germany 218,000, England 138,000, and France 91,000.

THE miners of the Pacific Coast States, as well as the agriculturalists are rejoicing at the liberal rain and snowfall of the past week. Unless there are abundant early snows in the Sierra Nevada, there is always a water shortage the following summer. It often occurs, however, that the rains are late in arriving, the greater part of the rain and snowfall coming after the first of the year.

ALASKA and the coal-land laws of that territory have been much discussed at Washington in the last year. As a result of a conference held at the White House January 12, a series of bills has been introduced in Congress by Mr. Knute Nelson, of Minnesota, opening the land to prospectors and providing for the granting of leases in blocks not exceeding 3200 acres. Details of these bills will be printed later.

GOLDFIELD CONSOLIDATED made a good showing at the annual meeting held at Evanston, Wyoming, January 9. The report for the fiscal year, which ended October 31, 1910, showed that 266,867 tons of ore of an average value of $40.72 per ton had been produced. This gave a gross production of $10,866,752, on which the net operating profits were $7,347,691. Dividends to the amount of $7,118,271 were paid.

ANNOUNCEMENT that the Western Engineering & Construction Company has been absorbed by the Yuba Construction Company marks the passing of one of the pioneer firms of gold-dredge constructors. Mr. F. W. Griffin and D. P. Cameron, first as a firm and later as the Western Engineering & Construction Company, built some of the first of the heavy boats at Oroville, California. From them came the 'California' type of dredges which, as distinguished from the 'New Zealand' type first introduced, are marked by heavy construction, and it is this that makes possible deep digging and high capacity. The Western Engineering & Construction Company introduced many of the features that are now common to all good dredges.

PHOSPHATE rock has been discovered in Montana as a result of work done by Mr. Hoyt S. Gale, of the United States Geological Survey. It seems probable that the field, which has been withdrawn from entry and is to be examined in detail, will prove to be large, and enough has been done to prove that the deposits are of good thickness and grade. The discovery was made by Mr. Gale in the course of land-classification work, and is more notable in that phosphate rock is not easily recognized and has previously been discovered by accident rather than as a result of careful scientific examination. Many Western phosphate beds were first prospected for coal; a mistake due to their bedded character and black color. In Tennessee the nature of the white phosphates was long unsuspected both by prospectors and engineers. In this case the geologists are ahead.

A VERY natural desire of mine managers is to be able to present a low cost-sheet for the inspection of their directors and stockholders, and incidentally for the illumination of the public at large, particularly the investing public. This ambition not infrequently leads to the careless or studied omission of important items of cost, which, if included, would radically change the tonnage cost. Such matters as the cost of power or of hoisting in mining certainly are proper entries in the mine cost-sheet, if power be employed. Then, too, there is sometimes a failure to distribute labor costs among the several departments, so that it is difficult to tell what proportion of the whole to charge to any particular portion of the mine. Some mine accountants fail to keep segregated costs of any kind, 'lumping' everything under operating cost. A cost-sheet need not necessarily be carried so far in its details as to render it absurd, as is sometimes done. It should, however, show the whole cost, with no omissions, and with a rational segregation of the cost of the various operations of mining so arranged that any business-man can find in it the information he seeks, without the assistance of an expert accountant to explain to him how it is that two and two do not make four, but something else. The suggestion made on another page by Mr. L. A. Whittaker, that a model 'Book of Accounts' be compiled for mines similar to that issued by the Interstate Commerce Commission for railroads, is in line with a resolution adopted by the San Francisco section of the Mining and Metallurgical Society last winter. The U. S. Bureau of Mines would be a proper agency for making the compilation. While under present laws the use of any single system could not be enforced, it would at least be helpful.

PETROLEUM production in the United States in 1910, according to preliminary figures collected by Mr. David T. Day, of the United States Geological Survey, amounted to 204,000,000 barrels. California led with an output of 73,000,000 barrels, a gain of more than 18,000,000 over 1909, nearly twice the remarkable increase of that year over 1908. The Mid-Continent field again ranked second, with an output, including the small amount of oil produced in the Rocky Mountain States, of 53,000,000. Illinois stayed in third place with 32,000,000 barrels to its credit, an amount that now equals the total production of all other States east of the Mississippi. The Gulf Coast fields, including Caddo in Louisiana, produced 14,000,000 barrels. It is interesting to recall that though production began in 1859 it was not until 1903 that the output of the United States amounted to 100,000,000 barrels per year. The second hundred million was added in just seven years. While some increases are to be expected and there are large areas of undeveloped territory, it is not probable that development will continue at the present rate.

Prospect First at Home

After sixty years of continuous and successful operation the Mother Lode of California continues to attract the attention of investors, and new enterprises, as well as the rehabilitation of old ones, call for frequent mention in our news columns. One of the latest is the West Eureka Company at Sutter Creek, which proposes to develop ground that heretofore has been only superficially prospected. At Plymouth the Alpine mine, which has lain idle for years, is being reopened; the Lincoln, at Sutter Creek, has recently been instilled with new life and the old workings are being unwatered. At Angels, a late report is to the effect that a new vein of rich ore has been discovered in the Lightner mine, and in Tuolumne county very rich rock has been found in the Tarantula mine. In fact, throughout the length of the great Lode new mines and old ones alike are being explored with results which will without doubt stimulate others to emulate the example of these fortunate investors. It merely emphasizes what was said in these pages recently. Search the old districts thoroughly before going to the ends of the earth to seek that which may be found at home. The great Mother Lode of California is 120 miles in length. Its deepest mines are 3500 feet below the surface, its production has been over a hundred million. By far the greater portion has not been explored even superficially. Here are

opportunities in a favored land, where costs can be predetermined and where success is quite as certain as in the heart of Africa, in Siberia, or in some other distant corner of the earth, difficult of access, but certain as to high cost, and uncertain as to result.

Look Out Below!

The past week has seen one more advance made in the inhuman art of war. An aviator near San Francisco took up with him as a passenger in his aeroplane, an ordnance officer of the United States Army, and the latter dropped from a height a specially prepared hand-bomb which exploded with terrific violence upon striking the earth. An examination of the vicinity where the bomb struck proved that a shell of this description, when exploded, scatters in all directions the materials of which the shell is constructed, as well as those with which it is filled, and that it would be very destructive of life within a radius of many feet. The bomb was a small affair, made for experimental purposes, but the test proved most satisfactory in its results; even beyond expectations. The natural conclusion to be drawn from this demonstration is that the dropping of explosive bombs from the sky upon an unsuspecting enemy will have a moral effect on contending armies such as is exerted by no other form of attack. The Maxim silencer, for small arms, and the gravity bombshell are likely to do much to promote peace.

Power on the Congo

It has been proposed to utilize the power of the river Congo in Western Africa where it flows in a series of rapids and falls, as it passes through the west-coast range of mountains which divides the great elevated central basin from the narrow strip of lowlands lying along the Atlantic coast. The purpose of this generation of power is to convert it into electrical energy to operate the railroad running from Matadi to Leopoldville. Matadi is at the western base of the mountains, on the south bank of the river Congo, 108 miles above its mouth; Leopoldville is on the river, above the falls and rapids, on the east side of the mountains, 345 miles from the sea by river, and 1147 feet above it. The river Congo is one of the greatest in the world. It is a tremendous stream at all seasons, draining as it does, over one million square miles of the great 'Dark Continent.' Below Leopoldville this great stream is confined at one place by the rocky cliffs of the west-coast mountain range to about 1300 feet in width. It rushes through the deep canyons in a series of rapids and wonderful falls. H. M. Stanley reported one sounding taken near the shore where the depth was 138 feet, and the current seven miles per hour. The potential energy which is here is almost beyond calculation or belief. That of the main river alone would be sufficient to operate not only all the machinery now in West Africa, and perhaps all that will be placed there, but possibly all that of Europe as well, could the mighty Congo be harnessed to the limit of its capacity, and the electrical energy transmitted. Besides this great power in the series of falls of the Congo, of which there are many, large streams enter from the sides, falling from 400 to 1000 feet within short distances. The future great value of the enormous power of these falls is limited almost wholly by the possibilities of economical transmission of the current to distant points where it may be utilized to best advantage. It may be many years before the Congo is utilized as a source of power, but when wanted, power certainly is available there in almost unlimited amount.

Progressive Mill Practice

California is often referred to as the cradle of gold mining, and such, indeed, it really is, but it is a matter of general surprise that there is a tendency in some directions, in California, to remain in the cradle. Particularly is this noticeable in the treatment of gold ores of the State. Other gold-mining regions throughout the world have in their early history, almost without exception, adopted California mill practices, but in many cases the newer countries have promptly drifted away from the 'time-honored customs' of California's millmen and evolved newer and better methods through experimentation, or have applied those already tried out in other new regions. In no district is this departure from traditional methods more radical than on the Rand. The ores of the Rand are relatively simple—a quartzose gangue with metallic gold and auriferous pyrite. The ore yields its gold readily to amalgamation and cyanidation. As concentration is not considered necessary on the Rand, the engineers, to reduce cost, years ago began to seek for methods of milling which would permit an increase of stamp duty. Year after year saw the stamp-duty increased by various ingenious means, until now, by coarse crushing and re-grinding, the capacity per stamp, as at the East Rand mills, for instance, has reached 20 tons daily, and even a higher rate is anticipated, as compared with that of 4 to 6 tons per stamp in the average California mill. That the gold ores of California are mostly readily amenable to the simple methods of recovery practised on the Rand is well known, and why California millmen do not make an effort to increase mill capacity along lines similar to those that have been successfully evolved on the Rand, is one of the things not easy to understand. An increase of stamp-duty without any material increase in the cost of power will certainly result in a decrease of milling cost per ton. At many California mines, by adopting the re-grinding methods of the Rand, employing Chilean or tube-mills after coarse-crushing in the stamp battery, the capacity could be raised from 4 or 5 tons per stamp to 10, and possibly to 15 tons, per stamp daily, while making as large a saving as by present methods. It seems well worth the effort, at any rate, and if the attempt be successful it would permit a stated capacity at a much lower capital expense for equipment.

Costa Rica Mineral Resources

By Lee Fraser

Geographically, Costa Rica may be most readily fixed in the American mind by its close proximity to Panama, being the southernmost of the five Central American republics, including Salvador, Honduras, Guatemala, and Nicaragua. In population, Costa Rica will probably not exceed 370,000, while its area is approximately 18,000 sq. mi., giving a density in population of about 20 per square mile. Compared with its sister republics, Costa Rica ranks last in population and second to last in area. On October 2, 1502, Columbus, then making his fourth voyage, landed on the shores of Costa Rica, and there founded a colony. Hostile Indians later destroyed the settlement and so successfully resisted the subsequent encroachments of these Spanish adventurers, that not until 1565, under Coronado, with the assistance of Las Casas, were they subjugated to the Spanish rule. In turn, Costa Rica was incorporated with Guatemala, to form a part of the Vice Royalty of New Spain. Between 1810 and 1821, revolutionary movements sprang up in Costa Rica, but were suppressed, under the Spanish Crown, until their culmination in the Declaration of Independence of the Central American States of Guatemala, on September 15, 1821. From that time the political history of Costa Rica is a story of events gradually leading up to her withdrawal from the Federation of Central American States on April 1, 1829, and the proclamation of her constitution on January 21, 1847, followed later by the proclamation of the present constitution, on December 7, 1871. Up to and including the time of the formation of the Federation, the course of the Central American States presents marked analogy to that pursued by those States which formed the nucleus of our present growth. But subsequent to that period, we see the disintegration of the Federation and final withdrawal of each State, and in this phase of Central American history we may read much of the character of its people. The question as to why no confederation of States was formed and maintained is indeed an interesting one, both from an ethnological and sociological point of view, but its further consideration may hardly be introduced into this article.

To almost everyone, foreign to the Latin American countries, their politics seem to be a *bete noir*, of such hideous and immense proportions as to preclude any chance of existence in safety, or holding of property in security, while within the borders of the territory it rules. But here one may take solace from the fact that most writers omit Costa Rica from the category of those countries infected by bad politics, and in view of the fact that scant information seems to be available concerning the laws and general conduct of government in Costa Rica, a short discussion on the subject would seem at this point permissible.

The several branches of the Costa Rican Government are altogether similar to those of other American republics, for all of their constitutions have been generally modeled after that of the United States. The congressional body is composed of a Chamber of Deputies, elected indirectly, by electors chosen by popular vote, and in the per capita ratio of 1 for 8000, or a fraction over 4000. One-half of Congress is renewed every second year. Five deputies comprise a permanent committee to which is delegated various powers. For instance, the committee takes the initiative in promoting new legislation, in the rearrangement of business, the formulation of decrees, bills, and similar legislation, all of which is subject to the approval of Congress in session. The President is elected indirectly by the people for a term of four years, and may not be re-elected to a consecutive term. In his deliberations he is assisted by a council and the committee of five deputies, the council consisting of a cabinet of four members, and any other appointed by the President. The federal powers lie in the supreme court, two courts of appeal, with civil, criminal, district, municipal, and justice courts. The supreme court is appointed by Congress, which in turn appoints the justices of the lower courts. Each of the seven political divisions, consisting in the provinces of San Jose, Heredia, Cartago, and Alajuela, and the Camarcas, Limon, and Punta Arenas, are administered by governors appointed by the President, who in turn recommend for appointment the chiefs of the cantons and districts and municipalities. The chief source of revenue of the Government is the import taxes, and additional revenues are gained from exports, monopoly and manufacture of liquor, and sale of public lands. Aside from the taxes levied by the municipality no property taxes are collected, with the exception of a small road tax. Mining machinery and supplies are admitted free of duty upon application. The mining code is liberal and perfect title to land and minerals may be easily acquired. The general mining code, it is reported, is about to undergo revision.

As elsewhere in the tropics, the difficulties of transportation greatly retard the development of the country's natural resources, to a greater extent than any other factor. Conditions now will be greatly ameliorated by the completion of the railroad from San Jose to the Pacific port of Punta Arenas, thereby giving a direct road from the Atlantic to the Pacific. Internal communications are accomplished by about 400 miles of railway, 1200 miles of telegraph lines, connecting with foreign cable lines and wireless stations at San Juan del Sur and Limon, postal service, and a fairly complete quota of roads and bridges. From the Atlantic seaport, Limon, a 36-in. gauge railroad extends 103 miles into the interior to the capital of the country, San Jose, at an altitude of 4700 ft., first passing through the ill-fated city of Cartogo, at an altitude of 5250 ft. About 330 miles of railroad terminate in Limon, almost two-thirds of which is used solely in the transhipment of bananas. The Costa Rican Government operates the line from San Jose to Punta Arenas, and from Punta Arenas to Esparta. Away from the railroad freight must be handled either by ox-cart or pack-mule.

At the close of the Cretaceous period is placed the

time of the upheaval of the sea bottom into land, forming the connection between the North and South American continents, and giving, at its immediate conclusion, a north-south trend to the continent. During the following Miocene epoch the country was subjected to magmatic intrusions. Simultaneously there occurred a shifting of the structural trend of the continent from a north-south to a north, 40° west, course, the new folds developing across the old north-south folds. The active forces, judging from the results produced, would appear to have expended their greatest energy in producing the movements throughout Mexico and the north, expiring in their last paroxysm to form the southernmost end of Central America, and to connect it with the southern continent. Subsequent to its formation, Costa Rica has undergone rapid and extensive erosion, upon both the Atlantic and the Pacific slopes, but more especially on the former, and under the disintegrating action of heavy rainfall and the growth of abundant vegetation, the highlands have been worn away to form with their waste, the plains of Los Guatusos, San Carlos, Santa Clara, Tortuguero, and the low-lying costal plain. Upon the Pacific slope the erosion has been less intense, and we find only the valley of the Tempesqui river approaching in extent the plains of the Atlantic slope. The country, drained by both El General and Grande rivers, is rugged and broken, suggesting a long period of erosion, before complete degredation to base level can be reached. In general, then, the topography of the country is decidedly broken and uneven, each stream and river having but commenced to seek its rest at sea-level, and in its turbulent effort to arrive at its time of repose, it is leaving behind it innumerable hills, ridges, and mountains in picturesque confusion.

City of San Jose, Costa Rica, Central America.

Shaft at Mine, Costa Rica.

Ancient Ornaments Found in Burying Ground.

In the light of present knowledge concerning the subject in Costa Rica, it appears that the deposition of minerals from intruding magmas, either by solutions emanating directly from them, or by direct intrusion of veins, was in no way extensive, if not of extremely rare occurrence. Numerous veins of quartz exist, but their origin, in all cases which have so far come up for consideration, may be considered

as closely related to metasomatosis which was followed by secondary enrichment. From a large number of veins examined on the Pacific slope an average strike was observed as N.30°E., while occasionally veins are observed striking S.60°E., or practically at right angles to the former and parallel to the structural trend of the country. Costa Rica has been and continues to be a region of continued seismic disturbance; the movements occurring, no doubt, along planes at right angles to or parallel with the tectonic trend. Then along these planes of movement the profuse circulation of the surface waters, so abundant in tropical countries, will in turn deposit vein-forming materials, with possible enrichment by minerals leached from the country-rock, for which cycle, conditions at the present time are, no doubt, as favorable as at any time in the past.

The known occurrences of minerals in Costa Rica are not numerous as compared with those reported in the nearby and adjacent republics, but, to the best of my knowledge, are given below. The Rio General district is undoubtedly a country of great agricultural and, presumably, mineral wealth, though nothing has been done to exploit it. In the river valley are a number of old burying-grounds which have given up several thousand dollars in gold idols, images, and various implements. The known occurrences of minerals in the Rio Grande district and the country lying to the north are more numerous, due to the fact that a large portion of the inhabitants of that country actually occupy the land, and not necessarily because there is more mineral in that region.

In regard to the Talamanca district, which comprises the southeast corner of the country, it is of interest to note the findings of W. M. Gabb, who was sent by the Costa Rican Government in 1874 to re-discover mines of fabulous richness supposed to exist in that district. He declares that such mines do not, and, for sufficient geological reasons, can not exist there. His instructions required him to look for mines, and he examined carefully for traces of the precious metals wherever he went. He found in a few places quartz veins, one of considerable size, others practically valueless, and also deposits of placer gold in a few localities, but he says the existence of gold is rather of scientific than economic importance. The gold occurs in the metamorphosed Miocene rocks, and always at a distance from the granites. The point at which he found gold nearest to the granite was at least a mile distant, although the rock was highly metamorphosed. The spot where he found the largest quantity of gold was miles away from granite. The base metals, oil, and coal have never received much attention, and aside from the fact that indications of their occurrence have been observed, but little information regarding them is to be obtained.

DISTRIBUTION OF MINERALS

Atlantic Coast: Cuartos Esquinas, black sand; Puerto Limon, natural cement; south of Puerto Limon, black sand; Puerto Viejo, black sand and gold; Rio Zhorquin, gold in sands; Rio Uren, gold in sands at headwaters; Rio Cuculis, coal; Rios Coen and Suagbli, oil; Rio Zent, copper; Montana Matina, coal; Calobozo, iron.

Cartago: Paraiso, copper, gold; Orosi, copper, gold, silver; El Copey, gold.

South of Rio Grande and north of Cerros del Puriscal, there are many occurrences of gold, lead, silver, and copper throughout the region.

San Ramon, Naranjo, San Mateo, and Esparta, Tuccares, and the Guacimal, Aranjues, Largatos, Abangarez rivers, gold, silver, lead, zinc, iron.

Laguna Tenorio: iron, gold.

Guanacaste, Sardina: asphalt, manganese, copper.

Actual mining operations for gold are being conducted by the Abangarez Gold Fields of Costa Rica, the Montezuma Mining Company of Costa Rica. At the La Union mine, the property is being developed, and some work is being done by the Aquacate Mines in re-opening some abandoned properties near San Mateo.

FAIRBANKS DISTRICT, ALASKA

The estimated value of the gold output of the Fairbanks district, Alaska, in 1910 was $6,100,000; the value in 1909 was $9,650,000. This falling off is due to the facts that many of the richest placers have been mined out and that no effective work has been accomplished toward mining gravels of lesser value. Plans for dredging some of the shallower creeks have been made, but nothing tangible has been accomplished. Meantime many of the most enterprising operators have turned their attention to prospecting auriferous quartz veins. Here, as in Seward Peninsula, there are large bodies of auriferous gravels whose gold content is too low to permit its recovery by the methods now in use. There was a scarcity of labor at Fairbanks in the spring, owing to the exodus to the Iditarod, and on some of the creeks the water supply was inadequate. These conditions also affected the gold production to a certain extent. It is estimated that about 130 placer mines were operated in the Fairbanks district during 1910; this is a falling off of over 50% from the average of previous years. As the gold production has declined only about 35%, the output per mine has increased. An average of about 1200 men were employed in this production through the year. Among the new developments were the operations on Fish creek, where little mining had been done previously. The pay-streak on Goldstream creek was also traced farther downstream. The most extensive mining, as in 1909, was done on Goldstream creek and its tributaries, Pedro and Gilmore creeks. Second in importance were the operations on lower Cleary creek and on the Chatanika flats. Fairbanks creek was also the scene of much mining. It is estimated that 20 claims were worked on Fairbanks creek, 13 on Ester creek, 8 on Fish creek, and 10 to 15 on other smaller creeks.

It is interesting to note the recent discovery of scheelite in Halifax county, Nova Scotia. The ore is reported to yield 60% tungstic acid. At present 25 men are at work.

Mine Accounting

By L. A. Whittaker

After several years' experience in mining offices, mostly in Mexico, it is evident to me that the right kind of attention is not generally given to the subject of accounting by the smaller mining companies. A mining engineer must be equipped with certain standard training before he can expect to hold a responsible position in his profession. The attaining of this costs him much hard work and study and he should realize to what extent the demonstration of his ability depends upon his office staff. Among these smaller mining companies there are many engineers who, on account of a difficult, or maybe impossible, condition, are not making favorable showings to their stockholders. It may be that they are doing excellent professional work, but usually the verdict of small investors is based only on the profit and loss sheet. When such an engineer can put before his directors and stockholders a simple and intelligent statement, showing every detail of what he is doing, and minutely accounting for all funds, his reputation as an engineer is benefited. It would naturally be thought that such a statement could be readily prepared, but the common lack of easily understood and comprehensive systems of reporting these details is working an injustice to engineers.

The book-keepers and accountants employed by the ordinary mining concerns are often men who have gained their knowledge of books in industries other than mining. This is accounted for by the fact that men of this class are more liable to seek employment in cities than they are to 'rough it' in mining camps. There is no other industry which undertakes as many different kinds of business as is carried on through the office of an isolated mining company. The officeman, therefore, to do his work thoroughly, must have a broad knowledge of industry, which can hardly be gained with any city firm handling one line of business. A competent city book-keeper has a great deal to learn before he can give the best results as a mining accountant. Especially in Mexico, but to some extent in the States, an officeman must be posted on the commercial and mining laws of the country, and his failure to so equip himself will sooner or later cause his company trouble. A manager's duties take him away from his office so much that he should test his accountant's knowledge in this line.

The 'working costs' of mining are prepared in such a variety of ways, according to the ideas of the engineer or the guesses of the accountant, that it would seem desirable to have some standard established for this work. Since an engineer's ability is judged by his 'costs,' he must realize that his accounting department needs the same skilful supervision that is exercised in his operating departments. An investigation shows that in too many cases this work is not understood as it should be. If an officeman has not a working knowledge of all the details of the mining business, he is liable to make errors in his distribution of expenses, and a cost sheet which is not accurate is useless. If a manager must make mental allowances for this inaccuracy and that arbitrary entry, he is losing the value of the money expended in making the cost sheet. In this branch of the work a mining accountant is distinct from a bookkeeper. He must use judgment based upon a thorough and intimate understanding of all the departments of his company, and he should realize the responsibility that is his in seeing that each department is fairly dealt with and that his manager can depend upon the report. If any good is to be gained from a 'cost sheet' the costs must be calculated promptly at the close of each period so that the manager may be able to make such changes as its figures may indicate are desirable. Quick work is the keynote of mining accounting. And, finally, the sum total of the cost sheet for any period should balance with the ledger for that period. This remark may seem superfluous, but it would be interesting to note the number of cost sheets that are independent of the financial sheet for the same period, and do not show the same total. Naturally, explanations can be given for these differences, but the ideal manager's report is one in which no explanations are necessary.

For the benefit of young mining engineers and those connected with the smaller mining companies a standard method of accounting should be established. The business conducted by the different railway companies throughout the United States is probably as varied and involves as many distinct branches and departments as that of the quartz mining companies. Yet the railway companies have established a standard method of accounting and the costs on all our railways are arrived at in exactly the same way. One superintendent's ability can be readily compared with that of any other. The Interstate Commerce Commission, acting for the railroads, has published a 'Book of Accounts,' which is used by all the railroads. This book covers every possible receipt or expenditure that may occur in the railway business. A standard system of account numbers is used, the business being divided into departments, and the departments subdivided into the different accounts. The book explains minutely what items should be charged to each account, and the accounts are explained so clearly that no room is left for difference of opinion as to any particular charge. An inexperienced clerk can, with the aid of this book of accounts, make a proper distribution of the expenses of his department. Naturally railway clerks become familiar with these account numbers, and their changing from one company to another does not detract from the value of their services. Mining engineers could get up some such a system of standardized mining accounting, and I believe its operation would be satisfactory to all concerned. The system would not leave the important matter of costs to the judgment of the accountant, but would give him a definite basis for all his work.

Zinc amalgam, made by dissolving strips of metallic zinc in quicksilver, forms an excellent dressing for mill plates that require frequent care.

Indiana Oilfields in 1910

By Raymond S. Blatchley

Trenton Rock Oil District.—The old Trenton Rock district, covering the greater portion of northeastern Indiana, has declined so rapidly in the last six years that it is gradually losing its place as an oilfield. In the past, more than 25,000 wells have been drilled, yielding gas under phenomenal pressure, and a large production of high-grade oil. The greater number of gas wells have long since been abandoned and new gas wells are now seldom drilled. About 9200 wells have been plugged and abandoned since the first of January 1905, and these with about 8000 dry wells in the field leave some 7800 bore-holes that are chiefly light oil-producing wells. There were 431 wells abandoned in 1905, 1063 in 1906, and 1501 in 1907. The number abandoned since is given by months in the table below. The greatest number has been abandoned in Wells, Grant, and Deleware counties. The cause of such abandonment lies mostly in the decline of the gas yield, which served as a basis of power for pumping.

The new development in 1910 was slight. About 125 wells were drilled, of which 25 wells or 20% were dry. The new production for the year only reached about 1200 bbl. It is interesting to note the decline in the Lima, Ohio, Trenton fields, which is a continuation of the Indiana area. Since 1905 about 6850 wells have been abandoned. The figures for various years are as follows: 1905, 674 wells; 1906, 1059; 1907, 1357; 1908, 1135; 1909, 1127; 1910 (11 months), 1299; giving a grand total of 6651.

Southern Indiana Oil District.—The major development in southern Indiana took place in Pike county in what is known as the Oakland City oilfield, named after a town near the field but in Gibson county. There have been 269 wells drilled, of which about 245 were completed in 1910. Of these 35 were dry, 17 yielded gas under good pressure, and 217 produced oil. The oil and gas were found at a depth of about 1100 to 1220 ft. I recently made stratigraphical comparisons of the logs of this field with those of the main oil areas of Illinois, for the Indiana Survey, and found that the oil and gas horizon lies in the Chester formations of the Mississippian series of rocks. The Oakland City sand is comparable to the Kirkwood sand of Lawrence county, the Benoist sand of the Sandoval, Marion County area, the Lindley gas-sand of the Greenville, Bond County field, and the Sparta sand of the Randolph County oil territory, all of Illinois. Considerable new development is planned for the area. The Gibson County, Indiana, field lies several miles west of the Pike County wells. The pool was defined several years ago and but little new development has taken place. The oil is found at a depth of about 850 to 900 ft. and comes from the massive Pottsville sandstones comprising the lower division of the Pennsylvanian rocks, and overlying the Chester formations of the Mississippian. Both oil areas of Gibson and Pike counties lie within the Eastern Interior coalfield. The following table compiled from the *Oil City Derrick* gives the combined new development, by months, of the Princeton, Gibson County, and the Oakland City fields:

	Wells Completed.	New Production.	Dry Holes.
January	12	450	6
February	19	693	4
March	19	720	2
April	17	545	6
May	15	600	4
June	26	1,615	2
July	27	595	2
August	29	1,080	6
September	26	370	4
October	14	395	2
November	20	205	10
December	..	...	..
Totals	224	7,268	48

NEW DEVELOPMENT IN TRENTON FIELD (after *Oil City Derrick*).

	Wells Completed.		New Production.		Dry Holes.		Wells Abandoned in Indiana.		
	Indiana.	Ohio.	Indiana.	Ohio.	Indiana.	Ohio.	1908.	1909	1910.
January	6	29	38	377	3	5	75	149	61
February	14	27	193	425	2	3	59	108	66
March	10	31	100	500	1	5	129	237	221
April	10	46	169	530	0	6	198	98	140
May	10	55	146	565	1	9	358	204	157
June	12	57	130	447	2	7	207	347	146
July	11	59	81	684	2	7	191	157	176
August	12	56	79	735	3	5	228	322	126
September	9	54	30	794	3	6	195	267	302
October	12	44	85	441	3	6	144	201	79
November	15	69	85	723	7	6	155	172	100
December	..	..	..	....	..	..	220	164	....
Totals	121	527	1,136	6,221	27	65	2,159	2,418	1,574

Entire Indiana Development (after *Oil City Derrick*).

	Wells Completed.	New Production.	Dry Holes.
January	18	488	9
February	32	886	6
March	29	820	3
April	27	714	6
May	25	746	5
June	38	1,745	4
July	38	676	4
August	41	1,159	9
September	35	400	7
October	26	480	7
November	35	290	17
December	..	...	..
Totals	344	8,404	75

Mining in Cripple Creek District

By William H. Storms

There are several things about the Cripple Creek district, of Colorado, that at once impress themselves upon the stranger. One of the first is the situation of large mining plants upon the very summits of a number of the highest hills; the town is at an altitude of about 9500 ft. Another is the

El Paso Shaft, Cripple Creek.

tremendous size of the waste dumps, many of them held in place by cribs of timber hundreds of feet in length in which are thousands of logs, suggesting the great expense incurred in hoisting these millions of tons of worthless rock, the great additional cost for timber and labor expended in building the cribs to maintain the dumps in position on the hillsides, and the reflection that a different method of mining, in many instances at least, would have saved much of this expense, which might have been added to the profits of mine owners and lessees. Still an-

The Elkton Mine, Cripple Creek.

other matter to attract the attention of the visitor is the ramification of the electric-car lines. They seem to run everywhere. The tracks, usually on heavy grades, sweep around the smooth hills from base to summit, curving to right or left almost constantly, winding their sinuous way through rock-cuts or over curving trestles, some of which are over 100 ft. high. There are said to be over 72 miles of railroad track in the district, and I do not believe there is 5 miles of railroad track on a tangent in the entire railroad system. Electric cars run at frequent intervals night and day, to, or near, all the important groups of mines. The larger towns are Cripple Creek, Victor, and Goldfield. These latter are three to four miles from Cripple Creek in a southeasterly direction, Goldfield being less than a mile northeast from Victor. Near the latter town are the Portland, Stratton's Independence, Granite, Strong, and some less prominent mines, and near Goldfield the Golden Cycle and Vindicator are the most important operating properties. Near Altman are the Pharmacist and Zenobia mines; a settlement has grown up on the northwest slope of Raven hill, near the Anaconda mine, and still another between the Cresson and the Elkton mines. Although Cripple Creek came into existence 19 years ago, it has lost little of its interest, for new and unexpected discoveries continue to be almost daily events. The present efforts of mine superintendents and managers in the Cripple Creek district are being directed toward the introduction of methods of mining which will permit a lessening of mining costs; the closer sorting of ore, and the elimination of unnecessary expense in ore-handling by the employment of automatically operated conveying devices —these latter above ground. At the same time, they are seeking the least expensive means of ore

Logan Shaft, Stratton's Estate Co., Cripple Creek.

treatment with highest extraction, whether it be in local mills owned by some of the mining companies, such as the mill of the Stratton's Independence, at Victor, and the large new mill of the Portland company on Battle mountain, or in those at a distance, as that of the Golden Cycle company at Colorado City, and of the Portland company near Colorado Springs. By far the greater number of mines, however, have no reduction works, and these ship to either custom mills or to smelters. The Standard mill at Colorado City is the largest milling plant in the State operating exclusively on custom ores, though the mill of the Golden Cycle company, near it, also buys ores. Competition between the mills and smelters is very close, and has resulted in repeated cuts in treatment charges during the past ten years. A material cut has only recently gone into effect in all of the reduction plants handling custom ores, which will make available a still lower grade of ore than has been profitably treated heretofore.

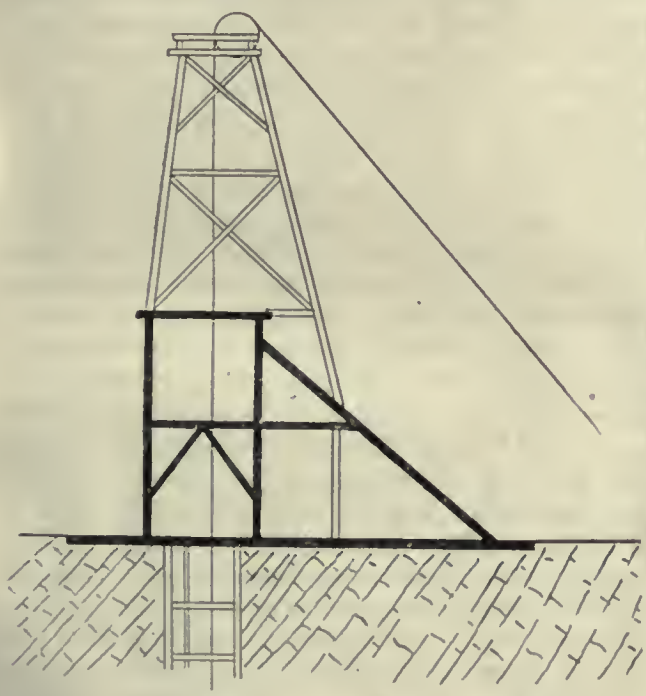
To the stranger, Cripple Creek presents the appearance of 'having seen better days'. This is true, too, for there are many idle mines, some of which are equipped with expensive mining plants. Many

buildings show signs of dilapidation, and the population has been reduced by many thousands. There are several causes for this comparative stagnation of the mining industry in Cripple Creek, the first being a temporary indisposition of capital to invest in mining in this district, influenced to a great degree by the labor conditions which existed here a few years ago, and which made it unsafe to invest largely in an enterprise that any day might be forced to suspend, due to the possible action of organized labor. The district still feels to a noticeable extent the baneful effect of those unfortunate days, though it is slowly overcoming this feeling of insecurity, and new enterprises are being started with great promise of success.

The larger number of mines of the district, including many of the most important ones, are being operated by groups of lessees. Indeed, this has always been a notable feature of mining in this district. Some of the leasing companies are incorporated and operate in essentially the same manner as the corporate companies operate their own mines. However, most of the leases are individual or partnership affairs, or associations of a few practical miners, who, under contract with the owner, prospect certain defined blocks of ground, develop and mine the ore, if any be found. The leases of this class contribute a very large part of the total tonnage of the district. Many of the lessees are men of limited means, and this fact has led to the introduction of the least expensive equipment, the utilization of crude structures, and the adoption of the makeshift in many directions, particularly on the surface; but the experienced lessee is a man who knows how to economize underground as well, and he operates his lease at a tonnage cost which corporate management can seldom, if ever, duplicate. The lessee rarely does anything that costs time or money without some direct object in view. He is unhampered by a finical board of directors; not weighted down by expensive engineering staff, nor by elaborate office equipment, with large clerical force. In fact, he is usually free from all the extraordinary expense incident to corporate management of mines, and devotes his entire time, attention, and energy to mining ore as rapidly and as cheaply as is consistent with present safety. The subsequent result of this policy of 'rigid economy' is seen in the surface subsidence of ground over mine workings, throughout the district, resulting often in the distortion of buildings, and other similar surface damage. The lessee builds surface structures generally innocent of what are considered essential engineering features, but they serve the purpose, and sometimes, if he is prosperous, he enlarges on the original plan by making striking additions, as evidenced by the accompanying sketch of a head-frame on the Whisper mine of the Gold Sovereign Co., near the Logan shaft of the Stratton's Estate Company.

Another condition which for a year or more past has retarded deeper development of the district has been the problem of handling the ever-increasing amount of water found in most of the deeper mines. In its comparatively early history, water became troublesome in many of the larger mines. The first water encountered in the mines of the district was in the Blue Bell adit near Anaconda. This stream ran for a long time at the rate of 200 gal. per minute. Several other adits, at various levels in different parts of the district, which were driven to develop ore, proved valuable as drainage conduits for the mines of their immediate vicinity. The first adit driven with a view to mine drainage as well as development was that known as the Standard tunnel. This was commenced in 1896, its objective point being the phonolite intrusion on Beacon hill. When the El Paso vein was cut, a flow of 250 gal. of water per minute came into the workings, which increased to 1000 gal. per minute when the phonolite was reached. The rate of flow further increased as the heading advanced. It was completed in 1899, and drained most of the mines of Beacon hill, Gold hill, and Raven hill, to its level. The benefits of this drainage tunnel were so apparent that it was soon determined to drive another at a lower level, and the first El Paso tunnel was started at a point nearly a mile southwest of the El Paso shaft. Work commenced in January 1903, and was continued until September 6 of the same year, when a connection between the two portions of the adit was made. This work was carried on with three headings: two from the El Paso shaft and one from the Cripple Creek portal. The flow of water from this adit was 2500 gal. per minute, and numerous deep mines of the vicinity were rapidly drained to levels deeper than their lowest workings, permitting the resumption of mining in these deep levels. This drainage adit was continued toward the Elkton and in time completely drained the mines lying in that direction to its own level. In time, mining operations, which were again vigorously prosecuted, had removed most of the known ore above the drainage level, and a new and still lower adit began to be discussed, as pumping or bailing was economically impossible. This new need resulted in the driving of the third drainage adit, called the Roosevelt tunnel. To accomplish this great work a corporation, known as the Cripple Creek Drainage & Tunnel Co., was organized in August 1906, and money was raised through subscription by the mines to be most greatly benefited. Work was commenced in May 1907, and was carried out mostly under contract by A. E. Carlton. Three separate subscriptions were necessary to complete the undertaking, the first being for $388,500, the second for $126,166.63, and the third for $26,000, making a total of $540,666.63. The adit was completed as far as the El Paso, where a lateral was run under the shaft of that mine and a raise driven 340 ft., the connection being made in November 1910 by means of a drill-hole. When the connection was fully completed the level of the zone of saturation of the vicinity began to subside rapidly. What the average rate of subsidence will be found to be is not yet fully established, although during the first month it was 12 ft. in the Elkton workings, and about 2 ft. in the Portland, which lies about a mile beyond the

Elkton. This rate of fall can not, however, be considered as an average, nor as even approaching it, for while the rate of subsidence will naturally be less at a distance than near the point at which the adit cuts the formation, the rate of subsidence will decrease with the constantly lessening hydrostatic head. In addition to this, there are certain rock masses and zones of rock which are more porous than others, and there are seams of clay, or of impervious rock strata, which will hold back millions of gallons of water until penetrated by underground workings. All of these factors, and probably others, will have a material bearing on the rate of subsidence of water in the district affected by the tunnel. However, enough has been learned from past and more recent experience, and from present conditions in the district, to indicate that the fall of



Lessee's Head-Frame on Whisper Shaft.

the water will be sufficiently rapid to make it possible to resume deep mining in many of the deepest flooded mines, at points below the old water-level. The new drainage adit cuts 740 ft. below the previous water-level of the mines, and mining engineers of Cripple Creek district are unanimous in the opinion that the enterprise was one of the wisest yet undertaken in the region. In fact, deep mining without it had generally become economically impossible. In the original design the form of the drainage tunnel was that of an upright rectangle. This form was changed by A. E. Carlton, the contractor, to a horizontal rectangle to facilitate drilling and progress. A single horizontal bar was used, on which was clamped three machine-drills. Much of the rock was extremely hard, but progress was rapid, nevertheless, for organization was perfect.

The beneficial effect of the completion of this last drainage adit is being daily demonstrated and it is confidently expected that the output of the Cripple Creek district will show a decided increase as the direct outcome of this project.

AN EARLY CYANIDE PLANT

One of the first, if not actually the pioneer plant to treat ore on a commercial scale by the cyanide process, was built near the Calumet mine in Shasta county, California in 1891, by A. B. Paul. It was thus described in the *Mining and Scientific Press*, in the issue of October 3, 1891.

"The plant is intended solely for the working of the McArthur-Forrest process, not alone on the ores of the three counties for which the company owns patent rights, but for all the ores that may be shipped from all portions of the coast. The plant will treat 10 tons of ore every 24 hours, and is so arranged that different lots of ore can be treated at the same time. In the treatment of the ore, the first operation is drying. It is then passed through a rock-breaker and into bins, from which it is fed into a Paul barrel-pulverizer, and when powdered the ore is placed in agitators and a 1% solution of cyanide of potassium added. After an agitation of 6 to 12 hours the liquor is drawn off into filtering tubs. These filters are of wash-gravel covered with canvas. The liquor passes through the filter and into storage tanks. From this the solution is drawn into a chest of zinc filters, each filled with zinc shavings. The liquor flows down through the first (box), up through the second, down through the third, and so on, to the end of the eight filters. The gold is precipitated upon the zinc shavings in the form of a brown powder. When desired, the chest is unlocked and the zinc shavings washed in clear water, which separates the gold. When it has settled, the water is drawn off and the gold, in the form of brown powder, melted into bars. The liquor from the filtering tank is pumped back to the first tank and sufficient cyanide of potassium added to bring the solution up to the original 1%. As will be seen, the process is very simple, no roasting of ores is needed, and no high-priced chemicals required, with a very small loss of materials used. * * * As numerous parties have failed in making small working tests of this process, it may not be amiss to state that very often cyanide of potassium is not more than one-half to two-thirds full strength, and it is therefore necessary to know the exact percentage of cyanide as well as to follow the company's method of treatment."

This is one of the first articles descriptive of the cyanide process ever published in a technical journal. The details given are sufficiently comprehensive to make the operation of the process easily understood, as far as knowledge of it went, but subsequent development of the process proved it to be far from the simple application of a long-recognized fact—that a weak solution of potassium cyanide would dissolve gold. Since that time, the fall of 1891, tons of literature of the highest type of classical contributions to metallurgy have been published, and experimenters are still earnestly engaged in the study of methods by means of which the process may be still further improved and its commercial application successfully extended to the treatment of those ores which are still refractory.

Losses in Hydraulic Mining

By Charles S. Haley

The average quartz mine engineer, or even the average gravel-dredging engineer, in my experience, is inclined to look with indulgent pity on the efforts of his hydraulicking brother to secure what is generally regarded by the former to be an unsatisfactory, or even poor, extraction of the value in the ground which he works. When a man talks about getting an 85 or 90% return in hydraulic mining, one who has had any experience at all in that line knows that either conditions were exceptionally favorable with respect to the character and weight of the gold, and the lay of the channel from which it was extracted, or that he does not really know much about it. This is only the case, however, in ordinary hydraulic mining, where the entire bank, including the top, can be run through the boxes, at a rate sufficient to pay adequate returns on the investment. Drift mining, like dredge mining, is quite another matter. The bane of the hydraulic man is the loss of the fine and flaky gold. After several thousand dollars has been spent in getting water on the claim, and after the time spent in removing the top, the average mine must depend to a great extent on getting most of the value which is disseminated through the entire gravel bank, as well as the thin streak of bedrock pay which is usually heavier gold. It is of some of the more common ways of saving, and incidentally of losing, this value, that it is my intention to treat. There are various ways of making sluice-boxes. In the larger mines in California, with box widths of 4 to 6 ft., railroad iron is used for riffles. The smaller operators, however, from whom comes the great bulk of hydraulic production of the State, with boxes averaging about 3 ft. in width, use fir blocks for riffles. These are ordinarily separated one from another by cobbles, with lining-boards to hold them down. In the fitting in of these blocks lies the cause of a great deal of grief.

In a box of the latter size named, a space of the width of a man's hand, or about 4 in., is commonly used. The blocks should be so wedged with the separating stones as not to fill up too much of the riffle space, and while firm, to keep them well apart. Care must be taken in having the blocks uniformly sawed. In the case of semicircular blocks, the sap side should be turned up-stream, so that side will be exposed to the most pounding of the boulders, for if the pith side were turned up-stream, they would soon be beaten into the condition of brushes, forming an excellent lodgment for fine gold and thus making it extremely risky to use them for the tail-end of the boxes when somewhat worn. All blocks are burned when worn out, and the ashes panned. On cold winter nights one can pile them on the fire and feel truly economical, in view of the results in the ashes in the morning. Before the blocks are put in at all, the last crack and seam in the boxes is calked with soft wood, and all the bottoms carefully planed. Otherwise when one goes to gather the amalgam, he comes to grief. Well seasoned blocks are usually preferred, as they last longer than green, but the latter are all right while they last. After the blocks have begun to wear, fresh ones are usually substituted at the upper end of the string first. The head of the string is usually left free of quick, to avoid the expense of retorting the heavy gold.

A long string of boxes is an advantage in saving fine gold, but hardly sufficient to make it worth while cutting bedrock to place them, unless the rock is very soft. The average grade of boxes of this type is from 5 to 7 in. to each 12-ft. length of box, according to the dump facilities, but it is sometimes necessary to worry along with a 3-in. grade, and a 9-in. is sometimes used to advantage. Outside of these limits, it is hardly safe to go. The boxes are usually made in 6-ft. lengths, for convenience in placing. Having equipped the boxes properly, the next thing is the undercurrent. In all mines where there is enough fine gold to make its saving worth while (and that means most hydraulic mines), an undercurrent, and often two or three of them, will pay for their cost and the trouble of cleaning them up, ten times over in a season. A grizzly of about 1-in. steel bars, set 2 in. apart, and about 2 ft. long, is set in the bottom of the box, on a level with the top of the blocks. All the large material goes over the grizzly, and the fine gravel, carrying with it most of the fine gold, drops between the bars upon the undercurrent. This is simply a box about two or three times the width of the main string, though much more shallow, as a rule, the blocks in it being but 2 or 3 in. thick, whereas the others are 10. A good part of the water is turned from the main box through the grizzly bars into the undercurrent, which runs at right angles to the main string. With the momentum which the heavier rocks have at the time that they reach the grizzly, however, it does not take so much water to carry them on out, a somewhat heavier grade being provided where possible.

The fine stuff spreads out fanwise on the undercurrent, and the velocity is lessened considerably. Also, the local eddies formed around the larger boulders are here absent. As a result, the fine gold gets a much better chance to settle here. With a short string of boxes an undercurrent will sometimes save from a third to half the entire clean-up, and with a long string it will save gold that the boxes would not otherwise stop. Many undercurrents are made without blocks at all. One of the simplest methods is to cover the bottom with brussels carpet. An improvement on this is to tack down 'chicken wire' (galvanized wire of about 1-in. mesh) on top of the carpet, so as to 'tuft' it and make it easier for the fine gold to stop. From the great amount of fine gold carried down-river each year by the freshets of our gravel-mining countries, and from the number of people who make a living (somewhat precarious, it is true) from 'mossing', that is, getting the gold that hangs up in the tufts of moss that drag in the river when it is up, it is easily seen how the stuff is carried by muddy water, and how much an undercurrent of the type just described is likely to save. Having the boxes and undercurrent correctly

rigged up, the piper must next receive attention. If he is anxious to help lighten the labor of his brethren of the sluice-hook by letting the water back up in a pond in front of the boxes and then lifting the entire mass, gravel, mud, and all, through the boxes in a turbid flood, with one flirt of the nozzle, it would perhaps be just as well to lighten his labors by depriving him of the opportunity. This sort of thing works very well as far as getting dirt through with a limited amount of water is concerned, but as the idea is not so much to get the gravel through as to leave the gold behind in the boxes, it is hardly practicable. Every time that the current of water fluctuates in this manner through the boxes, an eddy is formed which lifts the fine gold one riffle further along in the boxes. When it reaches the 'quick,' one might think that it would stop, but it does not. Instead, amalgam and all join in the merry chase, and eventually leap joyfully into the river. This I have proved by sad experience. The small heavy gold is not nearly so hard to save as the more showy flaky gold. The latter will wend its way past all manner of undercurrents and riffles regardlessly. In examining a property of this sort, it is advisable to give this fact full weight before investing, as no method has as yet been devised to satisfactorily entrap these thin plates of gold. The utmost care should be taken where the gravel bank is fairly heavy, not to allow one's self to be blocked up by piles of boulders. Of all sources of gold loss, this is perhaps the worst. When, in the ordinary course of driving the gravel to the head of the boxes, it is unavoidable to flirt the stuff all over piles of boulders which have been left by the derrick in the path, there is sure to be a considerable amount of the gold which will never get to the boxes. Simple as this may seem, it is not uncommonly done. When one is working low ground, with not the best of water facilities for the removal of tailing, it is best to begin operations on the upper end of the claim and work down. More than one operator has come to grief through filling the river with a dam of tailing on the lower end of his claim and backing the water up all over his bedrock, so as to make it impossible to clean it. The question of theft also enters to a certain extent into sluice-box losses, as one unfortunate found who slept on his boxes one night, only to find in the morning that they had been cleaned up within 6 ft. on either side of him. As it is always necessary in a mine of any size to employ a watchman at night, it is just as well to give him a sluice-hook and put a piper with him, so as to have money coming in as well as going out. However, with the best of care, hydraulic mining must ever seem rather crude in its results to the more fastidious cyanide engineer, for instance, who lies awake at night trying to decrease a leaching cost or to perfect a slime wash to save a cent or two on a ton. Hydraulic mining, from its very nature, can never be reduced to such an exact science as the operation of quartz mines, the mechanical concentration of sulphides, or the chemical treatment of ores, by any of the various wet processes now commonly employed.

Quick Mill Construction for Fort Bidwell Mines

By Algernon Del Mar

Various writers have given the time for the erection of a small mill at from three to eight months, and I have known of some that actually took longer. I believe the erection of the mill herein described to be a record, and as there are a few points in its construction worthy of notice, a description may be of interest.

The president of the company decided upon the

Fort Bidwell Company's Mill, Modoc County, California.

erection of a 5-stamp mill on October 9, 1910, and I was authorized to purchase and erect the same in the shortest possible time, for a snowstorm in Modoc county, California, at 7500 ft. elevation in November or December means a cessation of operations in an unprepared camp until the following July. I arrived in San Francisco on the morning of October 12. Before leaving the mine, I had outlined the necessary excavations, left orders for lumber, cement, sand, and rock. I found that none of the iron works had mortars in stock, line-shafts ready, or pulleys turned. The terms of my contract made it imperative that all machinery be loaded on cars within seven days after placing the order. It was awarded to the Joshua Hendy Iron Works, and was carried out according to program. The car arrived at Reno, Nevada, on October 24.

It was reloaded on the narrow-gauge cars the same day, and on the following night was at Alturas. On November 5 all machinery had arrived at the millsite, 60 miles from the railroad. Two days later a fall of snow covered everything, and it continued snowing off and on for nearly three weeks. Nevertheless, on December 1 the stamps were dropping. The total time from the date of receiving the order to build a mill on the property to ore-grinding was 52 days; from the time of ordering the machinery, 49 days, and from the time of delivery at the site, 25 days.

The force employed was six miners, foreman, blacksmith, and two teams with scrapers at the millsite and dams. The work included building two dams, excavating for mill, laying 1500 ft. of pipe-line from dam to pump, laying 1000 ft. of pipe-line from pump to mill, erection of pump and pump-house, building of mill from hewn timbers except 1 by 12, 2 by 12, and 2 by 4.

The mill has 5 stamps, 1000 lb. each, with mortar set on concrete base, battery-posts made of 12 by 28-in. timbers set in cast-iron sole-plates on concrete base. For a mill of this size I considered it most economical for the rock-breaker to be placed on the same level as the battery with an elevator to the ore-bin. The rock-breaker is here under the care of the batteryman, for in a mill of but 5 stamps one man is easily capable of doing all the work. There are other advantages in this construction, such as, less height needed for ore-bin, no vibration from breaker communicated to bin or building, the breaker is always in sight of the millman and does not run for hours without attention, as is often the case when in the attic of the ore-bin, and the dust, if any, is at once settled on the ground instead of filtering down from the ore-bin to every part of the mill.

It was found on excavating for the millsite that what appeared to be a porphyry bedrock was underlaid by tough blue clay of unknown thickness. Ten holes 4 ft. deep were drilled into this clay, the bottoms sprung with one-third of a stick of powder, and 1-in. rods, previously upset, were cemented in and turned over at the top. The concrete was laid on this foundation. The concrete base was 9 by 9 ft., except where extended at each wing for the line-shaft. Fifty-two sacks of cement, supposedly of 100 lb. each, were used with sand and broken rock in the following proportions: for the lower half, 1 of cement, 4 of sand, and 4 of broken rock; upper half, 1 of cement to 3½ sand and 3½ broken rock.

The hold-down bolts for mortar, battery-posts, and battery-post sole-plates are all 1½ in. The bar through the battery-post is 3 in. diameter. This combination makes the most rigid battery-post I have seen, the lower part having so little vibration that it may be considered *nil*.

For foundations for battery, engine, etc., for a 5-stamp mill of this construction, it is well to provide 60 sacks of cement, 8 tons of sand, and 15 tons of broken rock. This will meet contingencies such as having to make deeper foundations than originally planned, cementing in ground, reinforcements, and other unforseen possibilities which may, and usually do, arise.

This mill, when started with new shoes and dies, crushed, as nearly as could be estimated without scales, about 1 ton of ordinary quartz per hour, through a 40-mesh screen, with 6½-in. discharge. This tonnage must be attributed to the rigidity of the heavy mortar base and concrete setting, to new shoes and dies, and, no doubt, in part to the character of the quartz.

DEVELOPMENTS IN MINING AND PUMPING

By W. A. Thomas

*In the matter of power development there is a notable tendency toward development of central energy plants for mining operations, instances being those of the Consolidated Coal Co. at Van Lear, Kentucky, with turbo-generators, condensers, and sub-station equipment; the Clinchfield Coal Corporation at Dante, Virginia, with the development of a 2000-kw. central energy plant and four sub-stations. The Homestake M. Co. at Lead, South Dakota, is just completing a 6000-kw. hydro-electric installation by diverting the Spearfish river through some 25,000 ft. of rock tunnels to a canyon, thus securing a 400-ft. head. The power will be transmitted approximately 15 miles to the mines.

The application of electricity to pumping has made remarkable advances, both in mining operations, municipal water works, and sewage plants; installations of importance being that of the Ward Shaft Association at Virginia City, Nevada, consisting of four 250-hp. completely-enclosed motors with forced ventilation by driving air first through cooling coils, then through the motors, and again through the cooling coils, the water pumped being at a temperature of approximately 145° F., 2500 ft. below the surface of the ground, and the water for the cooling coils being taken from the surface at approximately 80° maximum temperature. Another important installation is that of the Grand Rapids sewage disposal plant, to provide against flooded conditions owing to rise of water-level in the river. A very important development of the past year has been that of small self-starting direct-current motors for isolated pumping work in and around coal mines. These motors are made so that they can be connected directly across the line without injury, the advantage being that starting devices are unnecessary and the pumps can be allowed to run constantly; in the event of the circuit being opened, no injury will develop when the power is again connected to the line with the motor on the circuit. The lead of the Baldwin-Westinghouse companies in the matter of constructing steel-frame mine locomotives has been followed by others, and the past year has witnessed a great number of installations of this type of locomotive, thus reducing frame breakage to a minimum, making much stronger locomotives and permitting greater horse-power of electrical equipment on a given weight of engine.

*Abstract from *The Electric Journal*.

Tungsten and Its Occurrence

The ores of tungsten most commonly found are wolframite, an iron-manganese tungstate, hübnerite, a manganese tungstate, and scheelite, a calcium tungstate. Tungsten occurs in other combinations, but the three mentioned are the only important ores of present commercial value. The composition of wolframite and hübnerite varies greatly, but whatever the ratio of the constituent elements they each form a valuable ore when massive, or concentrated from a gangue. These three ores are usually heavy, so much so as to attract the attention when occurring in pieces large enough to form hand specimens. Wolframite has a density of 7.2 to 7.5, and hübnerite about the same. Wolframite has a hardness of 5 to 5.5. It can be scratched with the point of a knife-blade, making a dark, often nearly black streak, though the streak varies, being sometimes brownish black, yellowish brown, or greenish gray. In color the mineral is grayish black, black, or brownish red. It is occasionally slightly magnetic. Hübnerite is similar to wolframite in appearance, though usually of a somewhat lighter color, and a little softer than the latter. Wolframite fuses easily before the blowpipe flame, hübnerite less so. The pulverized mineral is decomposed by nitro-hydrochloric acid with separation of tungstic acid as a yellow powder. Wolframite is sufficiently decomposed by concentrated sulphuric acid, or even hydrochloric acid, to give a colorless solution which becomes intensely blue upon addition of a slip of zinc. Scheelite is a white, grayish, yellowish white, brownish, reddish, sometimes greenish mineral, with a white streak, and a hardness of 4.5 to 5, being easily scratched with a knife. Scheelite is also a very heavy mineral, density 5.9 to 6.1, being in this respect inferior to either wolframite or hübnerite. It looks much like feldspar, though it is softer and very much heavier. When pulverized it dissolves in nitric or hydrochloric acid, leaving a yellow powder soluble in ammonia. Fuses easily before the blowpipe. Further reactions will be found in any book on mineralogy. As to the geological occurrence of the tungsten minerals, they may be found in almost any formation, though most commonly in crystalline rocks—schists, granite, and gneiss. Wolframite is found in the Black Hills of South Dakota in coarse pegmatite granite dikes with cassiterite; in limestone with quartz, in the Providence mountains of California; in schist near Von Trigger, San Bernardino county, California, and in a similar formation near Yucca, Mohave county, Arizona. Hübnerite, like wolframite, occurs under much the same conditions and the two are often associated. One noted occurrence is that at Lead, South Dakota, where these minerals were found in quartzite. Scheelite is even more commonly distributed. It is found in granitic schist at Etolia, San Bernardino county, California; in a gold mine at Grass Valley, California; in the Cliff mine, in Virtue district, Oregon, near Baker City, where the scheelite carries gold. Tungsten ores are found in nearly all the Western mining States and also in some of the Southern and New England States. Any region of crystalline rocks, cut by numerous feldspathic dikes, is a good place to search for any of the tungsten ores.

Tungsten in 1910.—Owing to a stronger demand, the price for tungsten ores was higher in 1910 than in 1909, and the production therefore rose. The output as calculated from returns received directly from producers and millmen was the largest so far made in this country—1824 short tons, valued at $832,992. Prospecting and development, which have been proceeding more or less steadily in an increasing ratio for the past seven or eight years, have found new deposits and opened others, so that there is now a fairly ready response to market demands. The Boulder county, Colorado, field is still the largest producing section, and the Atolia, California, field is second. The ore mined in Boulder county is ferberite (iron tungstate). The Atolia tungsten ore is scheelite. The Atolia field is much smaller than the Boulder field, and gives a higher yield proportionate to area. Returns of 1221 short tons of ore carrying 60% tungsten trioxide have been made by Boulder county buyers and producers.

The production of 1910 is believed to be the largest annual output made by this or any other country to date, but the value is less than that of the output for 1907, which was 1640 short tons, valued at $890,048. Very high prices prevailed during 1907, and tungsten at one time during that year reached a price of $14 per unit (1% of a ton in tungsten trioxide). During 1910 prices ranged from $6.50 to $8.50 per unit for ore carrying 60% or more of tungsten trioxide. Leaner ores brought a lower price per unit. A little ore was sold as high as $9 or more per unit to buyers having special needs.

The production of concentrated tungsten ores in the United States since 1900 has been as follows:

PRODUCTION OF TUNGSTEN CONCENTRATE IN THE UNITED STATES, 1900-1910, IN SHORT TONS.

Year.	Quantity.	Value.
1900	46	$11,040
1901	179	27,720
1902	184	34,040
1903	292	43,639
1904	740	184,000
1905	803	268,676
1906	928	348,867
1907	1,640	890,048
1908	671	229,955
1909	1,619	614,370
1910	1,824	832,992

TIN MINING IN ARGENTINA

There seem to be possibilities of increased quantities of tin being secured from Argentina from mines now in operation in the Province of La Rioja. This mine employs 75 people, and has 2000 tons of mineral out. No tin has yet been exported from Argentina, lack of railway transportation being a detriment in mining development. The cost of transporting a ton of mineral to the seaboard from the mine referred to is approximately $25 gold, figuring on the completion of the railway line to Cerro Negro.

Discussion

Readers of the MINING AND SCIENTIFIC PRESS are invited to use this department for the discussion of technical and other matters pertaining to mining and metallurgy. The Editor welcomes the expression of views contrary to his own, believing that careful criticism is more valuable than casual compliment. Insertion of any contribution is determined by its probable interest to the readers of this journal.

Avino Mines Company

The Editor:

Sir—Replying to Ralph Nichols' letter of December 2, I beg to say that I examined the Avino mines during November and December, 1898, for my clients in New York, and was thoroughly convinced at the time that the property never would be a paying proposition. My clients thereupon not only declined to take any shares, but got their friends to dispose of those they had. After the crash I had the property again examined, in January 1906, by one of my best engineers, and he could find nothing that would encourage me to take up the property and operate it. What I meant, and what I still claim is, that in undertaking to concentrate the ore, a radical metallurgical error was made, but it by no means follows that the property could have been made a commercial success by other methods.

J. PARKE CHANNING.

New York, December 23.

Metallurgical Patents.

The Editor:

Sir—Though not immediately interested, I wish to protest against the insecurity of metallurgical patents. It is a disgrace to an otherwise clean profession that the best men and the most eminent firms are the worst offenders. The chief cause of infringements is, of course, the isolation of plants which often necessitates the manufacture of apparatus on the ground and renders suit difficult. Second, probably, is the greediness of some patentees who often dare not enter upon a suit and yet put a premium on infringement by demanding excessive royalties. There seems here an opportunity for a campaign of education in the hope of bringing about a better tone. It is generally advantageous to buy patented apparatus, thereby receiving the benefit of the patentee's experience, instead of putting in a poorly proportioned, home-made affair. Further, it removes the inducement to improve metallurgical practice when a metallurgical patent is merely a joke on the patentee. N. C.

Mercur, Utah, December 23.

Cyanidation of Concentrate

The Editor:

Sir—In view of the articles and discussions on 'Cyanidation of Concentrate' appearing in recent numbers of the *Mining and Scientific Press*, the following particulars of practice at the Waihi mine, New Zealand, may prove of interest. The concentrate (from Union vanners and Wilfley tables) consists chiefly of iron sulphide with a small proportion of zinc, copper, and lead sulphides; it is shoveled from the collecting-boxes into tubs holding about 600 lb. wet weight. Care is taken to keep the concentrate under water and the product from each of the three mills is daily sent to the concentrate-treatment plant. Some 500 tons are produced each month assaying about 5.5 oz. gold and 65 oz. silver per ton. The concentrate is ground in tube-mills and delivered to spitzkasten, the coarse returning to the tube-mills and the fine passing to dewatering boxes. It is difficult to say just how fine the concentrate is crushed, but when ready for treatment it is in an impalpable condition. Agitation by air is carried out in conical-bottom tall tanks, the solution being kept at an average strength of 0.4% KCy. Time of agitation varies from 8 to 10 days. The solution is then separated by filter-pressing, and bullion precipitated by the zinc filament. No trouble is ever experienced in obtaining satisfactory precipitation. Consumption of sodium cyanide averages 16 lb. per ton: this represents a consumption of 0.25 lb. per ton of original ore. The cost, including labor, repairs, and renewals, power, transport, cyanide, zinc, flints, and sundries, is about $6.25 per ton: this represents 10c. per ton of original ore. The extraction has been uniformly good, as shown by the following figures:

		Gold, per ton.	Silver, per ton.	Extraction— Gold.	Silver
Year.	Tons.	Oz.	Oz.	%	%
1904	1,992	7.65	98.25	95.1	92.0
1905	3,719	6.65	96.35	95.5	93.3
1906	4,692	5.68	81.00	95.6	94.7
1907	5,581	5.40	66.75	95.7	94.3
1908	6,061	5.44	66.00	96.3	93.0
1909	6,339	5.60	63.30	96.3	93.5

E. G. BANKS.

Waihi, New Zealand, November 22.

Avino Mines Company

The Editor:

Sir—In the recent issues of the *Mining and Scientific Press* reference is made, by several well known engineers, to the Avino mines, of Mexico. The articles would lead the public to conclude that there are no two engineers who hold the same opinion of the property. It is to be regretted that the discussion was opened without first giving an unbiased review of its past history. Had this been done, there would have been no occasion for this contribution, the object of which is to throw some light on its earlier career. Engineers who open such discussions in the public press should remember that aside from the fact that these controversies are interesting and instructive to technical men, they owe it to their clients to confine the discussion, as far as possible, to technical matters. The public is apt to misconstrue or magnify some brief remark which would be quite harmless in technical circles. Once a subject of this nature is opened for discussion, and the financial results are publicly questioned, it remains for those engineers who have committed themselves on the merits of the property to defend themselves. In this case I consider an engineer's reputation more sacred than the profit and loss account of a corporation.

The several publications show a wide difference of opinion. Undoubtedly much of this difference

is due to misunderstanding. The opinions were derived from different viewpoints—mining, metallurgical, and financial. Furthermore, it is quite evident that some are discussing the mill ore, while others refer to the smelting ore. If all the engineers who have had to do with Avino—and they are many—could be called into consultation and instructed to make a joint report on the property, I believe some astonishing results would be disclosed. I believe that after the conference every member would frankly admit that some part of his past criticisms had been based on false impressions, or a misunderstanding of facts. I also believe that all of the mining engineers could sign a unanimous mine report, and all of the metallurgists could sign a similar metallurgical report, but I do not believe that the two classes of engineers could sign a joint mining and metallurgical report. One must be thoroughly familiar with the peculiar conditions existing at Avino to understand why I draw this distinction. The trouble in the past can be attributed directly to the mining engineers, not with their mine reports, but with their metallurgical opinions. They seem to think their mine report is incomplete unless they recommend a metallurgical process, and usually do so without even the assistance of a metallurgist; in fact, they have done so, contrary to the metallurgist's views. This policy has cost the Avino shareholders millions of dollars, because the directors are unable to disinguish between the two professions.

I first saw the Avino mines in 1896. They impressed me favorably. The property was then owned by the Diaz family. Up to that time practically all the ores had been treated raw by the patio process of amalgamation. From the Diaz brothers I gathered much valuable information regarding the metallurgical properties of the ores. They acquainted me with their experiments on certain refractory ores, whereby they found it necessary to roast with salt before treatment on the patio. Lead was of no value to them, and copper they avoided in mining. In 1899 I returned to Avino as metallurgist to the Avino Syndicate. Prior to that time the new owners had tested the ores by crushing in Chilean mills and concentrating on Wilfleys. I spent nearly a year in a 5-stamp mill, testing all the various classes of ores by concentration, pan-amalgamation, and chloridizing roasting, followed by lixiviation with hyposulphite of calcium. Concentration gave very poor results, amalgamation not much better; in fact, it was impracticable on certain ores carrying oxidized copper minerals. Lixiviation gave very satisfactory results. My report condemned concentration and strongly favored lixiviation. Contrary to my advice, concentration was decided upon, and my connection with the company ceased. After concentration had been the practice for 13 months, I returned to Avino as superintendent of reduction works. I found the mill running smoothly, but the metallurgical results were even worse than I had predicted. The resident manager gave me the following brief account of the year's work, which I will record from memory as best I can, using his words:

"You of course know that the consulting engineer instructed Fraser & Chalmers to design and equip this mill to treat 300 tons of ore per day. Mechanical difficulties have been many. The hardness of the ore was underestimated. More rolls had to be added to the primary crushing. The Chilean mills used to re-grind the jig middlings were unsuitable and had to be replaced by rolls. We have now 10 sets of 12 by 36-in. rolls to crush 300 tons per day. The design of the roll shells, with three-quarter-inch bevel, requires that the shells be shrunk on the cores. With this cherty ore the shells slip and sometimes burst. Our frequent shut-downs are due mainly to repairs to rolls. The repair costs in the crushing plant are excessive. The flow-sheet called for the 12 double four-compartment jigs to treat three sizes of feed, from 7 to 1 mm., and for the jigs to make concentrate, middling, and tailing. The middling only was to be re-ground and to join the original undersize as feed for the 12 Wilfley tables. Coarse crushing would not release sufficient of the disseminated minerals to allow of discarding the jig tailing. The re-grind equipment was not originally designed to treat the tailing, nor were there sufficient tables to treat the tonnage we were expected to put through. The failure of the mill resulted in the release of the consulting engineer. Since then the directors, as well as Fraser & Chalmers, have had several concentration experts here, and many improvements have been made. We are now treating a little under the estimated capacity, re-grinding practically all the jig tailing, and losing value in the slime. A couple of canvas-tables, now treating slime, would indicate that some success might be attained in that direction. One roasting-furnace and a few tanks are now regularly treating a small part of the slime by leaching with 'hypo' and the results from that experiment are very satisfactory."

This was the condition of affairs when the mill was turned over to me in 1901. After carefully studying the results, it was very clearly shown that the 96 jig compartments were producing silicious concentrate and consuming a lot of power and water, as well as making a very poor extraction. The plant was shut down for alterations and additions. Eight of the twelve jigs were discarded. The remaining four were cut in half, making double two-compartment machines, or a total of 16 compartments. Six large V-shaped classifiers replaced all the finer trommels. Thirty-six stationary canvas-tables, of the Dimmick type, were installed. The old and new flow-sheet, according to my memory, was approximately as follows:

	Old system.	New system.
Tonnage	275	150
Primary crushing	6 mm.	1.5 mm.
Jig feed, 3 sizes	6 to 1 mm.	
Jig feed, 1 size		1.5 mm. to about 40-mesh
Concentrate produced from jig	Bedding	Hutch
Re-grind to	1.5 mm.	About 16-mesh
Wilfley feed	Sand and slime	Sand
Canvas-table feed		Slime

The extraction was nearly doubled. The concentrate, on the whole, was less silicious. Within a

few months a point was reached where any additional extraction cost more than it was worth. We had reached the economic limit of concentration without being able to pay expenses. The plant was closed down on my recommendation, the concentration machinery removed, and several hundred thousand dollars charged off to depreciation. I recommended lixiviation. Ottokar Hofmann was sent to Avino to investigate. He approved all of my recommendations. The Board appointed Mr. Hofmann consulting metallurgist to the company. It was distinctly understood that the capacity of the leaching plant should not exceed 100 tons per day, and that in the event of the process being successful, profits should be looked for from additional capacity to be added later. The old mill and power-plant were made use of, as far as possible, and the new process started in the latter part of July 1902. With the starting of the plant, labor difficulties developed which were more important to solve than the treatment process. After breaking in the furnace crew, it was necessary to replace them with Japanese laborers for a month or so until another crew was brought in from outside districts. The labor question was serious for three months and effective for five months. July to December results show that the plant treated but half its capacity. The labor difficulties paralyzed the roasting department, where hand-stirred reverberatories were in use. Chloridizing roasting of silver-copper ore is an art which requires skill and experience. During those trying months, with new furnacemen to break in every few days, the art was not recognized. Each succeeding month gave lower costs and higher extractions. A complete clean-up was not considered advisable, on account of the impression it might make upon the labor agitators. But the value of locked-up metal was conservatively estimated and the net smelter and mint returns increased each month, giving promise of much higher results. Taking November and December collectively, an average of 48 tons per day was treated. After charging every possible expense, in Mexico, to that small tonnage, the financial books showed a loss of less than $600 U. S. currency, per month. These results were obtained from the average low-grade mill ore. They are by far the best results ever secured by the company. The company was reorganized. The new management called for a complete change of staff from consulting metallurgist to foreman. I was relieved in December, my foreman a week or so later. In January the first and last clean-up was made. It totaled far in excess of the estimates, a surprisingly large surplus of silver sulphide being found in the pressure-tanks, sufficient in fact to wipe out several months' losses. The process, in my opinion, was successful. Apparently the new management did not think so, because the plant only ran a few weeks after I left. Old and trusted employees, men in whom I had every confidence, who remained in the mill after I left, report that the calcium sulphide was not properly prepared, resulting in the 'hypo' solutions becoming very caustic, rendering the silver chloride insoluble. Whatever the cause, the process was condemned, and abandoned by my successors. Had those in charge at the time even laid any claim to the title of metallurgist, or chemist, or if they had even claimed to have had any previous experience with the process, or if they had understood the chemistry of it, their right to condemn it might have carried some weight. I still have confidence in the Avino mines, and in the success of the leaching process.

F. N. Flynn.

Clifton, Arizona, January 2.

GOLD IN PRETORIA

According to the *South African Mining Journal*, Pretoria now has a gold mine as well as diamond mines. It says: "The report of the discovery of a promising reef southwest of Pretoria brings to mind the work which has been going on upon the farm Mooiplaats, on the Hennops river, in the same direction. This property was first opened up to a small extent before the war. The occurrence is an apparently irregular body of quartz associated with diabase, which breaks through the dolomite in this neighborhood. Some wonderfully rich pannings are obtainable here and there, and a good deal of the float shows good value. As is usually the case with occurrences of that kind, however, extreme irregularity, both in the matter of value and size of vein are the leading characteristics, which militate against the chances of continuous and satisfactory mining unless a large amount of opening up is insisted upon. Owing to the high results of sampling over a comparatively small area, a 10-stamp battery was erected on the property some months ago. After a brief run, the ore supply gave out, and since that time the efforts of the manager have been almost entirely devoted to a search for the lost reef. It was reported lately that valuable quartz had again been struck."

THE BEGINNING OF HYDRAULICKING

The first hydraulic mining of which there is authentic record, was at Yankee Jim's placer camp in Placer county, California, three miles west of Forest Hill. A ditch was dug along the hillside, and from this a flume was built toward a small ravine where the mine had been opened. This flume was carried out until it had reached a point 40 ft. above the ground. Here the water poured into a barrel, to the bottom of which was attached a hose or pipe of rawhide. The nozzle was a tin pipe about 4 ft. long, and shaped like an ordinary horn, having an opening of 1 in. diam. at the end. With this small and simple apparatus, E. E. Mattison, the inventor, proved the superiority of his device over shoveling, and the idea was at once adopted and quickly improved and enlarged.

To Prevent Rust.—It is said that articles of iron or steel boiled in a solution made by adding 4 oz. of phosphoric acid and 1 oz. iron filings to 1 gal. of water, will form a black non-corroding coating over the surface of the metals, thus preventing oxidation.

Concentrates

Most of these are in reply to questions received by mail. Our readers are invited to ask questions and give information dealing with the practice of mining, milling, and smelting.

Coal and gold veins do not frequently occur in close proximity, but there are instances of such occurrence.

No legal location of a mining claim can be made without proper discovery. This is the first requisite of all locations.

Vapor from cyanide of potassium is fully as dangerous as when it is in a solution. Fumes from the chemical, its dust, or solution are equally deadly.

Corundum is aluminum oxide. Little aluminum has ever been made from corundum, although a few years ago it was thought that this mineral would be extensively employed for this purpose.

Mine maps are an absolute necessity. No mine can be properly and safely operated without accurate maps, and the work should be kept close up to date, never more than a month behind, and a week is better.

A millsite cannot be appropriated on land known to be mineral. It is not necessary to own a mine in the vicinity, or at all, to 'take up' a millsite on the unoccupied public lands of the United States. Five acres may be taken for a single millsite location.

Stinkstone is the name given to some porphyries, limestones, quartz, and other rocks which emit a peculiar fetid odor when struck by a hammer or beaten together. Curiously, it is rarely that quartz possessing this peculiarity is valuable for the gold it contains.

Zincblende occasionally is found which when scratched in the dark shows a faint phosphorescent light, called fluorescence. This has been mistakenly called radium by some. Blende possessing this peculiar property is not more valuable than that which does not have it.

Work done in a placer cannot be counted as 'assessment work' done on a quartz location on which the placer occurs. The annual labor for the quartz mine must be done for the direct benefit of the quartz location, either on the vein itself, or in the solid rock, such as driving an adit or sinking a shaft to reach the vein.

A track grade of 5 in. in 100 ft. is the average on good tracks. Poorly laid tracks of light rails and heavy cars should have a heavier grade. The grade on curves should always be heavier than on straight tracks. It pays to construct good substantial tracks with well made switches. The added first cost is soon repaid in saving of time.

The Sutro tunnel was run a total distance from the portal to the Comstock Lode of 20,016 ft. The lateral branches of the tunnel are about of equal length. It was one of the greatest mine-tunnel enterprises of the world, and was accomplished under great disadvantages—mechanical, physical, and financial. It cut the Lode at a depth of 1640 ft. in the Savage mine.

By arkose sandstone is meant a sedimentary rock consisting chiefly of the essential constituents of granite. Much of the sandstone of the coast range of California is of this character. It is evidently the débris of disintegrated granite. It is in rock of this character that most of the quicksilver deposits of California occur, and are usually associated with intrusions of serpentine.

Pitch pine makes a very durable mine timber, and will not rot, but is more brash than that of a less resinous character, and therefore not to be depended upon to the same extent as ordinary pine timber. Moreover, pitch pine takes fire very readily, and for this reason is even more dangerous than ordinary pine. It is wholly a matter of opinion whether timbers in tunnel sets will last longer if placed butt end up, than if placed butt end down. It is doubtful that there is any difference.

Posts and caps for drift sets have been molded from gravel, sand, and cement, and placed in mine workings, but have thus far been in the way of experiment. Ordinarily the miner uses whatever is most convenient and least expensive at the moment, having little regard for the distant future. The far-seeing manager, however, is more likely to contemplate ultimate results, and he may see more virtue, or economy, in concrete, or steel, mine timbers than the miner who more closely scrutinizes first cost.

Miners when selling a prospect or mine, usually demand cash. A certified check is sometimes used in mining deals. Such a check is an excellent thing to have in these cases, as it is as good as money and safer. The check is guaranteed by the bank against which it is drawn, that institution holding a sum equal to the face of the check for the person to whose order it was written. This money cannot be withdrawn from the bank by the original depositor, unless the certified check be returned to the bank unendorsed.

Gold in limerock is by no means unknown. There are several occurrences of gold in calcite, in crystallized limestone, and in massive limestone in California. Gold was found in a calcite vein in the Carbonate mine, near Oro Grande; in crystallized limestone at the Alvord mine, and in similar rock near Rabbit Spring in San Bernardino county; in each instance the rock was rich in coarse gold. In the Blackhawk mountains 45 miles east of Victorville gold occurs in gray limestone, and at several places in both Mariposa and Tuolumne counties, California, gold is found intimately associated with calcite, forming high-grade ore. Although there is an abundance of lime-soda feldspar (andesine), in the Calico district, no calcite has ever been recognized in the veins of the region.

Special Correspondence

ST. PETERSBURG, RUSSIA

Four Districts and Their Mineral Characteristics. — Manganese and Oil Industries in the Caucasus.—Iron and Coal.—Gold Mining.

Russian mining districts are four in number—the Caucasus, the Donetz Basin, the Urals, and Siberia. Each of these has its characteristic minerals. The first has oils, manganese, and copper in great abundance; the second is limited practically to iron and coal; the third includes iron, gold, and platinum as leading minerals; and Siberia, gold. As to the Caucasus, its mineral prospects, as foreshadowed by operations this year, may be said to be fairly divided. Manganese is for the moment hopelessly strangled by reason of the high freights prevailing. These have made it impossible to export manganese from the Caucasus, which up till a few years ago held the premier position in the world. Unless prompt measures be taken for its resuscitation, it is possible that the most gloomy forebodings of those directly interested in the industry may come true and the manganese business of the Caucasus be little more than a historic record. Respecting oil, which has been the principal industry of the Caucasus, the production since the beginning of the year, particularly in the later months, shows that notwithstanding every effort to improve the position, the oil won in the Baku area of the Caucasus is diminishing in quantity. When the new lands are put up at auction, probably the quantity will be increased; but the old wells will be in process of exhaustion. It would not therefore be safe to say, even if all the available Baku petroleum lands be brought into production, that anything like the old level of over 600,000,000 poods a year is going to be reached again. Farther west at Grozny, on the other hand, the production of petroleum has been growing for many months, and what used to be 30,000,000 poods per annum is going to be well over 60,000,000 poods this year. Grozny already turns out more than 10% of the total Russian production of petroleum. Farther north, in the Kuban province, is the famous Maikop area which, though long known as petroliferous, has recently developed gushers at a number of places, some of them of extraordinary abundance. These occurrences are recent and are the result of experimental boring and have attracted a large amount of English capital. The English houses are boring industriously, but hitherto it was houses like Spies, and pioneers like Prince Saltykoff and Mr. Selitrennikoff that carried off the prizes as far as successful boring goes. It is a promising field, though limited in extent. Wild enthusiasts have staked tremendous areas as petroliferous. There is little doubt that only a small portion thereof will yield payable oil. There is nowhere else in Russia, unless in Turkestan, where oil is yielded in anything like equal quantities, and the Turkestan field is a doubtful one. It has not maintained the promise it gave when oil was first reached; but, on the other hand, it has a fine inland market. There is practically nothing to compete with it. It is away, as far as is known at present, from any other oil sources capable of competing. The island of Tcheleken on the eastern side of the Caspian Sea, very rich in oil, asphalt, and kindred minerals, remains a mystery. The curtain is only lifted from time to time to announce some wonderful progress made there in point of development and exploitation, but it is promptly lowered again and all becomes mystery.

In the Donetz Basin, in respect to iron, it is difficult to get statistics of the production of the mines, and if such were obtained this year, they would not afford reliable data, either comparatively with past years, or as indicating prospects in the future. The iron industry of the South suffered from large reserves carried forward from the preceding year, and this was complicated later on by the cholera epidemic which caused great numbers of workmen to abandon the mines and return to their homes. The consequence must be that the year's total results will be disappointing. The same observation applies to coal. As a matter of fact, the coal production is known for a certain number of months and shows a decrease. This may be attributed, in the first place, to the reason given above, and in the second to the fact that since the price of petroleum came down, large numbers of consumers have abandoned the solid for the liquid fuel, which they had given up when it became dear after the 1905 disturbances.

The iron mining and heavy metallurgical industries of the Urals have been under a cloud for a long time, many of the works having been shut down for want of business, largely due, it is said, to competition from the South, the Donetz Basin, which by reason of its superior organization by foreigners, is able to produce iron and iron goods so cheaply that the railway carriage over the immense distance between that basin and the Urals does not present an effective obstacle to its competition in the Urals district. As to copper, there are three districts where this is produced in great abundance. In the Caucasus the increase in production is so great, amounting to 30 to 40% as compared with last year, that at this rate of progress the Caucasus must at an early date become an exporter of copper. There are no figures available to show how much ore is raised from the mines. This last observation applies equally to the copper fields of the Urals and Siberia, but in both these great copper areas progress is astounding. In these northern latitudes this progress is largely due to English initiative and enterprise, but there are Russian houses, too, with some historic houses, such as the Demidoffs and Bogosloff companies, which alongside their English rivals, so to speak, are largely contributing to make northern Russia and Siberia reliable copper-producing countries. The first eight months copper production over the Empire was 930,153 poods, against 607,640 poods last year's corresponding period. This is an increase of 36.2% over all the areas. The Caucasus increase, to which special reference is made above, amounted to 38.6%. Little need be said of platinum. It is purely a Urals industry. To dilate on it would simply be to repeat what has been said a hundred times before. The only novelty in connection with it is that the price of platinum has reached a record high level, and consequently the producers are working at high pressure. Probably when the figures are published for the year, some time about April or May next, it will be found that 1910 was a record year in the production of platinum. Manganese mining is an industry of the Urals also, but relatively the production is small and, the ore being too cheap to stand heavy railway carriage, it is only of local significance. There is also a considerable production near Nikolaieff, near the Black Sea. Some of this is exported, but it is largely used in the local iron works. There is one industry which will probably soon become important in Russia—that is phosphate mining. Agricultural centres are waking up to the value of mineral fertilizers, and the Government chemists, and more particularly the Royal Imperial Technical Society, are taking a lively interest in the production of superphosphates. Both phosphates and pyrite are found in considerable quantities in Russia, and consequently the material for producing useful mineral fertilizers is at hand. Still, large quantities of sulphuric acid have to be imported, because the deposits of pyrite and phosphates are not always convenient to each other.

The fever which was characteristic of the gold industry for some years has now completely cooled down. There is no longer any excitement on the goldfields, either in the matter of staking claims or in the promotion of new companies. It may be taken that all the unhealthy concerns floated are looked upon as dead, and only the substantial, good companies are working. These are doing good business. The leading gold companies of Russia are the Lena Goldfields and the Bogosloff. Then there are the Kishtim and others, all of which are doing well. The Lena, particularly, after many years of trial during which it was necessary to borrow extensively, is now producing record quantities of gold, has paid off debts and is clear of encumbrances. This, it is claimed by Englishmen, is largely due

to their intervention. On the other hand, Russian shareholders maintain that the greatest interest in shares held in the Lena fields lies in Russian hands, and they show a strong disposition to fight for their rights, declining to allow the English to do what they like with this Siberian property. Little need be said of Northeast Siberia, news from which appears chiefly to indicate that there is a tri-national struggle for mastery there. It lies chiefly between Americans and Russians, the Japanese intervening. The situation is by no means clear. The district is immensely wealthy in gold; but is entirely unorganized and unpromising, until the Russian Government puts the economic situation on a recognizable basis. In the Urals placers are being rapidly washed out and vein gold will have to be relied upon. Of this there are many signs. Geological surveys and other investigations have revealed that when technical exploitation takes place the veins will yield handsome returns to investors. In Siberia generally, the gold is alluvial. That does not mean to say that there is no vein gold, but the immediate future of the gold industry lies in gravel washing. Just now this is done mostly by hand, but if the country is ever to get much beyond its present state of gold industry development, dredging alone can do it. In the Amur province, on the other hand, along with alluvial, vein gold is more prominent than in other parts of the Empire, but here again, we have international complication. Russia may propose, but the Chinese, by reason of their proximity and the ease with which they can flood the country with workmen, will probably dispose. Here also the situation needs clearing up.

Salt is obtained in large quantities in various parts of Russia, such as the Caucasus in south Russia proper, and near the Caspian, as well as other parts, but it can only be called of local interest, as it cannot be said to affect the world's market. Other mining interests worthy of note in Russia, but of no great outside account, are asbestos, which is mined extensively in the Urals and Altai, and zinc, which is purely a Polish industry. A certain number of precious stones are won in the Urals and Siberia, but they are of the second or third-class order. As to technical matters in mining operations, nothing notable has arisen further than the fact that on the surface aerial tramways have become common, both in the coalfields and in the goldfields; and electricity is very largely employed underground in the Urals and Siberian mines, chiefly on properties run by foreigners. Poland need not enter into this review. It is a large producer of coal and iron with little significance for the outside world except in so far as it affects Austria and Germany.

FAIRBANKS, ALASKA

A Prosperous Season in 1910.—Innovation in Tunnel Driving.— Promising Quartz Prospects.

A prosperous season in this district has just closed. The production of gold for the year has not fallen much short of that of last year. The Seattle assay office reports a decrease of over $1,000,000 for Alaska, but part of this is accounted for by the fact that a large quantity of bullion has been shipped this year to San Francisco. Besides, in one of the banks at Fairbanks several operators have melted their own bullion, shipping it to other points. In this district the cream of the placer ground is being worked out, and while the lower-grade ground is fairly profitable, much of it has been abandoned for the present in favor of the newer camps. While development of quartz mines has progressed steadily, bullion from this source cannot supply the deficiency caused by decreased placer production. The encouraging progress made on several properties indicates that a substantial production can be expected from the quartz properties next year. While the Rhodes-Hall property was one of the first to show commercial ore, not much development has been done this summer owing to causes not connected with the property. The ore taken out last winter has been milled. From the Crawford lease, on a block 50 by 100 ft., close to $20,000 was produced, the ore averaging $150 per ton in free gold; and the quartz taken from the main tunnel, now in 800 ft., is being milled, returning as much as $150. There are now backs available in the main tunnel worth many thousand dollars, while the ore below is still untouched. Development consisting of driving an adit on the vein, is in progress. Close to this property on Willow creek the Tolovana Mining Co. is developing with hand-labor, and with funds supplied from the proceeds of ore broken. A recent run of 12 tons gave bullion worth over $1100. The Spaulding-Clough property has been prospected on the surface during the past season. This winter the 60-ft. shaft, in which $50 ore was found last spring, will be again opened and development work pursued. The Willow Creek claim, belonging to Herschberger, Buell & Phipps, has been producing ore that is now ready for shipment. This claim was leased by Mr. Buell. On Wolf creek, where some rich ore has been taken out by Horton & Solomon, a 200-ft. cross-cut has been driven this summer to open the vein. A novel method in tunnel driving has been used here. Instead of drilling and shooting, steam points with Burleigh bits have been used. With 24 hours steaming the schist crumbles and can be readily mucked out. This method has proved economical and rapid, and was discovered by noticing that a piece of schist placed on the boiler crumbled after 24 hours' application of heat. Lawrence McCarty has been prospecting at the head of Wolf and Fairbanks creeks and has made several mill-runs of his ore which averaged $70 to $80 per ton; while the owners have machine-drills available, they will not be used till threatened litigation is settled. These are the only machine-drills so far brought in. The litigation between the Butler-Petree and the Rex Mining Co. has been settled in favor of the Rex. About $30,000 has already been spent on the Butler-Petree, a 160-ft. incline shaft and several prospecting levels having opened a vein from 4 to 8 ft. wide, the ore assaying about $30. The Pioneer Quartz Mining Co.'s property on Chatham has been cross-cut on the hill to open the vein. A lease on the lower end of the claim is being worked by P. R. Colvin. A test shipment of ore to the Fairbanks mill ran $60 per ton.

Two leasing companies are at work on the Fredericks lode. On the lower lease a level is being driven on a 7-ft. vein; on the upper lease a 75-ft. shaft has been sunk and some good ore found. This lode was discovered by prospectors walking through a railroad cut. The rock ballast at that point has given assays as high as $100 per ton. Glazier & Crockett have the lower, and Ernst Peterson the upper lease. Samples taken from ore sacked for shipment on the upper lease have assayed $150 to $200 per ton. On the divide between Vault and Wild Cat creeks, Hoel Bros. and Johnson & Witmer have opened two good prospects. One vein varies from 15 to 20 ft. thick and carries high-grade ore. Ore from a smaller vein milled over $40 per ton. A 2500-lb. lot sacked without sorting gave these returns at the Fairbanks mill. Two shafts have been sunk on these properties, one 50 ft. deep and the other 70. As the four partners mushed in over the trail last spring, the locating and development of the two veins represents less than a season's work. Besides the Vault Creek properties, Sam Hoel has located a lode at the head of Dome creek. The left limit of Fairbanks creek has been the scene of the most promising discoveries of the year. M. T. and A. H. Cook have traced and located a series of veins on a group of 10 claims. A 60-ft. adit has been driven into the Excelsior that exposes a 7-ft. vein, carrying from $10 to $20 in gold and from $15 to $30 in silver. The adit is being extended to tap a smaller vein cropping on the surface that assays high in gold. A prospect shaft on the Plumbum opened a 15-ft. vein, containing $5 in gold from wall to wall, with a foot of oxidized lead on the foot-wall, carrying 220 oz. silver. While the Plumbum and Excelsior are nearly parallel and seem to cross Fairbanks creek, smaller veins carrying high-grade gold ore have been found that almost parallel the creek. Beginning with a foot of high-grade ore on one claim that pinched to a few inches at the frost line, the shoot at 40-ft. depth has widened to 5 ft. Thirty inches

of $20 ore has come in on the foot-wall, the rest being a high-grade decomposed quartz, assaying up to $700 per ton. Above this group of claims, on the left limit of Fairbanks creek, August Hess has traced and is opening a vein of high-grade white quartz. Below the claims of Cook Bros., Goyette & Jacobson are sinking on a 2½-ft. vein, the dip of which changed from north to south at a depth of 30 ft. A shipment of ore will soon be made to determine its value. While these cases show how much a few prospectors have accomplished this year, there are other discoveries too numerous to mention that are lying idle for want of money to buy grub and powder. As this situation is clear to everybody, two companies are being formed that should help matters considerably. Sufficient funds have been pledged by one to bring in 2 core-drills the first of next season. The object of the company is to prospect the existing orebodies and take an interest in the claims as part or all payment for work. Labor cost being a big item here, these drills should be useful and successful along this line. E. H. Mack is promoting the company and reports the support of local capital. A leasing and contracting company, that purposes to bring in equipment for power-drills and other necessities of economical mining, will probably operate here next year.

BLACK HILLS, SOUTH DAKOTA

Black Hills Conditions in 1910. — Labor Situation. — Important Developments of the Year. — Homestake Water Power System. — Dredge at Mystic.

January 1, 1910, was far from a happy holiday in the Black Hills, South Dakota. With every mine, from the great Homestake down, suspended on account of labor difficulties, the outlook was anything but bright. Commencing late in the previous summer, with the Homestake as the main point of attack, the action of the Western Federation of Miners made it necessary for all of the operators of the region to suspend. Suspension of operation on November 24, 1909, by the Homestake was followed by a suspension of all Black Hills properties. The Homestake, early in January, began recruiting a new crew, numbering old employees who swore allegiance to their employers as against the Federation, and miners brought from the neighboring States of Missouri, Kansas, Colorado, Michigan, Wisconsin, etc., and operations were gradually resumed until by the middle of March the mine had again reached its full capacity. Since that time it has operated uninterruptedly. The neighboring properties then made moves looking toward resumption, with the result that by June all were again operating to capacity. The 'card system' is now almost universally used in the mines of the Hills, and an employee must state over his signature that he is a member of no union. On January 21, the 200-ton cyanide mill of the Wasp No. 2 Mining Co., at Flatiron, was destroyed by fire, but was later rebuilt on an enlarged scale, the new plant having been put in operation on December 1, last.

Two important ore discoveries were made in the Black Hills during the year, one of which was made in the Golden Reward, where, during the summer, an orebody was opened that several months' development has shown to have a length of over a quarter of a mile, a thickness of about 14 ft., and a width of close to 300 ft. The Golden Reward's 250-ton cyanide plant at Deadwood is to be increased to 500 tons capacity; and a roaster is to be built to give the ore from the new shoot a preliminary treatment that will make it amenable to the cyanide process. This is one of the biggest discoveries ever made in the Bald Mountain district and assures the Golden Reward a mill supply for many years. The second discovery was made at Carbonate, where the Black Hills Development & Financial Corporation, locally known as the 'Bunce deal,' opened the old workings of the Iron Hill, Seabury-Calkins, Home Run, and other well known producers. One of the important showings in the property is a blanket deposit of jasper ore, containing about $6 per ton in gold. This orebody is considered amenable to cyanidation. Other ore contains galena and hornsilver. In November it was announced that a smelter would be built early in the year 1911. Except during the time of suspension on account of labor difficulties, the other Bald Mountain properties operated to good advantage. The Mogul company, the largest producer, kept its Bald Mountain mines and Pluma mill active, working as high as 340 tons per day. The Lundberg, Dorr & Wilson cyanide plant at Terry, operated on its own ores and those from the Portland and P. H. Bertschy's lease on Imperial territory. Late in the summer the Portland Mining Co., which by purchase recently largely increased its mining area, proposes erecting an aerial tramway to connect mines and mill. The Reliance M. Co. has been reorganized and financed to carry on the operation of its property at Bald Mountain. One of its problems is the disposition of its tailing. The mill is situated on Annie creek, above the Homestake hydro-electric plant, and the spring rains have twice washed out retaining dams and allowed the tailing to run into the Spearfish. The latter has been enjoined against polluting Spearfish creek, and may build a substantial dam and discharge the tailing dry, instead of sluicing it. A body of

New Wasp No. 2 Mill, Flatiron, S. D.

pyritic ore, in the workings of the Gilt Edge-Maid company, gave assurance of an abundant supply of pyrite, and work has been begun on a pyritic smelter at Galena, two miles down the gulch from the mine. A concentrating plant and experimental smelter are to be erected. The Homestake's Spearfish hydro-electric installation has been completed and contracts have been let for the equipment of the power-house. Tunnels totaling 23,862 linear feet, 7 by 9 ft., cross section, carry the water approximately three-fourths of the distance from the intake to the penstock. The power-house will contain three 3000-hp. overhung Pelton water-wheels, three 2000-kva. A. C. generators, ten 667-kva. oil-insulated, water-cooled transformers, two 100-kw. 3-bearing motor generator sets and one complete switchboard. The Westinghouse Electric & Mfg. Co. has this contract. The completion of the tunnel work and the letting of contracts for equipment mark the beginning of the end of a stupendous task, actual work on which was begun two years ago, and the completion of which is anticipated about the middle of 1911. During 1910 the Homestake company promoted the organization among its employees of the Homestake Employees' Aid Fund. Under its plan of operation each employee contributes $1 per month, and the company binds itself to donate not less than $1000 each month. A graduated scale of benefits has been adopted. The Alder Creek company, being financed by F. B. Hitchings, of Chicago, states that a big cyanide mill will be erected early this year to treat ore from its ground, adjoining the Wasp No. 2.

A Colorado company has about finished building the first gold dredge in this district at Mystic, on Castle creek, where the ground was thoroughly tested. The dredge will be driven by electricity, and its operation will be watched with much interest, and its success may lead to other installations of this kind on Castle and Rapid creeks. Tin milling was conducted during the summer and fall by the Tinton company, and results were so encouraging that it is announced the plant is to be enlarged next summer.

GLOBE, ARIZONA

Interesting Data Concerning the Newer Mines of the District.—Activity and Progress.—Miami Mill.

The Inspiration Copper Co. continues its exploration work, both with churn-drills and in underground workings. This company is probably getting better results than any other company operating in the Miami district, since practically all the work with the churn-drills and that underground are continually opening new orebodies and adding to the valuation of the property. At present two of the company's churn-drills are being used for exploration, while the other four are used in blocking out the orebodies already discovered. Sinking in the Joe Bush and Colorado shafts continues, and ore of commercial grade is being found in the latter. In all the holes recently drilled the average grade of ore found has been much higher than when drilling was first started; in some of the holes samples assayed 3%. The concentrator of the Miami Copper Co. is rapidly being finished and there seems no question that everything will be in readiness to begin operations about February 1. The road to the portal of the tunnel through which the concentrate will be hauled is ready and the tramway from the railroad in Miami should be finished in the next two weeks. Steam was turned on in the new boilers on New Year's eve, and all the new machinery tried worked satisfactorily. With the exception

Globe, Arizona.

of a few minor details the concentrator is in condition to start treating ore. In the exploration department the churn-drills being used in the northwestern part of the property continue with 12-hour shifts, three of which are averaging 35 ft. each per day. The Apache Copper Co. has started work on its property situated six miles northeast of the Old Dominion mine, at the foot of the Apache mountains. Considerable work was done on these claims a few years ago and some shipments of ore were made that sampled as high as 10% copper. A resumption of work on these claims may result in a new producer for the Globe district. The Pfister brothers, of Pittsburg and Globe, are in charge of this work. The Warrior Development Co. started shipping its ore to the smelter at El Paso the first of the year, instead of to the Old Dominion at Globe as heretofore. Its daily shipment amounts to about 100 tons, but the intention is to increase this by 25% in the near future. The ore being shipped consists of the usual high-grade chrysocolla that samples 10% copper. The orebody in block 40, that was opened some time ago, and in which development work has been carried on lately, shows a considerable tonnage of commercial ore of the same character. M. E. McCarthy is in charge of the work at the property and has about 75 men employed. The California adit, on the property of the Copper Reef Consolidated Mining Co., is now in 530 ft., and it is expected that within the next 25 ft. the California lode will be cut. In the inclined shaft on the North Star claims a depth of 435 ft. has been reached; the last 25 ft. of sinking was in the hanging wall. At 400 ft. the vein that this shaft has been paralleling was opened and ore found that assayed 12% copper, and about 30% iron. The intention is to continue sinking until the 500-ft. level has been reached, and after a station has been cut a cross-cut will be driven to the lode that was opened at 400 ft. The stockholders of this company will hold their annual meeting in Globe the first Monday in February. The Summit Copper Co., purchaser of the Gibson property eight miles west of Miami, is in position to ship ore averaging 30% copper. In the course of developing and blocking out the low-grade ore, much high-grade chalcopyrite has been found that it will pay to haul by wagon to the railroad at Miami, and in the next six weeks shipping will be started. At the present rate of extraction an average daily shipment of about ten tons can be made. Bins have been constructed near the new vertical shaft, close to the wagon-road. The Gibson mine, as this property was formerly known, holds a high place among the mines of the district; for the past six years it has produced more high-grade copper ore than any other mine in the vicinity of Globe, and from the developments since the ground was taken over by the Summit people it would seem that it will be able to maintain this reputation. A station is being cut at 200-ft. depth, and when this is completed a level will be driven east and a raise made to connect with the old workings to provide ventilation. It is probable that a body of ore will be developed in the driving of this level, as it will be along the Pasquale vein in which ore assaying 4% copper was found on the 300-ft. level. In cross-cutting west on this level a vein of ore was opened in which some of the richest ore was found. In the north drift on the 300-ft. level a winze was started on the high-grade chalcopyrite ore that was found a short time ago, but at 10 ft. the flow of water was so great that sinking was discontinued; the ore will be reached later from below, when the cross-cut on the 400-ft. level is completed. This vein when discovered measured about 9 in. wide, but with a little development it widened to 2 ft., samples of the ore assaying 35% copper. With the exception of the old Pasquale adit, which was the first work done near the new shaft, and a few stopes from this adit, from which some ore was taken, little work was done by the former owners, and indications are that the Pasquale is richer than the Summit vein that was worked by the original owners. In the old workings, on the Summit vein, repairs are being made in the drifts and everything being put in readiness for ore extraction. In one part of the old workings there is a body of ore extending from the 400 to the 300-ft. level, and about 30 sets wide, which assays about 5% copper. Raises made on both sides of this orebody make it possible to estimate its extent. When this mine was formerly shipping, ore that assayed less than 25% was not considered of value, and it is estimated that there is over 100,000 tons of ore on the dump that will sample from 5 to 8% copper. In December two tons of this ore was sent to an Eastern firm which is to make tests to determine the best method to treat the ore, as well as the kind of machinery required. At present about 60 men are employed underground and on the surface workings, Charles Myers being superintendent.

TORONTO, CANADA

The Railroad to Porcupine. — Many Claims Purchased in That Camp. —Progress of Development.—Cobalt Dividends.—Coniagas.

Excellent progress is being made with the construction of the branch line of the Temiskaming & Northern Ontario railway to the Porcupine gold camp. The number of men at work is about 250, and this force will be doubled in January, or as soon as laborers can be procured. The clearing of the right of way is almost completed. Freight and passenger rates by the winter sleigh road have been considerably reduced, the prevailing freight-rate from the railroad being 70c. per 100 lb. A number of properties are changing hands in anticipation of a boom. One feature, ominous of coming wild-cat flotations, is the readiness of promoters to pick up locations anywhere within the area, regardless of whether any actual discoveries have been made. Among recent transactions is the purchase of a number of claims by the Newman-Mancha-Johnston syndicate, composed of Louisville, Kentucky, and Haileybury,

Ontario, investors, the locations obtained including the eight Healey properties in Del Oro, the Ritchie group of four claims, and the two Mancha locations in the same township. Development work on some of these has begun, resulting in finding good ore. Young Bros., of North Bay, Ontario, have bought for about $10,000 the Tisdale claim of W. S. Edwards, who was connected with the Dome. A New York syndicate has an option on ten claims owned by Fred Harris, John Novack, Silas Howson, and Willard Pooler. The Hollinger, some of the stock of which was recently put on the market, and which is about the only non-dividend issue that is holding firm during the holiday depression, has 70 men at work and several finds have been made. The main shaft is down 175 ft. and it is stated that the ore taken out at this depth is equal to that on the surface. Percy A. Robbins, who has been for some years in charge of the McKinley-Darragh of Cobalt, has been appointed manager of the Hollinger at a salary of $20,000 a year. He will also have charge of the milling company and look after the other Timmins interests. The Dome company has placed a contract for a 40-stamp mill.

The total dividends paid by Cobalt mining companies for 1910 amount to $7,902,000, or including the estimated profits of the O'Brien, a close corporation, to $8,302,000. A calculation of dividends yielded since the establishment of the camp, including estimated returns of close corporations and mines when under private management, gives an aggregate of $25,342,355. The Nipissing heads the list with returns of $6,340,000, followed by Kerr Lake, $2,730,000; Crown Reserve, $2,653,221; and La Rose, $2,079,185. The total number of mines which paid dividends during 1910 is 11. At the annual meeting of the Coniagas a report was presented showing a surplus of $952,402. The revenue for the fiscal year was $1,010,433, the expenses being $256,524, leaving a net profit of $753,888. The Coniagas Reduction Co. treated during the year 1788 tons of ore and shipped 2,726,609 troy ounces of refined silver. The cost of production was 13.28c. per ounce. In the east drift on the 300-ft. level of the Beaver an 8-in. vein carrying smaltite and high silver content has been tapped. This is not a new vein, but tests at the upper levels show nothing equal in richness to the ore at depth. High-grade ore has been opened at the 300-ft. level on No. 3 vein of Hargrave, about 80 ft. from the Kerr Lake boundary. Driving on the same vein 60 ft. above this is in progress in high-grade ore. The shareholders of the Trethewey have ratified the proposal to increase the capital from $1,000,000 to $2,000,000 for the purchase of other properties. A number of the Gowganda mines shut down for the Christmas holidays. The Bartlett has sunk a shaft 100 ft., and obtained good ore in a crosscut at the 40-ft. level. The power-house and machine-shop were recently burned, but the machinery was not injured, and the damage will be repaired. The shaft of the Boyd-Gordon is down to 200 ft., and will be sunk lower. Crosscutting is being undertaken to open the vein at present depth. The Reeves-Dobie people have begun concentrating low-grade ore, the stamp-mill having a capacity of 20 tons per 24-hr. day. The Miller Lake-O'Brien and the Millerett companies are taking out high-grade ore for winter shipment. The Canadian Government, in order to encourage the copper industry, has passed an order in Council, providing that no royalty shall be charged on the products of copper mining locations for 10 years from January 1911. H. M. Ami, for 20 years connected with the Canadian Geological Survey, has applied for superannuation on account of continued ill-health.

CENTRAL AMERICA

Sale of the Bonanza Mine.—A Recent Flotation in England.—Scarcity of Labor.

The Bonanza mine has been sold, subject to the owners' securing title from the Government to a claim protecting the dip of the lode. The claim desired is one of the Dietrick concession, and it is understood that an arrangement has been made whereby the owners of the concession will interpose no objection to the acquisition of this claim as part of the Bonanza group. The Santa Rita mine and mill are operating, and producing $1000 to $1500 per month, part of which is being applied in liquidating indebtedness. The Jicaro Gold Estate, formerly operated by an English company which opened the San Christobel mine, was floated in London recently at £75,000. Conditions generally in Nicaragua are becoming settled, and the mines on the western side are operating again, though labor is scarce. In fact, the greatest difficulty in operating in any part of the country is the matter of obtaining sufficient labor. The Oroyo Exploration Co. has exercised its option on the Babilonia mine in La Libertad district, and is putting in a plant on the Leonesa. The Javali and San Juan are operating, the former having 10 and the latter 5 stamps dropping.

SPOKANE, WASHINGTON

Brief Resume of Operations in the Coeur d'Alene.—Noteworthy Revival at Republic.

The Coeur d'Alene district, in the northern part of Idaho, which is credited with one-third of the annual lead output of the United States, has had a year of marked activity in development and production. The record of the year was characterized by the adjustment out of court of the litigation that had been pending between the Bunker Hill & Sullivan M. & C. Co. and the Federal Mining & Smelting Co. for the possession of certain mineral holdings in the Wardner part of the district; by the completion of the

Bunker Hill & Sullivan New Mill.

Idaho Northern railroad from Enaville into the Murray and Pritchard Creek region; and by the addition of several mines to the list of ore-producers. The Bunker Hill & Sullivan company, standing at the head of lead-silver operators, put the first unit of its new concentrating mill in operation last summer, and since then has been concentrating an average of 1350 tons of ore per day in its two plants; the second unit of the new mill is expected to be ready for work in the next three months. This mine is entered through the Kellogg haulage adit, which starts near the millsite and extends 10,000 ft. to the ore-zone, cutting the vein at about 2400 ft. depth on its dip of 45°. While the greatest ore output still comes from the workings above this haulage level, recent development has been continued to a depth of 600 ft. below it; and at the collar of the interior shaft that starts on this level an electric hoist is to be installed. The Federal company is mining at Wardner, Mace, and Mullan; and is operating three concentrators. There are large ore reserves exposed in the mine of each of these groups, though the settlement made with the Bunker Hill company results in diminishing the importance of the Wardner group. It is understood that the company contemplates doing extensive development in new ground, and that it is in the market to purchase other properties. On August 31, 1910, it had a cash surplus of $1,015,109. The Caledonia and Stewart mines, both in the Wardner country, have been operated successfully the past year, the latter concentrating its ore in a leased mill; the former is practically a new mine. The Success mine, near Wallace, is perhaps the most successful zinc mine in the district. A mill is operated by which zinc and lead concentrates are made. The Gold Hunter, a lead-silver mine at Mullan, has

been opened to great depth by adits and winzes, and over 200 tons of ore per day is being concentrated. The Snowstorm, yielding copper ore, has been developed by a number of adit-levels, the ore shipments amounting to 100 tons per day. The mine force has been lately doubled. The Hercules, one of the richest lead-silver producers in the Coeur d'Alene, is situated near Burke. It produces a big tonnage of first-grade ore, and a larger output of concentrating ore, the latter being milled at Burke. The ore is graded at the company's sorting plant, situated at the mouth of its No. 4 adit. The mine is opened by four adit-levels, the lowest of which taps the orebody at a depth of 1700 ft. The Hecla M. Co., which developed its mine at Burke by means of a 1200-ft. shaft, with levels leading from it to the orebodies, has modern electrical equipment for hoisting and has good facilities for sorting and concentrating. The progress made this year in Murray district has been characterized by extensive development, considerable production, and mill construction. The building of the railroad from Armsted, Montana, to Salmon, Idaho, has greatly stimulated the mining industry in Lemhi county, Idaho, which comprises silver-lead and gold mining.

The most pronounced revival of a hitherto lifeless mining district has taken place at Republic, where the Republic Mines Corporation has mined and sold ore sufficient to pay $225,000 for the mine, which it held under option, and to pay dividends to its stockholders in the amount of $100,000, all during 1910. The ore from which this revenue was derived was taken from stopes not more than 150 ft. below the surface. As the result of this success other mining and leasing companies have become very active in that district. Not less than ten properties are being developed in the vicinity of Orient, on the Kettle river; and two or three of these, notably the First Thought, are satisfactory ore producers.

NEW YORK

Carnegie Trust Co.— Morgan Interests in United States Steel. — The Copper Situation.—Influence of Copper Porphyries.— Calumet & Hecla.—Arizona Copper Company.

The culmination of the troubles of the Carnegie Trust Co., with which, however, Andrew Carnegie was in no way associated, has been a feature in New York financial circles. Charles C. Dickinson, its late president, had become interested in an alleged process for transmuting base metals, and was stated to have been injured by the inhalation of fume while seeking to witness the transmutation taking place in the crucible. The Trust company has long been known in the Street as a weak spot, and relief was felt when it was known that the State Banking Department officials had taken charge. Two or three other smaller institutions, built up by Morse-Heinze methods, were taken in hand at the same time by the larger banks headed by J. P. Morgan & Co., and Mr. Morgan is again being recognized as the official towing and salvage cruiser in Eastern financial waters. It is also recognized that the salvage so exacted is heavy. J. P. Morgan & Co. is considered the head of a financial organization that dominates the banking situation in the East. In addition to the annexation of another group of banks the Morgan interests are credited with advancing their influence in United States Steel. The recent resignation of William E. Corey as president is looked upon as the end of the Carnegie influence, and the surrender of the field to the Morgan crowd, headed by E. H. Gary.

The forecasters have been busy figuring out some arrangement for the early formation of a copper merger, to be headed by Mr. Corey, or by George W. Perkins, till recently a partner in the house of Morgan & Co. The copper merger is believed to be dependent upon the outcome of the cases now before the United States Supreme Court, in which the interests of the Tobacco Trust and Standard Oil Co. are involved. The copper situation is becoming critical. The curtailment policy, much talked of as stabilizing the market, appears to have failed of its purpose. The producers apparently are favorable to restriction of output provided 'the other fellow' does the restricting. December production was 123,339,219 lb.; that of November was 119,353,463; October, 126,469,284; September, 119,519,983 lb., showing plainly that the output, if decreased at any time during the past half-year, has not yet made itself felt in the refinery product. Some consolation is being extracted from the fact that copper stocks showed a net decrease for the month of 8,358,874 lb., but this is due chiefly to the export of 88,104,075 lb., which is considerably larger than for any single month since the association began its monthly compilations. Domestic deliveries shrank from 60,801,992 lb. in November, 67,814,172 in October, and 64,501,018 in September, to 43,594,081 lb. in December, showing that consumers have returned to their former position of allowing the sellers of copper metal to carry the load of metal, adopting again a policy of buying only for immediate needs. It is not alone present production that makes the situation critical, but the output of the copper-bearing porphyries must be reckoned with. Miami, Ray Consolidated, Chino, Inspiration, and Mason Valley are nearing the time of initial production. For the year production increased 46,717,996 lb. over 1909, and the deep-level mines and the steam-shovel properties will alike be obliged to co-operate without regard to which party may or may not be responsible. The consumers are looked to for the betterment of the situation as compared with a year ago and for a net decrease of surplus stocks of 19,735,916 for the year. The Calumet & Hecla merger may not have plain sailing. The holders of Isle Royale are understood to be strenuously objecting to the proposed deal. Isle Royale was controlled by the Bigelow interests, which, when the control was in contest two years ago, tried to enjoin the Calumet & Hecla in the Michigan courts, claiming a conspiracy was afoot to force a consolidation. This suit is in a way still open, the court having said that if at any time the Calumet & Hecla attempted to force a merger the court could then act. In the interest of future peaceful conditions the various companies in the Globe camp, operating in the porphyry district, including the Miami, Live Oak, Keystone, Inspiration, and others, have executed a side-line agreement, which will eliminate possible disputes in the course of operation. J. Parke Channing, who is credited with having fixed the ratio of exchange upon which the various companies are to go into the Calumet & Hecla merger, having completed that work, is again giving his attention to the development of the Miami. Mr. Channing has been in Arizona for some days awaiting the commencement of operations at the new plant. The Miami mill has some original ideas Mr. Channing put into effect, and the Miami crowd and the Guggenheim people are watching for results with interest. The Ray Consolidated and Chino mills are both being modeled after the Utah Copper and Nevada Consolidated plants, and there is some rivalry as to final results between the Miami and the other two companies. Miami has been quiet in the New York market for some time.

Recent cable dispatches announce the death of John Gill, of Edinburgh, Scotland, for many years chairman of the Board of Directors of the Arizona Copper Co. Early last year Mr. Gill was in this country and was engaged in several long conferences with the Cole-Ryan interests, who were at that time endeavoring to secure a controlling interest in that company. It is stated that an offer of 50s. per share was made for the control, Mr. Gill's price being 70s. Together with other coppers, the market in Arizona has eased off and the stock is now selling around 30s. per share. It is claimed in Boston that the United States Smelting, Refining & Mining Co. is planning to re-open the Richmond-Eureka property in Nevada, having recently purchased the old Eureka & Palisade railroad.

There has been a stimulation of interest in the Nevadas by reason of the Tonopah Mining Co.'s excellent record for the last month of the year, which amounted to $194,000; the highest previous months were April and May of last year, which ran $184,000 each. The showing of Tonopah Mining and the development of the Tonopah Belmont into a mine has aroused new interest in precious metal mining.

General Mining News

ALASKA

The report of the Alaska Treadwell Gold M. Co. for the month ended December 15, 1910, was as follows: Mill time, 30 days. The 240-stamp mill ran 24 days, 25 min.; water power, 3 days, 2 hr., 26 min.; steam-power, 20 days, 21 hr., 59 min. Ore crushed, 27,619 tons; concentrate saved, 569.94 tons. The 300-stamp mill, water-power, ran 8 days, 2 hr., 56 min. Ore crushed, 13,990 tons; concentrate saved, 304.37 tons. Estimated gross value of free gold, $62,729.01; estimated gross value of base bullion, $893.26; estimated gross value of concentrate, $44,671.06. Total, $108,383.33, less $527.58 for 195 tons from 700 Ft. Claim, $107,855.75; total realizable value, $106,777.20. Operating expense, $93,277.31; net operating profit, $13,499.89. Construction expense, $17,735.33. Yield per ton of ore milled, $2.59. Stock of ore broken, 68,691 tons. Development work, 847 ft., 195 ft. in ore, 652 ft. in waste; assay-value of ore, $1 to $3.51 per ton.

The report of the Alaska Mexican Gold M. Co. for the month ended December 15, 1910, was as follows: Mill time, 30 days. Full mill of 120 stamps ran 29 days, 7 hr., 52 min.; water-power, 6 days, 2 hr., 16 min.; steam-power, 23 days, 5 hr., 36 min. Ore crushed, 17,347 tons; concentrate saved, 374 tons. Estimated gross value of free gold, $30,537.13; estimated gross value of concentrate, $32,727.40. Total, $63,264.53, less $1209.42 for 671 tons from 700 Ft. Claim, $62,055.11. Total realizable value, $61,434.56. Operating expense, $35,959.86; net operating profit, $25,474.70; construction expense, $2770.06. Yield per ton of ore milled, $3.57; stock of ore broken, 1672 tons. Development, 459 ft., 271 ft. in ore, 188 ft. in waste; assay-value of ore, $2.28 to $4.62.

ARIZONA

MOHAVE COUNTY

The Needles Mining & Smelting Co., a subsidiary of the United States S. R. & M. Co., owns and is operating the Tennessee, Banner, and Champion mines in Chloride district, the ore mined from them being shipped to the company's concentrator and smelter at Needles, Cal. Sinking is in progress in the Tennessee shaft, now at a depth of about 500 ft., the intention being to sink to 1200 ft., and the property is to be explored and developed at that depth. The product of the mine is lead, silver, iron, and zinc ore. The Union Basin M. Co., operator of the Golconda mine in Cerbat range, during 1910 shipped 242 cars, or 8712 tons, of ore averaging 47% zinc, accompanied by some gold, silver, and lead. Besides paying for development and improvements, the company has paid dividends amounting to $70,000. John Boyle, Jr., one of the principal stockholders, is the general manager. The Tom Reed Gold Mines Co., in the month of December 1910, extracted gold and silver bullion of the value of $75,500. The mine, stamp-mill, and cyanide plant are in Goldroad district.

YUMA COUNTY

It is announced that the smelter at Swansea, belonging to the Clara Consolidated Gold & Copper Co., is to be put in operation this month. The Copper Lead Development Co. is sinking a shaft, and doing other development work on its property near Swansea. It is said there is 1000 tons of gold and copper ore ready to be hauled to the smelter.

CALIFORNIA

AMADOR COUNTY

(Special Correspondence.)—The shaft at the Lincoln has been retimbered to the 450-ft. point, and the drifts on the 500-ft. level are being drained. As soon as this has been accomplished, a reservoir will be constructed to hold the surface-waters, and all the drainage from the Wildman & Mahoney mines, which connect with the Lincoln at the 500-ft. point. With the completion of this reservoir, a cross-cut will be driven to the west in hopes of intersecting the rich west vein of the South Eureka. The shaft will be unwatered to the bottom and cross-cuts extended from the 650, 800, 1200, and 1950-ft. levels. The Argonaut company has placed an order for a 500-hp. electric hoist. This will replace the engine at present in use. The management is planning for more extensive operations this year. Excellent ore reserves have been opened in the lower workings. The Bunker Hill continues to disburse regular dividends of 5c. per share monthly. On the 1950-ft. level the vein has been opened about 500 ft. and has a width of close to 20 ft., the bulk of the ore being of milling grade. It is expected to have the 20 additional stamps in operation about February 15. It is reported here that the Amador Queen No. 1 mine will be re-opened at an early date. The 1200-ft. shaft will be unwatered and east and west drifts extended. The property was recently bonded to C. D. Porter of San Francisco. The South Eureka shaft has been placed in good condition and operations are to be resumed. During the period of inactivity the company has paid regular monthly dividends of 3c. per share out of the treasury. The Kennedy continues its normal output. Good ore is being mined in the vicinity of the 3500-ft. level, and recent developments have proved satisfactory. The 100-stamp mill is operating steadily.

Jackson, January 12.

IMPERIAL COUNTY

The mine and 40-stamp mill at Hedges are in operation with a force of 200 men. This property is in the eastern part of the county, 5 miles north of Ogilby station, on the Southern Pacific. The Southern Pacific Co. is to be paid $773,000 by the United States Government for the work it did three years ago in stopping the overflow of Imperial valley by the Colorado river. The company asked for $1,600,000.

KERN COUNTY

Ore is being mined on two veins of the Butte Lode mine at Randsburg. That being taken out and milled by E. Baldwell yields $50 per ton. James Rice, another lessee, has 75 tons ready for the mill which is reported as assaying $100 per ton.

SIERRA COUNTY

It is claimed that H. L. Johnson, of the Tightner mine, at Alleghany, recently shipped gold bullion of the value of $75,000, and that the gold for this shipment was recovered from 1200 lb. of quartz.

TUOLUMNE COUNTY

(Special Correspondence.)—The Spring Gulch mine is to be unwatered preparatory to the operation of the property, which, with the Somerset, is held under bond by W. B. McCubbin and George Ash. The latter claim is being developed, and the find made several weeks ago insures good returns when the milling of ore is commenced. The Mohican mill will be in operation again in about six weeks. A small force of miners has been steadily employed in development, and a supply of ore will soon be available, some of which is of high grade. It is reported that a body of ore 65 ft. long and 18 in. wide, assaying $600 per ton, has been uncovered in the Glanelli mine, near Arastraville. The Gold Ship Mining Co. expects the arrival soon of three Westinghouse transformers and a Byron Jackson pump for its gravel property near Groveland. The electric transmission line has been completed. The property is to be equipped for the economical extraction, crushing, and washing of gravel by next spring. Some development work is being done at the old Tarantula mine, near the Rawhide. The 20-stamp mill at the Tarantula, is reported as about completed and will be started in a few days. Eighty men are employed at the App. A pump capable of discharging 20 in. of water per minute, and which will be operated by electric power, has been installed at the 300-ft. level in the Jumper. A contract has just been let to make a 200-ft. raise, and much other new underground work is contemplated. With the completion of the surface improvements the Jumper will be among the best-equipped mines on the Mother Lode. The site upon which for more than a half century has stood St. Ann's Catholic church, at Columbia,

is to be the scene of hydraulic mining operations, the ground, but a few acres in all, having been sold to T. C. Crawford, of London, who is interested in mines on the Mother Lode near Jamestown. The work of exhuming the remains of the dead from the church cemetery has been finished, and the brick edifice will be razed to the ground. This spot is probably the only piece of virgin ground in that neighborhood, and is known to contain gold in paying quantity, the land surrounding the premises having long since been entirely overturned by the placer miners. Secret efforts were once made to extract some of the rich gravel from the church lot by means of a tunnel driven from adjoining property. It is even asserted that the bricks of the old edifice contain gold, having been made from auriferous clay of a nearby hill which was subsequently mined. It is reported that rich ore has been found in the New Albany mine, one of the group of properties owned and operated by the United Mines Corporation. A deep shaft is to be sunk at the Hidden Treasure mine, in the Groveland district, owned by M. N. Laufenburg, of Stockton, and others. A 2-ft. vein of $8 ore was discovered on the Lone Star group while cross-cutting to tap the Lucky Find vein. The adit will have a length of 350 ft. when the objective point has been reached. The new vein was found 250 ft. from the mouth of the tunnel. It is understood that work here will be increased in the spring. The property is situated a few miles northwest of Confidence, and is owned by J. W. Watters, of Santa Cruz. It is predicted that there will be great mining activity in the vicinity of Crocker's this year, several rich properties opened by prospectors during the last several months having passed to the hands of men having ample funds for development.

Tuolumne, January 14.

COLORADO

CLEAR CREEK COUNTY

(Special Correspondence.)—The Wide Awake mine, on Sherman, recently purchased by Otto Shatz of Denver, is again undergoing development. The adit, now in 500 ft., is to be driven farther. The Ohio and Mapleton claims, on Kelso, have been purchased by Eastern parties, and it is stated that development will be commenced at once. In the breast of the adit an 8-in. streak of ore is exposed that mills 65% lead and 55 oz. silver per ton. Another shipment of galena, consisting of 30 tons, was sent out last week from the Josephine mine. The usual returns of $65 net were realized. Work has been resumed in the adit being driven on the Centennial vein, on Leavenworth. A body of mill dirt 12 ft. wide is being followed that averages $14 per ton in gold and silver. All of the electrical equipment for the Malm electro-chemical plant has been placed in position. It is stated that the plant will be ready to start ore treatment some time in February. James Humphrey, who holds the Edgardine property under bond and lease, is developing. The adit is to be driven to cut under the old shaft where ore was mined that milled as high as $300 to the ton in gold and silver. Griffith & Co., leasing on the seventh level of the Little Mattie, made a shipment last week that sampled 5.02 oz. gold and 16.50 oz. silver to the ton. The Treasure Vault, on Seaton, at Idaho Springs, is producing the highest grade ore milled in Clear Creek county. A shipment was made last week that assayed $200 per ton. One ton of first class is now sacked that will mill close to $2000 per ton. R. R. Graham & Co. are owners. A car of ore from the Kinda mine last week sampled $35 per ton. The Ben Harrison, at Freeland, is now a steady shipper. Ten tons of ore is being broken daily that assays $60 per ton.

Georgetown, January 11.

GILPIN COUNTY

The ore shipments at Black Hawk from Gilpin county mines for 12 months, from December 1909, to November 1910, inclusive, are as follows: December, 2875 tons; January, 3175; February, 3075; March, 3275; April, 3350; May, 2600; June, 2850; July, 1900; August, 2175; September, 2075; October, 2150; November, 2275 tons, making a total for the year of 31,765 tons of crude ore and concentrate. To this should be added 23,000 tons hauled from Gilpin county mines to Idaho Springs, and 2280 tons shipped at a station on the Moffat railroad, giving a total of 57,045 tons shipped from this county.

LAKE COUNTY

The Iron-Silver M. Co., the properties of which are on California gulch, Leadville, is having exploration work done from the Tucson shaft. This prospecting is being extended into the blue limestone to find bodies of zinc-carbonate believed to exist there. Similar work is to be carried on from other shafts of this company for the same purpose. Work on the Progressive group, on Fryer hill, is to be resumed this month. The property is now in control of the Mound City Mines Co. of St. Louis, for which H. L. Sisty is manager. The surface plant is being put in order, and the first work will be to unwater the shaft, and this is to be followed by an examination, and exploration work. Recent development on the New Monarch, Little Ellen hill, has resulted in opening several veins of ore, varying from 4 in. to 2 ft. in width; the lowest samples showed $15 per ton. The Little Chief, on Fryer hill, has been leased to M. L. Hoffer, who has sunk a new shaft 145 ft., and intends to continue sinking till he reaches 300 ft.; driving for the ore will be started at the latter depth. The Durkin mine, Fryer hill, has a big body of lead-carbonate ore which was exposed by the caving of an old iron stope. E. Brady and partners, the lessees, have made a drift some distance in the orebody and are making shipments. The Helena, on Iowa gulch, is being prepared for the installation of an electric pump in the main shaft. A cave that occurred in the higher workings exposed lead ore, considerable of which is being hoisted. The Matchless shaft has been retimbered, and the miners now employed are taking out 50 tons of ore daily. The Big Chief, on Carbonate hill, has a body of zinc-carbonate on one of the upper levels, and exploration on the lower levels is in progress to discover similar ore that is believed to extend into this property from mines lower on the hill. Shipments of zinc and lead ores from the Big Chief amount to 75 tons per day.

MINERAL COUNTY

The Commodore mine, at Creede, which belongs to A. E. Reynolds and others, is being operated this year by the owners, under the superintendency of Harry Van Horn. Previous to December 1 the property had been worked for a long time by lessees. The Amethyst is in the hands of a new company.

SAN JUAN COUNTY

The Iowa-Tiger Leasing Co. mined and concentrated 3000 tons of ore in December, shipping 425 tons of concentrate, that sampled about 0.9 oz. gold, 8 oz. silver, and 45% lead. For the two years ended December 31, 1910, the Iowa and Tiger mines, from which the product above mentioned was taken, produced ore valued at $400,000, and the lessees on the property in that time paid the Iowa Gold M. & M. Co. $50,000 in royalties. Those mines are in Silver Lake basin, at an altitude of 12,000 ft. above sea-level, and about 2200 ft. higher than the railroad track on the Animas river. The mill is situated half way between the mine and the railroad; an aerial tramway, about two miles in length, serves for transporting ore to the mill and concentrate to the railroad branch extending from Silverton to Eureka. The names of the other mines of the Silverton region, from which concentrate was shipped in December, are as follows: Ledge, 475 tons; Colorado & Arizona, 150; Hercules, 825; A. Pearson, 50; Sunnyside, 175; E. Zanoni, 50; Silver Lake, 125 tons. The Dives lease, Shenandoah, Queen City, Brooklin, Green Mountain, Yankee Girl, and others produced an aggregate of 400 tons for the month, which was shipped crude. A number of mines which are closed down for the winter are expected to be put in operation later in the year, among which is the Highland Mary, which is opened by adits on Cunningham gulch. There has been considerable activity in this region the past few months, though the work is mostly done by lessees. One of the important operations is the driving of the Joker tunnel.

IDAHO

BEAR LAKE COUNTY

L. A. Jeffs and M. S. Duffield of Salt Lake are opening a deposit of calcium phosphate near Paris, and they expect to find a market for a considerable tonnage of it in California for use as a fertilizer. The Oregon Short Line Co. is building a 12-mile branch from Montpelier to Paris.

LEMHI COUNTY

The Leesburg Gold M. & M. Co., which owns and operates the Italian mine at Leesburg, has opened a 20-ft. vein of ore, samples of which assay $75 per ton in gold. This ore was found at a depth of 95 ft. The company has a 30-stamp mill on the property, and employs about 40 men. Equipment for electric power is being provided. Leesburg is 15 to 20 miles west of Salmon City. The Allie M. Co., operating at Gilmore, contemplates erecting a mill for crushing and cyaniding gold ore, of which it is estimated to have 18,000 tons accessible, that assays about $13 per ton.

SHOSHONE COUNTY

(Special Correspondence.)—The Marsh M. Co., for which A. A. Booth is manager, has leased the mill of the Pittsburg Lead Co., situated on Nine-Mile creek, three miles from Wallace. Some new machinery is to be installed and the mill will be put in operation about April 1. The Marsh mine is at Burke. The Knickerbocker Mines Co. of Spokane is developing the Charles Dickens property near Kellogg, and in sinking a winze from the No. 3 adit a vein of shipping and milling ore was opened. The depth of the winze is 120 ft., and it is to be sunk deeper. The new working shaft, sinking on which began some time ago, is to be sunk farther by contract. James Neilson, E. H. Averill, W. H. Winfree, Edward Evans, F. G. Morrison, and C. Van der Zwaal are among those interested. A 2000-ft. adit has been driven on the Echo ground, near the Hercules mine at Burke, the heading of which is expected to cut the vein at a short distance farther. The Echo is controlled by persons in the Coeur d'Alene. Work has been resumed on the Butte & Coeur d'Alene mine, which has a 400-ft. shaft. Present work consists of driving on the 400-ft. level. Several lots of lead-silver ore have recently been shipped.

MONTANA

BROADWATER COUNTY

(Special Correspondence.)—The Ohio-Keating G. M. Co., having eight claims in Radersburg district, is to resume operations about February 1. The electric power line has been extended from the Keating to the Ohio-Keating, and the shaft equipment is said to be ready for using the power. The property has been opened to a depth of 220 ft., the last 100 ft. being in ore of commercial value. R. M. Calkins, of Seattle, George M. Borquin, W. H. Penfield, C. H. Smith, and J. F. Oppenheimer of Butte are directors of the company.

Radersburg, January 9.

SILVER BOW COUNTY

(Telegraphic Correspondence.)—The fire which broke out on the 1200-ft. level of the High-Ore mine January 14, is the most serious in its possible consequence of any fire in the history of the camp. The High-Ore drains all of the Amalgamated mines. There are numerous connections with all the other mines. The gas drove out all the miners from the North Butte, Mountain View, Modoc, and other mines. Through the courtesy of the Butte-Ballaklava Copper Co. the fire is now being fought from that property, as it is the only point from which the fire can be reached, since the shaft affords the strong down draft. This shaft was promptly tendered, and turned over to the Anaconda company for this purpose, and the air-line has been converted into a water-line for making hose connections in order that the streams of water might be thrown on the fire. The fire stopped the pumps on the 2800-ft. level of the High-Ore mine and drove out the men from the main central pumping plant of the Amalgamated company on the 2200-ft. level. The water pumps are now working, but on the 2800-ft. level, though no longer flooded, the pumps are still out of commission. Guards have been placed at connecting workings and several of the mines can now be worked. The Ballaklava mine is free from fire and smoke, as it was promptly bulkheaded against the fire until the Anaconda company was allowed to tear down the fire doors to get access to the fire area. The lower levels are flooded as a result of the generosity of the Butte-Ballaklava company in turning the air-line over to the Anaconda company, thus stopping the Ballaklava pumps.

Butte, January 18.

NEVADA

CHURCHILL COUNTY

The Nevada Hills Con. M. Co. is sinking a new 3-compartment shaft which is to serve the two mines of the company—the Fairview and the Eagle. The new shaft has a collar of concrete, and a steel head-frame is to be erected. The flow of water into the lower workings has increased, and the company is figuring on an increase of its pumping facilities. The extension of the electric-power line to Fairview is in progress.

LYON COUNTY

The Mason Valley Mines Co. is making progress with the work of constructing its smelting plant at Wabuska to smelt the ores of Yerington district. Thus far the work has been confined to putting in the concrete foundations for the principal buildings, including those for ore-bins and warehouse. The plant is being constructed under direction of Jules Lebarthe, who is reported as stating that power is to be supplied by the Truckee General Electric Co., which is to extend its transmission line from Virginia City to Wabuska.

WHITE PINE COUNTY

(Special Correspondence.)—It is expected that the Steptoe Valley Smelting & Mining Co. will try California fuel-oil under its No. 5 reverberatory furnace, and if found satisfactory it will equip its entire plant for using this fuel.

Ely, Nevada.

The storage tanks are situated at such an elevation as will permit oil to be supplied to the entire plant by gravity, and if the experiment prove satisfactory supply pipes will be laid to all parts of the plant. The question of fuel-supply has always been an important matter with the Steptoe company. Even with the waste-heat boilers at the furnaces it requires an enormous amount of coal to make steam for the generation of the 5000 hp. which is the average requirement of the plant. All coal is shipped from Wyoming and Utah, and as it is necessary to maintain a large supply, considerable loss has resulted from fires in the stockpile and from deterioration. It is estimated that the Steptoe plant would require about 1500 bbl. of oil per day if the plant were equipped for oil burning; and it is possible that all engines of the Nevada Northern railroad and the dinky engines engaged in the removal of the overburden at Copper Flat, as well as the steam-shovel engines, may be equipped with oil burners. The cost of installation will be large, but if a saving can be made, and a more satisfactory fuel secured, it will prove a good investment in the end.

The milling of tungsten ore by the United States company, operating near Osceola, is a new industry in Nevada.

which promises to be of much importance. It is expected that the first shipment of concentrate will be made to New York within a few days. The crude ore contains from 1 to 50% tungstic acid. The mill has a capacity for handling 100 tons of ore per day, being equipped with crusher, coarse and fine rolls, jigs, Wilfley tables, and Isbell vanners. Water is supplied by a 6000-ft. ditch, discharging into a pipe-line 600 ft. above the plant. The property is opened by a tunnel, and the mining is done by air-drills operated by a water-driven compressor. The ore is trammed from the tunnel directly to the ore-bins at the mill. The vein crops frequently along the surface for a long distance, apparently showing the best ore at higher elevations. It is probable that mining this class of ore will prove very profitable to the company. E. L. Fletcher of Ely is the manager, and the company is controlled by Oscar A. Turner, formerly of Tonopah, and his associates of Philadelphia and Baltimore. The Telluride Power Co. contemplates erecting a power plant on Cleveland creek, about 30 miles east of Ely, where it is proposed to generate 2000 to 3000 hp. for the Giroux company of this district. This power company, however, has no connection with the Giroux company. The stream from which the water will be taken is one of the largest in this section of the State, and has a constant flow of water throughout the year. The project has been inspected by engineers, who have made favorable reports. It is estimated that 400 tons of pipe, machinery, and other material will be required in the construction of the plant. It is stated that construction work will be commenced on the plant next spring.

Ely, January 7.

OREGON

BAKER COUNTY

The Bonanza mine and 10 stamps of the mill are being operated by Henry Dodson as lessee, who is reported as being successful. The Bonanza was opened by Geiser brothers 15 years ago, who operated it five years at a great profit. They sold the mine to a company of Eastern men, who failed to find the tonnage of pay-ore that the mine was supposed to contain, and after having performed considerable development work closed it down. It is situated close to Whitney, on the Sumpter Valley railroad.

GRANT COUNTY

The Cougar mine, near Granite, was recently examined and sampled, and this fact is taken as evidence that a proposal to purchase the property is under consideration by people representing a smelting company.

UTAH

BEAVER COUNTY

(Special Correspondence.)—The Horn Silver mill will be ready to commence treating ore the first week in February. The new machinery is being installed in an old building, and while some of the old machinery is being used, the entire scheme of treatment is new. The South Utah is producing one and a half cars of concentrate daily, and it is reported that its copper production for December was 380,000 pounds.

Frisco, January 12.

JUAB COUNTY

(Special Correspondence.)—Sioux Consolidated declared a dividend of 4c. per share last December, making the total for the year a little short of $120,000. The mine's production came from one claim. The old board was re-elected at the annual meeting. The treasurer's report showed cash on hand amounting to $82,409.99. The Edmunds Exploration Co. intends to prospect in the northeastern part of Tintic district. A contract has been let to sink a 100-ft. shaft which may be continued to a depth of 500 ft. The ground is at the base of Pinion ridge, and the shaft is being sunk between two fissures in limestone. The King William, which is being developed from the Eagle & Bluebell's 1900-ft. level, has workings in blue limestone which constitutes the ore-bearing formation.

Eureka, January 14.

SALT LAKE COUNTY

(Special Correspondence.)—The Utah Apex has made an important discovery of copper and lead ore in its Parvenu tunnel and in a raise from the No. 7 level. Regarding a recent suit filed against this company by the Bingham-Mary, an official states that the Bingham-Mary or any other company interested is free to make a survey of its workings. The Edmunds Exploration Co., headed by J. E. Edmunds, has acquired the Copper Glance and Bingham Amalgamated and will commence work on them in the spring. Part of the old workings will be extended to open orebodies known to exist at greater depth. The Montana-Bingham has found ore in its south drift that assays $6 in gold, 8 oz. silver,

Utah Apex Mine.

and 12% copper. The main cross-cut heading is now 260 ft. from the Quinn fissure, in which it is thought rich ore will be found on being intersected by this cross-cut.

Bingham, January 14.

(Special Correspondence.)—It is reported that high-grade ore has been found on the lower levels of the Honerine, the upper levels of which yielded ore of similar grade several years ago. The Kearsarge, in Dry Canyon, near Stockton, has shipped a carload of ore that will sample $60 per ton. The mine force is to be increased next spring. The Ophir Hill Consolidated has commenced driving a 3000-ft. drain and transportation tunnel. Work of extracting ore has been suspended and efforts are centred on the tunnel work. A shaft is being sunk which will give two additional working faces. The tunnel will drain the mine and give 300 to 400 ft. additional stoping ground.

Stockton, January 15.

(Special Correspondence.)—The Utah Mines Coalition Co. has installed equipment for electric power at its mines in Big Cottonwood, and derives its power from the new hydro-electric plant in Provo canyon. The Columbus Extension Co. has opened high-grade copper ore in a drift off the main tunnel, the latter's heading having been in ore for the last 100 ft. It is now within 50 ft. of the contact for which it is being driven; when completed it will be 4000 ft. long.

Alta, January 12.

The Midvale concentrating and electrostatic separating plant of the United States S. R. & M. Co., besides operating on lead-zinc-iron ores from its own mines, is to be a custom plant in part. The old Winnemucca mill in Bingham canyon has been leased to Werner Ziegler, who intends operating it on custom ore. The mill has equipment for 150 tons capacity, and the plan is to concentrate low-grade lead-silver and copper ores.

SUMMIT COUNTY

(Special Correspondence.)—At Park City the latest rumor is that the Ontario and the Daly are to be consolidated. Both have been great mines, but in late years have been in the hands of lessees. Daly West for the first eleven months of 1910, shipped about 27,000 tons of ore and concentrate; Daly-Judge shipments aggregated 23,500 tons.

The Daly West has a number of leases in force under a new lease agreement. The stockholders of the Uintah-Treasure Hill Co. met and endorsed the action of the directors in selling the property to the Silver King Coalition Co. for $100,000, which amount is to be paid in two equal installments. A small force of men has been put to work at the California mine in Thane's canyon. The zinc ore on the dump at this mine is to be shipped to the United States company's Midvale plant for treatment.

Park City, January 14.

TOOELE COUNTY

(Special Correspondence.)—The Tooele plant is smelting about 600 tons of copper ore daily, this being the amount received from Utah Consolidated and South Utah mines, the latter's product being concentrate. This is about half the tonnage that it was expected to treat, the difference being due chiefly to the falling off in shipments from the Utah Con. It is stated, however, that the latter company is shipping ore of better grade than for some time, so that production is not affected as much as the tonnage would indicate.

Tooele, January 14.

WASHINGTON

FERRY COUNTY

(Special Correspondence.)—Walter E. Trent, of Los Angeles, has taken a bond on the Mountain Lion property, situated in the northern part of Republic district. It is reported that the mill is to be remodeled and re-equipped. The Mountain Lion was developed and equipped several years ago by Jonathan Bourne and associates, but is now owned by J. C. Larson of Ottawa. The North Washington Power & Reduction Co. is erecting a cyanide plant in this district; and the Rathfon cyanide mill is being operated on tailing of the old Republic mill. The Insurgent Leasing Co., operating on Eureka gulch, is shipping ore that assays about $25 per ton. E. J. Delbar and Merrill Bros. are the principals in the company. J. L. Harper, manager for the Republic Mines Corporation, and his associates, have secured control of the San Poil and North San Poil groups, situated on the west side of Eureka gulch. The Republic Mines Corporation has acquired the Morning Glory claims at $25,000. In driving on the 400-ft. level of the Quilp mine a new ore-shoot was opened, exposing ore 7 ft. wide.

Republic, January 14.

The mining properties being operated and developed in Orient district comprise the First Thought, Swamp King, Kettle River, First Thought Extension, Second Thought, Buckskin, Alice E., Chickamun, North Star, McKinley, and Napoleon. The building of a mill on the Napoleon is said to have been planned.

SPOKANE COUNTY

Prospectors and other mining men are anxiously awaiting the passage by Congress of a measure whereby the mineral lands of the Spokane Indian reservation will be opened to entry. The territory proposed to be opened contains some lodes and deposits of silver, copper, and tungsten.

CANADA

BRITISH COLUMBIA

(Special Correspondence.)—W. H. Aldridge has resigned as managing director of the Consolidated M. & S. Co. of Canada, Ltd., and will become associated with William B. Thompson & Co. of New York. R. H. Stewart has been promoted to general manager, and S. G. Blaylock to assistant general manager, both to have offices at Trail. In order to encourage the copper-mining industry, the Government at Ottawa has ruled that no royalty shall be charged on products of copper-mining locations for a period of ten years. The shipments of ore from Rossland district during the week ended December 31 were as follows: Centre Star, 2930 tons; Blue Bird, 30; Le Roi No. 2, Ltd., 376; Le Roi No. 2 (milled), 300; Le Roi, 118; Mayflower, 30 tons.

Rossland, January 7.

(Special Correspondence.)—The Kootenay Gold Mines, Limited, has taken over the Granite-Poorman mines and mill. The intention is to double the capacity of the stamp-mill (now 20 stamps) and cyanide plant. Thos. Gough, E. E. Guille, and others are directors. Over 25 men are working at the Athabasca and the mill has been started. The first gold brick was taken to Nelson last week. Ore is ready for shipment from the California and King George V. properties. The compressor will soon be in operation on the Perrier. A body of rich ore has been found at the Nugget mine, Sheep Creek. On the No. 3 level a drift has been run nearly 500 ft. on a shoot of ore averaging $26 per ton. An option has been given for a short time on the Alpha mine, adjoining the Standard, near Silverton. The figure named is $50,000. A 5-ft. vein of ore was found at the Tiger near Ainsworth.

Nelson, January 7.

(Special Correspondence.)—At a recent meeting of the directors of the B. C. Copper Co. the question of declaring a dividend was left over until the meeting to be held in January. It is claimed the company has nearly $300,000 in its dividend fund. The operations of this company's mines and smelter for November resulted in the production of about 917,994 lb. copper, 10,794 oz. silver, and 2845 oz. gold. Copper cost was 9.42c. per pound. The shipments of ore from the Boundary district for the week ended December 31 were as follows: Granby, 29,539 tons; Jackpot, 420; Mother Lode, 8234; No. 7, 50; Nickel Plate (milled) 1000; Rawhide, 4000; Snowshoe, 2343 tons.

Phoenix, January 7.

ONTARIO

(Special Correspondence.)—At a meeting of the Tisdale Mining Co., Frank C. Armstrong of New York was elected president; E. P. Earle, president of the Nipissing Mines Co., vice-president, and D. Lorne McGibbon of Montreal, and Samuel J. Dobie of Haileybury, directors. This company takes over the properties of the Armstrong-McGibbon Syndicate: the 17 Dobie claims in Tisdale township, Porcupine Mining District. All of the unissued treasury stock was taken up by the original syndicate, which also undertakes to provide the necessary money to develop the property. Charles E. Watson, who has been identified with the management of some of the properties in the Cobalt district, has become manager for the Tisdale Mining Company.

Porcupine, January 5.

MEXICO

CHIHUAHUA

(Special Correspondence.)—The Rio Piata Mining Co. shipped in the month of December 78,000 oz. silver bullion from its mine in the western part of Chihuahua. On account of the insurrection in that State, the silver could not be shipped to the city of Chihuahua in the usual way, but had to be carried by pack-mules westward to Alamos, which is on a branch of the Southern Pacific railroad, over which it was shipped to Guaymas and thence by water to Manzanillo. It was then sent by rail to the refinery at Monterey.

Chihuahua, January 10.

SONORA

The Butters cyanide plant, in Minas Prietas district, has been leased to the Mines Company of America, operating the Creston-Colorado mines in that district. The acquisition of the Butters plant, which has a monthly capacity of 7000 tons, gives the company facilities for milling 16,000 tons per month.

SINALOA

The Carcol Mining Co., in which R. J. Coleman and A. J. Bettles, of Salt Lake, Utah, are interested, has a partly developed mine and a mill of 30 tons capacity, situated 55 miles east of Rosario. Development work, in charge of Mr. Coleman, has been going on during the past two years. The ores contain gold and silver, some samples assaying 25 oz. gold and 1500 oz. silver per ton. The mill is to be remodeled, and cyanide equipment installed. Rasario, an old town, is now on the line of the Southern Pacific railroad.

GOLD AND SILVER MINING IN 1910

In a preliminary review of the gold and silver industry in the United States in 1910, the United States Geological Survey presents the following data, compiled by H. D. McCaskey: Preliminary statistics compiled by the Director of the Mint indicate that in 1910 the value of the total production of gold in the United States (including Alaska and the insular possessions) was $96,055,214, a decrease of $3,618,186 from the value of the output in 1909, which was $99,673,400. Notwithstanding this decrease, the gold-mining industry was on the whole and during most of the year progressive and in a satisfactory condition. Important increases in production are indicated for California, Nevada, and Arizona, and smaller increases for New Mexico, North Carolina, South Carolina, Utah, and Washington. Serious curtailment of copper production would of course affect the gold output, particularly in Montana and Arizona, but the total decrease from this cause would be relatively small, as the great bulk of the gold produced continues to come from placers and dry or siliceous ores. The preliminary figures show that Colorado has lost first place to California and now stands second, and that Alaska has lost third place to Nevada and now stands fourth. South Dakota and Utah remain fifth and sixth, respectively, in order of gold production, but Arizona has changed places with Montana, and these States now stand respectively seventh and eighth in order of output. In Alaska there was a total decrease of $3,350,000 in the value of the output of gold, but a marked increase in gold lode mining, particularly in the Juneau district. Placer mining in general was active in Alaska in 1910, and production from old districts and prospecting of new fields continued to be features of the industry. In Arizona the increase in gold production in 1910, amounting to over $600,000, was due largely to activity in the Gold Road and Tom Reed mines, in Mohave county, but is to be ascribed partly also to increase in the production of copper, in which Arizona ranked first in 1910.

In California an increase in value of gold production is due largely to continued success in gold dredging and to the maintenance of output from the Mother Lode mines. In Colorado a decrease in gold production was shown in the recovery from both milling and smelting ore, but was due mainly to partial temporary suspension of deep mining in Cripple Creek pending the completion of the great Roosevelt drainage tunnel. In Idaho and Montana decreases in gold production are indicated. In Idaho gold production decreased generally, but particularly in Idaho county; and in Montana decrease was expected as a result both of decreased output of copper at Butte and to a smaller degree of decreased production from siliceous ores in Chouteau and Fergus counties. There was an increase of gold production in Montana, however—from siliceous ores in Deer Lodge county and from iron sulphides in Broadwater county. Dredging operations in these two States remained active in 1910. In Nevada the statistics indicate an increase of over $1,500,000 in gold production in 1910 over that of 1909, due chiefly to an important increase in production by the Goldfield Consolidated mines. Jarbidge, National, and other new camps attracted much interest in 1910, and Esmeralda, Humboldt, and Whitepine counties in general show increased production for the year. In New Mexico an increase in gold production is indicated by early returns. In Oregon preliminary figures show a decrease in gold output. In this State the production of gold from placers has been decreasing, and although the deep mines have produced a greater quantity of ore, the grade has been generally lowered during the last few years. In South Dakota labor troubles in the early part of 1910 continued to militate somewhat against the full production of the gold mines of the Black Hills, and a decrease in value of about $1,400,000 for the year is indicated for the State.

In Utah the production of gold in 1910 was slightly above that of 1909, when the value of the output was $4,213,300. The mining industry in all the great camps was in a flourishing condition during the year. The output of copper and zinc in Utah was in 1910 materially increased, and the production of gold profited by this increase. In Washington there was an increase of $280,000 in value of output of gold, due to increased activity in the Republic district.

The production of gold in the Southern States in 1910 indicates decrease in Georgia and Virginia and increase in North and South Carolina, each being due largely to the operations of one mine. The gold output of Alabama, Tennessee, and Texas shows little change in 1910. In the Philippines a material decrease is indicated, from $247,600 in 1909 to $90,357 in 1910.

The production of silver in 1910 in the United States, as indicated by preliminary figures compiled by the Director of the Mint, was 56,438,695 fine ounces, an increase over the production of 1909 of 1,717,195 fine ounces. This increase, if borne out by final figures, must be credited to increased production of silver from dry and siliceous gold-silver ores, from lead ores, and, to a smaller degree, from zinc ores, as the production of copper, the ores of which supply nearly a third of the silver output of the United States, was somewhat decreased in 1910. The production of both lead and zinc, however, increased in 1910. The average price of copper was slightly lower than in 1909, the average price of lead was increased, and that of spelter remained the same. The rather remarkable decrease in both the quantity and the price of copper and the increase in both the quantity and price of lead in 1910 were accompanied by an increase in both the quantity of silver produced and in the average price of the metal. The value of the silver production of 1910 is estimated at $30,194,702, the increase being $1,739,502. The average price for silver in 1909 was 52c. per fine ounce. The domestic market price for silver has averaged 58c. per fine ounce for the last ten years, and during this same period the average annual domestic production has been 55,543,200 fine ounces.

With the decrease, since the bonanza days of the Comstock and other silver mines, of production from ores essentially classed as silver ores and the serious decline in market price, the production of silver in the United States has shown a certain independence of its market price and has depended rather on the mining of gold, copper, lead, and mixed ores. With satisfactory prices for the base metals and decreasing costs for mining and smelting them on a large scale, and with the general increasing gold production of recent years, silver production may therefore be expected to continue to increase in the United States, notwithstanding the growing production from Mexico and Canada and the higher tax imposed on silver by the Indian Government. The silver market itself has been inviting during 1910, however, as indicated by higher average market prices. Large crops in China and India, growth of trade throughout the world, and a tendency to greater use of silver in the arts—as, for instance, in photography—have sustained the price and held out hope for the immediate future. As the output of silver is intimately connected with the mining of other metals, its own active market augurs well for mining in general and is widely reflected throughout the industry. The most notable increase in the silver production of any individual State in 1910 as indicated by the preliminary mint figures, is that of 1,225,346 fine ounces in California. These figures are subject to revision, however, as the copper production of this State is known to have decreased considerably in 1910, and as no other source for so large an increased silver output in California is known. An increase of 312,041 fine ounces is indicated for Arizona, where copper mining and smelting have been active. Increases of about 359,000 and 691,000 fine ounces are indicated for New Mexico and Utah, respectively. In Utah there was an important increase in the output of copper and zinc, that of copper tending to augment the silver production, but a decrease in the output of lead, which would correspondingly reduce the silver output. In Washington an increase in silver production of over 100,000 fine ounces, or more than 100 per cent, is indicated, and if borne out by final figures will probably be

found to be credited largely to the Republic district. An increase of about 50,000 fine ounces is also apparently to be credited to Michigan, although copper production is known to have decreased somewhat in that State in 1910.

Decreases in the production of silver in 1910 are indicated in Alaska, where it would be expected as incidental in part to decreased gold production; in Colorado, where it was relatively small and not unexpected; in Idaho, where the falling off was also relatively small and may possibly be ascribed to the decreased tenor of silver in lead ores, as these ores furnish the bulk of the silver output of Idaho and the production of lead is thought to have increased in this State in 1910; in Montana, where the indicated decrease is over 400,000 fine ounces and is probably due largely to decreased copper production; in Nevada, where the preliminary figures indicate a decrease of nearly 773,000 fine ounces, possibly due to decreased production of silicious and lead ores and in the face of a known increase in copper production; in Oregon and Texas, where the change indicated is nominal; and in South Dakota, where a decrease was looked for in sympathy with decreased gold production.

According to estimates made by the Bureau of Statistics, the imports in 1910 were valued at $29,599,000 for silver in foreign ore, $12,703,000 for silver in foreign bullion, $2,011,000 for silver in United States coin, and $1,097,000 for silver in foreign coin. The total value of silver imported is therefore estimated at $45,410,000 for 1910. The exports during the same year were valued at $350,000 for silver in domestic ore, $30,000 for silver in foreign ore, $51,820,000 for silver in domestic bullion, $3,100,000 for silver in foreign bullion, $120,000 for silver in United States coin, and $550,000 for silver in foreign coin. The total value of silver in exports in 1910 is estimated, therefore, at $55,970,000, or $10,560,000 in excess of the value of the imports. In 1909 the value of the excess of exports over imports of silver was $11,404,607, and in 1908 it was $9,613,541; previous to 1908 it had not been below $15,000,000 for several years. The imports of silver in 1910 were, as usual, chiefly in ore and bullion and came mainly from Mexico and Canada. The exports were almost wholly in ore and bullion, and went, as usual, chiefly to the United Kingdom and in smaller amounts to Hongkong and France.

The mining industry of Utah during the year 1910 was in a flourishing condition. The gold, silver, copper, lead, and zinc produced will aggregate in value fully $33,000,000, an increase over the value for 1909, which was $31,380,092. Eighteen mining companies paid dividends of over $8,000,000. The largest single dividend payer was the Utah Copper Co., which distributed over $4,500,000. Approximately 6,163,089 tons of ore was mined and treated in 1910, an amount greater than that mined and treated in 1909, which was 5,122,589 tons. The quantity of ore mined has been increasing each year since the steam-shovel was first employed at the copper mines in the Bingham camp. Fully 70% of the ore mined in Utah in 1910 was derived from the porphyry deposits at Bingham, where 17 steam-shovels were at work. About 11% of the ore mined in the State was shipped directly to the smelters. The greater part of the remainder was treated at concentration plants, a comparatively small portion having been sent to amalgamation and cyanide mills. The copper producers, who have been striving to reach an output that shall be classed as normal, increased the production of copper to about 126,000,000 lb. in 1910. This is the record output for Utah, and is about 14,000,000 lb. greater than the mine production of 1909, but is still under the yearly production that may be maintained, judging from preparations being made by the heaviest producers of copper, who continue to add to milling and mining equipment.

The production of gold and silver was considerably increased in Utah in 1910 through the increased output of copper and zinc, but this increase was somewhat offset by a decrease of production of precious metals due to the decreased lead output. Early reports on the production of bullion and precipitates of amalgamation and cyanide mills show an increase in the production of gold in 1910 over the output from these sources (29,861.43 fine ounces) in 1909, the output for 1910 being approximately 35,196.97 fine ounces. Therefore, judging from the facts given, the State's output of both gold and silver has increased in 1910. Zinc ores and concentrate shipped from Utah in 1910 to Colorado, Kansas, Oklahoma, Wisconsin, Ohio, and West Virginia contained approximately 16,513,877 lb. of zinc, which was used in the manufacture of spelter and pigment. The producers of zinc were the Daly West, Daly-Judge, and United States mines at Bingham, and the Scranton, Horn Silver, Cedar Talisman, and numerous small tailing plants at Park City.

In Colorado in 1910, as compared with 1909, silver production increased slightly in value, owing to an increased price per fine ounce in 1910. There was a considerable increase in lead output, but a decrease in the yield of copper. Less gold and silver was recovered both from bullion and from smelting ore. The Globe, Pueblo, Arkansas Valley, and Durango plants of the American Smelting & Refining Co. and the Salida plant of the Ohio & Colorado Smelting Co. were active during the year. The Argo plant of the Boston & Colorado Smelting Co. was closed March 17, 1910, after many years of successful operation, having been established in 1872 at Black Hawk and moved to Argo in 1873. The pyritic smelting plant of the Modern Smelting & Refining Co., started in October 1909, closed May 31, 1910. The pyritic plant at Golden was taken over by the North American Smelter & Mines Co., was blown in April 9, 1910, and operated almost continuously during the year on ore from its own and other mines in Clear Creek county and from other counties in the State.

Whether Montana shall hold its enviable record of being first on the list of copper and silver producers depends much on the yield of the copper mines at Butte. The State headed the copper list in 1909, but is second to Arizona in 1910, although it remains first in the output of silver. The mines of Montana produced approximately 286,000,000 lb. of copper in 1910, a decrease from the yield in 1909, which was 312,056,538 lb. The average monthly production of copper, which in 1909 was about 25,600,000 lb., was reduced to about 23,000,000 lb. per month during the later part of 1910. However, according to a statement issued by the management of the largest interest, the new work and development in the mines will be vigorously carried on and the milling and smelting works at Great Falls and Anaconda will be worked to their full capacity. It is evidently the intention to treat lower-grade ores.

The Mogollon or Cooney district, in the southwest corner of Socorro county, contains several gold mines, chief of which is the Ernestine mine, which is and has been for years the heaviest producer of gold in the Territory. The Socorro Mines Co.'s mill, at Mogollon, was operated throughout the year; and the Helen company and the Treasure Mining & Reduction Co. were also producers in 1910. In the Magdalena district, a lead-zinc camp, in the central-western part of Socorro county, the operations of the Ozark Smelting & Refining Co., the Tri-Bullion Smelting & Development Co., the Germany Mining Co., the Mine Development Co., and the Mistletoe Mining Co. should show an increased output. The 20-stamp mill of the Rosedale Gold Mining Co., at Rosedale, which has been operated on gold ores, was burned in September.

The status of Idaho's mining industry is largely gauged by conditions in the Coeur d'Alene district, in Shoshone county, although these give little conception of the status of gold mining in the State. During 1910 the large lead producers made a normal production of that metal, but as there were several new producers the total output was brought up to about 224,000,000 lb., which exceeds the output of 1909 by 9,000,000 lb. The silver production, closely allied to that of lead, being derived largely from lead ores, remained close to 7,000,000 oz., although in the last four years there has been a gradual decrease in production of silver from lead ores. The closing of the Trade Dollar mine at Silver City has also diminished the silver output slightly.

Decisions Relating to Mining

Specially reported for the MINING AND SCIENTIFIC PRESS.

DUMP FROM COAL MINES—DAMAGES FOR NUISANCE

The dirt dumped from a coal mine making a permanent pile from 250 to 300 ft. long, 100 ft. wide at the base, and 50 to 60 ft. high, was held to be a permanent nuisance, and that only one action could be maintained for the recovery of damages, and that the measure of damages was the decrease in the value of the property injured thereby.

Risher *v.* Acken Coal Co., (Iowa) 124 Northwestern 764. Feb. 1910.

INJUNCTION TO PREVENT REMOVAL OF OIL

A court of equity has jurisdiction of a suit brought by the senior lessee in an oil lease against the original lessor and a junior lessee of the same land to enjoin the removal of the oil from the leased premises; and in such an action a court may settle all conflicting claims of the lessees and grant such relief to either claimant as the pleadings and proof may warrant.

Smith *v.* Root, (W. Va.) 66 Southeastern 1005. Jan. 1910.

OPTION SALE OF MINES

Where an option agreement for the purchase of coal in place provided that notice of its acceptance should be given in writing, and where the persons having such option took no steps to complete their title for seven years, and the owner retained possession, paid taxes, claimed the title, and gave an option to another person, it was decided that in an action involving the title under the agreement, that the quesions whether the notice of acceptance was given, and whether the option agreement had been abandoned, were questions of fact for the jury to determine.

Cambria Iron Co. *v.* Leidy, (Pa.) 75 Atlantic 186. Jan. 1910.

CONSTRUCTION OF LEASE OF MINE

A lease of fire-clay provided for the payment of ten cents per ton royalty on all coal taken from ten separately described tracts of land; by a course of dealing between the lessor and the leasee a royalty of seven and one-half cents per ton as to certain tracts was paid. Afterward the lessee assigned the lease; but the assignee was not entitled to mine the clay for the seven and one-half cents royalty, because of the course of dealing between the original lessor and lessee, where it did not appear that such assignee had any knowledge of the course of dealing. And where the original lease was changed and thereafter a new lease entered into, such original lease and the lease as changed were merged in the new lease.

Thomas *v.* Harbison-Walker Refractories, (Pa.) 75 Atlantic 199. Jan. 1910.

CONSTRUCTION OF OIL LEASE—ABANDONMENT

An oil lease gave the lessee the right for 10 years to explore for oil and gas, and provided that if a well was not completed on the premises within 3 months from the day of the lease, the lessee should pay to the lessor a quarterly cash rental, in advance, for each additional 3 months the completion of any well was delayed. In an action on the lease it was held to be an executory contract and vested no title in the lessee to the oil and gas in place; that the lease contemplated the development of the premises within a reasonable time, and the lessee could lose his rights thereunder before the expiration of the period stated by abandonment of the lease, though it contained no forfeiture clause, and his intention to abandon the premises could be established by proof of such facts and circumstances as would show a voluntary waiver of his rights.

Smith *v.* Root, (W. Va.) 66 Southeastern 1005. Jan. 1910.

COPPER PRODUCERS' STATEMENT

The Copper Producers' Association's December statement shows a decrease during the month in accumulation in this country of 8,358,874 lb., as follows:

Stock of marketable copper of all kinds on hand at all points in the United States December 1, 1910	130,389,069
Production of marketable copper in the United States from all domestic and foreign sources during December	123,339,219
Deliveries of marketable copper for consumption and export during December	131,698,093
Stock of marketable copper of all kinds on hand and at all points in the United States January 1	122,030,195

December 1910 production and deliveries compare with December 1909 as follows:

	Production.	Deliveries.
December 1910	123,339,219	131,698,093
December 1909	117,828,655	129,066,071

Exports and domestic deliveries compare:

	Exports.	Domestic deliveries.
December 1910	88,104,075	43,594,018
December 1909	59,546,570	69,519,501

TIN MARKET

L. Vogelstein & Co. report that owing to smaller Straits shipments and larger deliveries than anticipated, December tin statistics make a more favorable showing than expected. Deliveries were good on both sides of the Atlantic. Over here they amounted to the unprecedented quantity (for December) of 3600 tons, bringing the total for the year up to the new high record of 45,350 tons. There may be hard times and dull business in other lines, but apparently not in tin, and this in spite of every effort on the part of consumers, big and little to use as little as possible and carry the smallest possible stocks. Still the year closed with only 854 tons on hand, less than one week's supply, and almost all of that was English, Chinese, and sundries—practically no Straits. This will necessitate continued drafts on London, where stocks are closely held and a premium already exists on tin for prompt shipment. As to the future, Straits shipments for January are estimated at 3700 tons, which will probably mean little if any increase in the visible this month, though it is a Banca sale month. Predictions are freely made that the visible will be down to 14,000 tons by the end of April and the price considerably higher than it is today. These predictions are expected to be realized, though fully conceding the dangerous character of the market. While caution is advisable in dealing with tin, that ultra-conservatism which has in the past led many buyers to be chronically short of the market is no more likely to be profitable during the next two or three months than it has been in the recent past. The outlook for some time ahead is for small supplies and occasional stiff spot premiums on top of a general high range of prices.

THE IDITAROD placer district was visited by A. G. Maddren, of the Geological Survey, during the summer of 1910, and the following notes are based on his report. The district is drained by the river of the same name, which is tributary to the Innoko, a confluent of the lower Yukon. The placer-bearing area can be reached in summer by a steamer journey of about 400 miles from the Yukon. There is a more direct winter trail from Holy Cross, on the Yukon, and the district can also be reached by a winter journey of some 450 miles from the town of Seward, on the Pacific seaboard. In the summer of 1910 there were about 2500 people in the district, and the gold output is estimated to have a value of about $350,000. This indicates that the influx of population was out of all proportion to the gold production. It appears that the amount of proved placer ground is not sufficient to support the population now in the district.

Personal

Professional men are invited to send news of their engagements and travels. Such news is interesting to friends.

W. S. Noyes is in Oregon.

Howard D. Smith is in New York.

E. P. Kennedy is in San Francisco.

Ralph Arnold has gone to New York.

Oliver B. Finn is now at Colorado Springs.

Bulkley Wells is at Marysville, California.

R. H. Toll is examining mines in Honduras.

R. Y. Hanlon is at Manila, Philippine Islands.

Fred L. Lowell has gone to Chihuahua, Mexico.

F. J. Siebert is at the St. Francis, San Francisco.

Robert H. Richards was in New York early in January.

C. S. Herzig has removed his office to 42 Broadway, New York.

F. M. Meyers is examining mines in Tuolumne county, California.

W. C. Alexander and W. G. Page are at the Van Nuys hotel, Los Angeles.

E. C. Brown expects to go to Lower California to open placers near La Paz.

J. R. Finlay has resigned as general manager for the Goldfield Consolidated.

Reiji Kanda is examining the Okshi beach placers, near Nagasski-Ken, Japan.

Charles A. Griffin has returned from mine examinations near Kingman, Arizona.

Benjamin F. Tibby, of Salt Lake, spent a few days at San Francisco the past week.

Julius Kobig and P. L. Sherman, of Los Angeles, were at the St. Francis, San Francisco.

W. L. Leland has returned to Los Angeles from mine examinations in northern Nevada.

W. W. Whitton is engineer with the Espada Mines Co. of Hostotipaquillo, Jalisco, Mexico.

W. S. Keith is now manager of the mining department of the M. E. Miller Co. of Los Angeles.

Mark B. Kerr has been at San Francisco from the Pittsburg mine near Grass Valley, California.

H. W. Turner is in London, and will go to Russia to examine copper deposits about February first.

James W. Abbott is general manager for the Nevada-Des Moines Mining Co., operating at Pioche, Nevada.

W. C. Austin has returned to Nevada City, California, from an examination of mines at La Dura, Sonora, Mexico.

Wilbur H. Grant has been employed to make a geological survey of the properties of the A. S. & R. Co. near Matehuala, San Luis Potosi, Mexico.

Jay Lonergan has gone to the Imperial Pei-Yang University at Tientsin, China, where he will succeed Thomas T. Read as professor of mining engineering.

Grant B. Shipley, formerly engineer of mining and timber preserving machinery for Allis-Chalmers Co., is now president of the Pittsburg Wood Preserving Company.

P. R. Parker, formerly with the San Francisco office of The Bucyrus Co., is now in charge of the Seattle office of the Yuba Construction Co., at 1224 Alaska building.

H. C. George, who has been director of the Wisconsin State Mining Trade School for the past three years, has resigned to become mining engineer for the Wisconsin Zinc Company.

N. H. Darton, for many years geologist on the United States Geological Survey, has been appointed the geologist of the new United States Bureau of Mines, with headquarters at Washington, D. C. He will continue his investigations of the geological conditions under which explosive gases occur in coal beds.

Market Reports

LOCAL METAL PRICES.

San Francisco, January 19.

Antimony	12—12¾c	Quicksilver (flask)	44½
Electrolytic Copper	14½—15¾c	Tin	42½—44c
Pig Lead	4.75—5.70c	Spelter	7—7¾c

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

METAL PRICES.

By wire from New York.

Average daily prices in cents per pound.

Date.	Electrolytic Copper.	Lead.	Spelter.	Silver, per oz.
Jan. 12	12.33	4.48	5.50	54½
" 13	12.28	4.48	5.50	54½
" 14	12.28	4.48	5.50	54⅛
" 15	Sunday.		No market.	
" 16	12.28	4.48	5.48	53¾
" 17	12.33	4.48	5.48	53⅞
" 18	12.38	4.48	5.48	53⅞

ANGLO-AMERICAN SHARES.

Cabled from London.

	Jan. 12. £ s. d.	Jan. 19. £ s. d.
Camp Bird	1 16 0	1 17 0
El Oro	1 6 3	1 7 9
Esperanza	1 17 3	1 15 6
Dolores	1 5 0	1 5 0
Oroville Dredging	0 6 9	0 6 9
Mexico Mines	7 12 6	7 16 3
Tomboy	0 15 0	0 15 0

(By courtesy of W. P. Bonbright & Co., 24 Broad St., N. Y.)

COPPER SHARES—BOSTON.

	Closing prices, Jan. 19.		Closing prices, Jan. 19.
Adventure	$ 6½	Mohawk	$ 44
Allouez	5	North Butte	28
Atlantic	4	Old Dominion	40
Calumet & Arizona	46	Osceola	109¾
Calumet & Hecla	515	Parrot	11
Centennial	12½	Santa Fe	1¼
Copper Range	67¼	Shannon	11⅝
Daly West	3¼	Superior & Pittsburg	14
Franklin	7¾	Tamarack	45
Granby	37	Trinity	4
Greene Cananea, ctf	8½	Utah Con	
Isle-Royale	14½	Victoria	1¾
La Salle	4½	Winona	8½
Mass Copper	7¼	Wolverine	118

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

MINING STOCK QUOTATIONS—NEW YORK.

(By wire from Catlin & Powell Co., New York.)

	Closing prices, Jan. 19.		Closing prices, Jan. 19.
Amalgamated Copper	$ 64⅛	Miami Copper	$ 19
A. S. & R. Co.	78	Mines Co. of America	5⅛
Braden Copper	4⅛	Montgomery-Shoshone	1/16
B. C. Copper Co.	6⅞	Nevada Con	18⅝
Butte Coalition	18⅜	Nevada Utah	⅞
Chino	20⅞	Nipissing	10⅞
Davis Daly	1⅝	Ohio Copper	1½
Dolores	5½	Ray Central	1¾
El Rayo	3¾	Ray Con	17¾
Ely Central	1/16	South Utah	¾
First National	1⅞	Superior & Pittsburg	13⅜
Giroux	6½	Tenn. Copper	34¾
Guanajuato Con	⅛	Trinity	4½
Inspiration	8⅜	Tuolumne Copper	4⅝
Kerr Lake	7¾	United Copper	4½
La Rose	4⅝	Utah Copper	46
Mason Valley	9¾	Yukon Gold	3⅞

SOUTHERN NEVADA STOCKS.

San Francisco, January 19.

Atlanta	$ 13	MacNamara	$ 19
Belmont	5.62	Mayflower	4
Booth	8	Midway	17
Columbia Mtn	3	Montana Tonopah	1.00
Combination Fraction	17	Pittsburg Silver Peak	76
Fairview Eagle	35	Rawhide Coalition	3
Florence	1.57	Round Mountain	40
Goldfield Con	7.70	Silver Pick	5
Gold Kewenas	6	St. Ives	16
Great Bend	2	Tonopah Extension	98
Jim Butler	26	Tonopah of Nevada	8.12
Jumbo Extension	30	West End	57

(By courtesy of San Francisco Stock Exchange.)

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EDITORIAL

SEISMOLOGISTS in the United States recently organized the Seismological Society of America and it is now announced that publication of a series of bulletins devoted to earthquake studies is about to be undertaken.

FIRE IN LARGE MINES is the dread of miners, as it is always destructive of property and sometimes of life. A fire which started from some unknown cause in the High Ore mine at Butte, on January 14, resulted in the loss of two lives, and had not prompt measures been taken to prevent it, the fire must have spread to adjoining mines and caused a general suspension of work on Anaconda hill. The Butte miners, however, have had much experience with mine fires and apply heroic remedies, usually with satisfactory results, as in the present instance, for at last accounts the fire was under control.

TWO HUNDRED MILLION DOLLARS is stated to be the value placed on the Parrot mine by the minority stockholders of that Butte, Montana, property. These stockholders are those who are not in accord with the recent sale of the stock of the Parrot company to the Anaconda company at what was, in comparison, merely a nominal sum. The Parrot is in the heart of Butte district and consists of numerous fractional claims, with a total area of a little more than 40 acres, which is the equivalent of about two full-sized claims. However, the value of a mine is not usually determined by its superficial area, but by the size and value of the orebodies. The Parrot company has been in existence about thirty-one years and has paid in that time less than $8,000,000.

ACQUIREMENT by the Consolidated Gold Fields of a controlling interest in the Breyten Collieries in the Ermelo district has been commented upon at Johannesburg. According to local critics, the present rate charged for the ordinary railway carriage of coal from Ermelo, as much as 75c. per ton, will have to be paid in excess of what an equally good steam-coal property could have been acquired for and worked in the Middelburg district, besides which in these times when all the gold mines are reducing their coal requirements to a minimum, the outlook for the coal trade of the Transvaal is not of the brightest. Again, the Breyten Collieries are situated several miles away from the railway, and as several equally good, if not better, properties exist on the line of railway, the construction of a long branch line seems to be an unnecessary expense and to involve waste of working capital.

METALLURGISTS everywhere have read with regret that the Western Association of Technical Chemists and Metallurgists is to disband. In the six years since that society was formed it has made an enviable record. While the membership has been small, the discussions were always stimulating and the papers published in its journal, the *Western Chemist and Metallurgist*, have been of uniformly high character. We hope that those who have been active may continue their interest, working through one of the other established societies. Technical chemists have particular need to guard against being buried under routine work. They should keep their interest in research alive, and to do that nothing aids so much as frequent contact with their fellows. The local sections of the Mining and Metallurgical Society and of the American Chemical Society afford opportunities that professional men can not afford to overlook.

Powder Magazines in Mines

Another instance of the mistaken economy of storing large quantities of nitro-powder in mine workings was afforded a few days since, when the powder stored in a drift near the main shaft on the 200-foot level of the Keating mine at Radersburg, Montana, exploded, killing several men. That more of the men underground in the mine at the time did not lose their lives was due to the fortunate fact that they were enabled to escape through an old shaft at some distance from the scene of the disaster. The cause of the explosion is unknown, but it should never have been possible. The storage of dynamite in mine workings is a reprehensible practice, and State laws usually prohibit it, which is perfectly proper. There are so many instances of the explosion of powder magazines in mine workings that it is surprising that managers continue to store powder underground. Usually no one outside the mine where the disaster has occurred has any knowledge of the underground magazine. Strict rules concerning the handling of powder should be enforced in every mine, for often the men have access to the powder without restriction, and experience has shown that accidents of this kind are fewer where only one or two men are permitted to enter the magazine and to carry powder to and from it.

State Mine Inspector

Once more a bill has been presented in the California legislature providing for the creation of the office of a State inspector of mines, and the appointment of a competent engineer to fill the responsible position. As usual, opposition from the mine-owners is evident. At each legislature for some years past a similar bill has been presented and always defeated, although no one except certain mine owners will deny that such mine inspection is not only desirable, but necessary. Numerous mining States have official mine inspectors, but the attempt to create this office in California has thus far failed. The opponents claim that there would be no particular objection to a State mine inspector if there were any assurance that the inspector would prove to be a capable and honorable man—they have their doubts. Possibly the real cause of this opposition lies in the fear that he may prove to be a capable and honorable man. A State inspector of mines occupies a responsible position. It is his duty to protect the lives and health of the miners, as far as possible, while being just to the owners. Competent and impartial mine inspection would in some cases perhaps increase the cost of mine operation; in others it would reduce it by improving working conditions. Among the duties of the mine inspector is that of examination of hoisting ropes, the investigation of ventilation and the sanitary conditions underground, inquiry as to the storage of explosives in the mines, and a rigid investigation into the cause of accidents. It is his business to see that the State laws are enforced, and beyond this his duty does not extend. It is his privilege to be autocratic, but that is necessary, or his office were better abolished.

Stope-Drill Contest

Competitive tests of machine-drills have long been a periodical feature of mine operation on the Rand. The results of these contests have been published from time to time with elaborate details, but the contest recently ended there was, in our opinion, the only one which was really conclusive in its results, for the reason that instead of merely a few hours drilling, this last contest was continued through a period of nearly a year. Interest in this competition, which was initiated by the always progressive Transvaal Chamber of Mines, was stimulated by the award of a prize of £2500 for the best small drilling machine that could be produced for stoping under conditions existing in the Witwatersrand mines. This premium was increased by an additional offer by the Transvaal Government of £2500, making a total of £5000, the running costs of the contest to be paid jointly by the Chamber of Mines and the Government. A competitive trial of rock-drills operating for a few hours at the surface, drilling holes in granite blocks, is a very different matter from an actual competition of machines which operate throughout a period approximating a year, and meeting the frequently changing conditions incident to the operation of the mines. This is the only fair test of a machine-drill. Nineteen different types of drills were entered for the contest, of which nine were discarded at the preliminary trials made on the surface and later underground, and ten actually entered the trial to continue for 300 shifts. These were the Holman 2⅛ inch, Holman 2¾ inch, Siskol, Climax, Imperial, New Century 0.0., Konomax, Chersen, Waugh, Murphy, and Westfalia.

The stope-drill committee decided the contest on the basis of footage costs, which is the only absolutely fair way in which to arrive at a rational conclusion. Very low footage costs were obtained, notwithstanding that the men running the machines were unfamiliar with them at the start.

Drills of the reciprocating type were awarded first and second place, outclassing those of the ham-

mer type, contrary to the expectations of many. The cost per foot of drilling with the four leading machines was: Holman 2⅛ inch, 9.77 pence; Siskol, 9.90; Holman 2¾ inch, 10.91; and Chersen, 11.94 pence.

In their findings the committee recommended the reciprocating piston machines of lighter weight—120 to 130 pounds—for use in very narrow stopes, those less than three feet, and heavier machines in larger stopes. The drilling-bits should be parallel at the sides and flat for about an inch from the cutting edge.

Utah Geological Survey

A bill has been introduced in the legislature of Utah providing for the establishment of a State Geological Survey. This is an excellent project and deserves success. Utah is one of the few States that has never undertaken a systematic study of its natural resources, and while the United States Geological Survey has done much good work in Utah, as elsewhere, great areas remain practically unexplored, to say nothing of the larger regions that are unsurveyed or unstudied. The creation within a few years of a great copper industry where lead and silver mining were previously dominant, the beginning of zinc mining, and the discovery of phosphate rock, suggest other discoveries and developments that may reasonably be expected when the resources of the whole State become known. There are undoubtedly minerals still to be found, mines to be developed, and camps to be established. Iron occurs, but just how important the deposits are, is not yet certain, despite the fact that a few have been carefully studied by the officers of the United States Geological Survey and engineers in private practice. Petroleum is found, though output is, as yet, unimportant. While the mineral production of Utah is already large and growing, there is no doubt that it is destined to increase rapidly for many years. In the economical exploitation of the mineral resources of the State, accurate maps and detailed reports such as may be furnished by a properly conducted State survey will many times repay the cost. Utah, as is true of most other Western States, owns large amounts of public land and hence has a direct interest in securing an accurate inventory of the mineral wealth within its borders. The geologist, however, is concerned with more things than the finding of orebodies, and under modern conditions a geological survey has many duties aside from those directly related to the mining industry. Maps, and accurate maps, are essential to all geological work, and are in demand for engineering purposes of many sorts. Roads, drainage works, irrigation canals, water storage, these are a few of the features of modern life that call for maps. In an arid State such as Utah, the conservation and economical use of the natural rainfall will always be of first importance, and for this the knowledge of the geologist, as well as his maps, is requisite. Modern industry, too, involves many incidental technical problems. Prevention of pollution of streams by débris, of the air by smoke, preservation of health in the mines, and many similar subjects, require legislation or executive action which should be based on sound advice as to the technical as well as legal and sociological features of the case. In many States the director of the Geological Survey is a constant adviser of the State officers in such matters. Through his own studies, and those of his assistants, he brings to the service of the State accurate knowledge as to most important phases of many of these problems. This, we believe, is a wise development, though it goes without saying that if such duties are to fall upon the head of such a bureau, a well-trained man must be selected for the position, and he must be adequately supported. A dishonest man, a weak man, or one who is incompetent, may do much harm, and in these days when conservation problems are so important and so much to the fore, every State needs the best possible service in this direction.

The form of organization of a State Geological Survey is one concerning which there is much difference of opinion. In general, it is customary to place a bureau under the direction of a separate board or commission, and to give it independent funds. This plan has many advantages. Work which is worth doing is worth doing well, and a Survey that is incidental to other work will be diverted from its main purpose. The disadvantage of the separate commission is that multiplicity of boards divides responsibility. This is being urged in Utah, and it is proposed to make the Survey a part of the School of Mines. With no reflection on the officers and teachers of that excellent school, it may be pointed out that the main purpose of a school is to teach, and the history of such connections elsewhere has been that Survey funds have been diverted, often with but slight return to the Survey, to give the students summer field work. They ought to have such work, but it is wiser to do as in Nevada, where school funds are frankly used for that purpose. Survey work needs the undivided attention of trained men rather than the incidental care of a busy professor aided by student assistants. If, too, a Survey is passed over bodily to a school, it is less directly brought to the attention of the Governor and the Legislature, and is to that extent less useful. Securing an appropriation and being let alone, should not be the chief aim of the head of a Survey, and it is, in practice, an excellent thing to have the Governor in direct touch with the work. In Utah a board consisting of the Governor, the President of the State University, the President of the Agricultural College, and the Director of the State School of Mines, has been proposed, and a board so organized should work well. It has the advantage of being ex-officio, it should be free from politics, and it would bring the Survey into direct friendly relations with both educational interests and the State executive. With such an organization, a competent man should be able to do work of real merit and wide benefit, and such a Survey would be a good investment for Utah or any other State.

ABC of Empire Drilling—II

By J. P. Hutchins and N. C. Stines

***The Drilling Pump.**—As the name indicates, this pump is essentially a tool that drills and pumps simultaneously. The component parts include a barrel, a bale, a stem and coupling, a drilling-bit, and a ball-valve. The barrel is a section of pipe, about 2 ft. long, the outside diameter of which is slightly less than the inside diameter of the drilling or casing pipe. One end has the bale-stem and coupling riveted to it in such a way as to leave an opening through which the content of the pump is dumped. The other end has the drilling-bit screwed into it. The drilling-bit resembles an hour-glass with the top and bottom removed. The lower part has a sharp hard nickel-steel circular drilling-edge. The upper part forms a seat for the hard-steel ball-valve. In the barrel of the pump, a few inches above the valve-seat, is a stop to prevent the ball-valve from falling out when the pump is inverted when dumping.

This tool has the following advantages: (1) The circular bit is an ideal form for a drilling-tool, as it has no corners to break or wear rapidly, and the wear is slow and evenly distributed around its circumference. (2) It has a valve that does not wear, get out of order, or permit the loss of any part of the sample. (3) It requires no dressing or sharpening. (4) As soon as the core is crushed or loosened, it is picked up by the pump and held by the valve; thus all work is effective and no time is lost in unnecessary crushing. (5) As fast as the material is picked up and held by the pump, a fresh surface is constantly being exposed and no energy is wasted, as happens when drilling with an ordinary drill-bit through an accumulation of crushed material. (6) As the material is picked up with a minimum of crushing, its characteristics, and those of its valuable content, undergo a minimum of change; they are, therefore, more easily interpreted and there is no loss, due to attrition, of the valuable content.

This tool is used nearly all the time. It will crush any boulder that enters the pipe, even though it may be longer on its axes than the inside diameter of the pipe.

Its disadvantages are: (1) It is somewhat difficult to empty because of the projections of the bale where it is riveted to the inside of the barrel. This is due to design and can be easily remedied by leaving a flush screw-joint. (2) It does not work well in solid clay, as it is hard to get the clay out of it. (3) In some kinds of sand it does not work well, and it is then proper to substitute the helical-pocket-pump, which is designed particularly for penetrating sand.

Drilling Under Various Conditions.—As a means of illustrating the complete cycle of operations of the Empire-drill outfit under various conditions met with in prospecting, this hole will be continued as a hypothetical hole, and the various tools, their use and operation, will be described. Difficulties such as are met in practice will be assumed to occur and the means of overcoming them explained.

*Continued from *Mining and Scientific Press*, p. 43.

Drilling Medium Ground.—Assume that gravel of fine to medium size and loose to medium tightness is being penetrated. Under such conditions the drilling-pump is used and the hole can be sunk at the rate of about 25 to 50 ft. per 10 hours. Assume that the first length of pipe has sunk until the platform is almost touching the ground, the horse-power pin is taken out, the horse-power lifted by two men and set out of the way. A pair of chain-tongs is so placed on the pipe and held as to prevent it from rotating backward as the platform is turned in that direction. This breaks the joint between the pipe-head and the pipe. The platform is lifted off and placed to one side, and the pipe-head is unscrewed by hand. Another length of pipe, with clean and oiled threads, is screwed on to the piece of pipe projecting from the ground. In doing this, care must be taken to prevent damaging threads. The best procedure is as follows: the length of pipe to be put on is carried in an approximately horizontal position and the end to be screwed on is laid half way across the top of the projecting pipe, so that when the new length is uprighted, it stands on the edges but does not slip on to the pipe in the ground. The new length is then lifted and carefully slipped over the threads of the pipe in the ground, and rotated to the left until it drops the width of a thread. Then it is turned to the right and screwed up by hand until it almost shoulders. If these precautions are not taken, and, instead, the new pipe is slipped over the projecting threads and then uprighted, there is a likelihood of the threads being damaged by burring, and time lost in repairing them. The pipe-head is then put on and screwed up by hand, the platform lifted into place, the horse-power attached, and all the four men mount the platform. The horse is then immediately started so that all new joints will be set up. Assume that ordinary drilling has been resumed and that the pipe does not sink, the core having been drilled out. There is then danger of drilling below the pipe and thereby getting a false sample. In such case the pipe must be driven as described earlier in this paper. It is usual to drive one foot at a time.

Drilling in Sandy Ground.—Suppose that a sand stratum is reached and the drilling-pump is not making its customary progress. The helical-pocket-pump is then substituted. This pump is just like the drilling-pump except that it has a helical bit designed to bore into sand. The operation is as follows: The tool, having been lowered until it rests on the core, is then rotated from 180 to 360°, the string of tools is lifted 2 to 2½ ft. and dropped. This series of operations is repeated several times. The sand is thus picked up by the helical bit, as it is rotated, and forced into the pump as it drops and held there by the ball-valve. The further manipulations are the same as in the case of the plain drilling-pump.

Drilling in Clay.—Suppose that immediately under this sand clay is encountered which does not discharge freely from the drilling-pump. The small auger-drill-spoon is lowered into the pipe and worked exactly like a post-hole auger. Clay can be penetrated with this tool at a very rapid rate, and decomposed bedrock has been bored with it at the rate

of over 10 ft. per hour. In this hypothetical hole, suppose the downward course of the pipe has been stopped and driving does not serve to sink it. This may be caused either by a boulder, buried timber, cemented or frozen ground. In the first three cases, progress is made by using the rock-bit, an ordinary fluted drilling bit, the length of which is the same as that of the other tools. Therefore the graduations will show the position of the tool with relation to the bottom of the pipe. Churn-drilling is done as usual, and unless the boulder is large and hard it can be broken so that the pipe can be driven through it. This is the time when drilling below the pipe is necessary and permissible. As a matter of fact, many holes can be sunk in rocky ground without encountering any boulders that need this treatment.

Emptying the Drilling Pump.

When a boulder is so large that it cannot be penetrated by driving, or by drilling and driving, it is necessary either to abandon the hole and start a new one near it or to pull the pipe a foot or two to prevent damaging it and to blast the boulder with half a stick of No. 2 dynamite. Blasting in this way shatters the sides of the hole and shakes in material not belonging to the sample. When the pipe has again been sunk to the depth from which it was pulled, the content of the pipe must be pumped and allowance made for any excess of gold contained therein. It is usually better and quicker to abandon the hole and start a new one near it unless the hole is deep. A buried timber, if in a good state of preservation, is very hard to penetrate with the pipe or by drilling; while it is not impossible to drill through it, it is usually impossible to cut a hole of sufficient diameter to get the pipe through. Here, as before, it is usually better to abandon the hole and start a new one near it. If the timber is not in a good state of preservation, it gives no trouble. If the obstacle is frozen ground, plenty of hot water, heated in a tank furnished for this purpose, is frequently poured into the pipe. This, of course, thaws it and is of considerable assistance, but it is advantageous to also drive the pipe, for more rapid progress can thus be made. It is sometimes advisable to drill a little below the pipe, for in frozen ground the sides do not cave. Thus about 2 ft. per hour can be made. When tightly cemented gravel retards progress, it is necessary to use the drilling-bit and to drive the pipe frequently. Cemented gravel can be easily recognized from the cemented pieces brought up by the pump.

Drilling in Running Ground.—Sometimes loose sandy ground, with a large content of water, is struck. Usually the pipe sinks very rapidly through this and no trouble ensues unless the water-level in the pipe is considerably lower than the ground-water level. In this case water flows into the pipe and carries running ground with it. Such a circumstance is noted by the occurrence of an excessive core. It is then best to drive the pipe until solid material is reached. An allowance must be made for this excess of core. It is always best to rotate the pipe when driving it, for it makes driving easier.

Stuck Tools.—It sometimes happens that through carelessness the drilling-pump, after having been churned for some time, is allowed to rest on the core in the bottom of the hole and the agitated material settles around it and holds it fast. It is often possible to release the pump by turning the string of tools and lifting at the same time. When this fails it is necessary to uncouple the rod at which every joint breaks and to lift out those rods which are above the broken joint. When lifting a string of tools from the hole, it saves time to uncouple the rods in 10-ft. lengths. The pump-jar device is attached to those drill-rods which have been lifted out and then lowered into the pipe until it rests on the uppermost coupling left in the pipe. On the lower end of these jars there is a funnel-shaped steel shell, the largest diameter of which is slightly smaller than the inside diameter of the pipe. This guides the two couplings together and the joint is easily made. These jars are similar in construction and action to the jars of ordinary drilling rigs. The stuck pump is soon jarred loose. If any other tool becomes stuck in the pipe, as seldom happens, the same procedure is followed.

Recovering Lost Tools.—Inexperienced drilling crews are apt to drop a tool or the string of tools into the pipe. In such an event a sufficient length of rods is lowered into the pipe, and a connection is easily made because of the taper thread couplings, and the lost parts so recovered. If for any reason anything that cannot be recovered as above described, should be dropped into the pipe, it is necessary to drive the pipe until a large core is secured. It is then best to pump the water out of the pipe, so that its extra weight will be removed and not tend

to force out the core or plug as the pipe is pulled to recover what is lost in it. Care must also be taken in pulling the pipe, not to jar it, for this would also endanger losing the core or plug and the lost article held by it. When bedrock is reached the hole is continued until no more gold is recovered. It is then good practice, if the bedrock is coherent and not too hard, to drive the pipe hard into it until a considerable core is obtained or until it can be driven no farther. The water of the hole is then pumped out and the pipe pulled, the object being to get an unchanged sample of the bedrock, and it also insures properly getting every particle of gold of the sample.

Pulling the Pipe.—The horse-power is detached, the pipe-head loosened as explained above, the platform removed, and the pipe-head unscrewed. Immediately after removing the pipe-head, the gripping device is slipped over the pipe and allowed to rest on the ground. This device does not retard the upward motion of the pipe, but it grips it automatically, should it start downward. This device is simply two bars of steel slightly bent and sharpened on one end like a cold chisel, fastened together in such a way that the convex sides of the bars are always down. The pulling-cap is screwed onto the pipe, the pulling-stand placed within 18 in. of the pipe, the pulling-lever inserted in the yoke of the pulling-cap and rested on the fulcrum, placed at a convenient height, and the turning-bars inserted in the rings of the pulling-cap. Several of the men bear down on the power end of the pulling-lever, while others rotate the pipe as is done in sinking it. In this system of drilling the pipe is both sunk into and withdrawn from the ground largely by the aid of rotation. Inasmuch as a lever 25 ft. long or more can be used having a ratio of power-arm to weight-arm as 24:1, each 100 lb. of weight on the power end exerts a lifting force of more than a ton; the pipe can be pulled at the rate of 60 ft. per hour. The tools that do this work so effectively must be described. The pulling-cap is a device made of two pieces, the lower piece is screwed to the pipe and has two rings, one on each side, large enough to receive two sticks of 4 in. diam. The other part is a yoke, swiveled to the lower part. This yoke, 10 in. diam., receives the weight-arm of the pulling-lever. The pulling-stand is a fulcrum made of channel-iron thoroughly bolted and braced. Holes about 1.5 in. diam. are spaced about 5 in. centres for the full length of the uprights, about 6 ft. Into these holes a pin, grooved circumferentially at each end, fits loosely; when in place the sides of the grooves straddle the webs of the channels and serve to stiffen the pulling-stand by tying the two uprights together when the pulling force is exerted. As the pipe is pulled from the ground, the pin of the pulling-stand is raised from hole to hole until the top hole is reached. There is then about 5.5 ft. of pipe projecting from the ground, with ample room to put on the chain-tongs, of which two pairs are used, one of which is placed on the upper section of the pipe, the pulling-lever is removed from the yoke of the pulling-cap, and the pulling-cap unscrewed and removed. The upper length of pipe is unscrewed and carefully taken off and for this purpose the following manipulation has been found to be the best. A crowbar is driven into the ground alongside the lower chain-tongs handle. A piece of 1½-in. pipe 6 ft. long is slipped over the handle of the other chain-tongs. One man holds the crowbar, while several others strain against the pipe-handle on the other tongs, one man, meanwhile, tapping the joint with a hammer. This is sufficient to break the joint, although it is often necessary to use considerable force, for the pipe-joints may have been set up very tight by the horse pulling hard on the end of the sweep, which action is like that of a 12-ft. wrench. After the first length of pipe has been pulled, it is usually much easier to pull the rest and it is faster to use the pulling-chain slung over the end of the lever and around the pipe, instead of the pulling-cap. When this is done, the pin in the pulling-stand is placed at a convenient height and left there. When the pipe is pulled until the power-arm touches the ground, the lever is raised and the chain slips down to a new position, automatically gripping the pipe as the pulling lever is again brought into action. This manipulation is repeated until all the pipe has been pulled from the ground and disconnected.

Moving to and Starting New Hole.—Usually when there are less than four lengths of pipe remaining to be pulled, part of the crew can be spared to commence moving the tools and pipe lengths to the new hole and arranging them, as explained above. The move may be a short one, in which case it is often advisable to start two men boring with the drill-auger-spoon, so the new hole will be far enough along to receive the first section of pipe as soon as it is brought from the last hole. This completes the description of the drilling of the hole and pulling the pipe. This operation is repeated whenever a hole is to be sunk.

Labor.—It requires four men to do the actual drilling and a fifth laborer, either man or boy, to hand up and take down tools to and from the men on the platform, as required, to empty the pumps, and to act as a roustabout. All of the above are unskilled laborers. The man in charge of the operation, who also does the panning, should be experienced. One horse is needed to rotate the pipe. As this work is not hard, an animal weighing 600 to 800 lb. is usually fully strong enough. Sometimes where it is not possible to get an animal to rotate the casing, one to four men are used; these men use bars as when rotating a capstan, and these bars can be of such lengths as the difficulty of rotating requires.

Care and Repair of Tools.—All threads must be kept clean and lubricated with an oil and graphite paste and all tools should be kept off the ground and sufficient care exercised in handling them so the threads will not be battered. In case threads are damaged, they can be easily repaired by using either a sharp cold-chisel or a three-cornered file. There is very little wear and tear and the parts that do wear, namely, the cutting shoe and circular drilling pump bits, are easily renewed. The fluted drilling-bit is used so little that it is seldom necessary to sharpen it. An Empire drill has been used for months where

there was no blacksmith outfit and sharpening was done on a grindstone. As wear and tear is very slight, depreciation is very slow, and as breakages are infrequent there is practically no time lost.

Transport.—The drill can be transported anywhere that men can walk, and also in small canoes, as it knocks down into small pieces.

Rate of Drilling.—Drilling can be done, under average conditions and where the ground is 30 to 50 ft. deep, at the rate of 30 to 50 ft. per day; when ground is shallower, a still faster rate can be maintained; when it is deeper, progress is slower. The drill as described above has been used to a depth of 110 feet.

Deep-Drilling Apparatus.—It is claimed that with a deep-drilling apparatus, holes 200 ft. or more deep can be drilled. This apparatus is attached to the platform and consists in a hand device to act as a spring pole. A small wire rope is substituted for rods, only enough rods being left on the tool to give weight.

Cost of Drilling.—With labor at $1 per day and a horse at $1 per day, and ground from 30 to 50 ft. deep, the actual drilling costs 12 to 20c. per foot. In frozen ground 25 ft. deep, 2 ft. per hour can be averaged, and recent work in Siberia has shown that this has been done there with an inexperienced crew for 23c. per foot. In Idaho, with 6 ft. of snow on the ground, and half the time spent in shoveling snow away from the drilling places, the thermometer at times 25°F. below zero, and labor at $3.50 per shift, drilling was done at the rate of 37½ ft. per day of 8 hours and at a cost of 65c. per foot. At another place in Idaho, ground 15 ft. deep, labor $2.50 per day, with four men and one horse, an average of 42 ft. per day was made at a cost of less than 27c. per foot. In South America, ground 19 ft. deep, labor 50c. per 9-hour day, and eight men, an average of 22 ft. per day at a cost less than 19c. per foot was obtained. In Siberia, with 30-ft. ground, in parts frozen, labor 75c. per 10-hour day, with nine men and a horse, the average rate per day was 32.5 ft. and the cost 25c. per foot. In Colorado, ground 18 ft. deep, labor $2 per 10-hour day, with five men and a horse, an average of 51 ft. per day at a cost of 25c. per foot has been noted. It must be remembered that in each case a green crew had to be broken in and that for the first few days progress was much below the average given. On long jobs the average rate would be greater and the cost less.

Pulling the Pipe.

Precautions.—The drilling-pump must not be allowed to rest on the core after it has been churned up and down, as there is danger of its sticking as described above. There is no danger of the pump sticking if it is allowed to rest on the core immediately after lowering into the pipe. Plenty of water should be used, and it is better to have the water-level in the pipe higher than that of the ground water, to prevent the running in of ground when loose water-bearing sand is struck. If the water-level is allowed to get too low, the ball-valve will not seat tight, and the sample will be lost from the pump as it is being raised to the top of the pipe. As an indication of insufficient water in the pipe, it will be observed that mud splashes up onto the rod. In making joints, care must be taken to have the rod-joints set-up tight, otherwise they may work loose and endanger the threads. In setting-up tight, it is only necessary to jerk the rod-wrench once, as the play between the rod and the wrenches and between the straddling wrench and the hole has the effect of a quick sharp blow. A single jerk is also all that is necessary to break the joint. Care must be taken never to drive pipe until all pipe joints are shouldered. It is generally bad practice to drill below the bottom pipe, although it is sometimes permissible in breaking through a large boulder or in drilling frozen or cemented ground. Great care must be taken to have the hole started vertical. If after the first or second length of pipe is in the ground, it is seen that it is not plumb, a wedge driven in between the pipe and the ground on the side toward which the pipe leans, will often force the pipe over far enough to make it plumb. In case this does not result in plumbing, it is better to pull the pipe until it can be wedged to a vertical position and then drive it to the depth from which it was pulled. The extra core obtained in this way must be discarded. In carrying the pumps from the hole to the dump-box and dumping therein, care must be taken that nothing slops over the top of the pump or splashes out of the box. It is a good plan to mark the pipe every foot with chalk. This makes it easy to keep track of the depth of hole.

The nitrate industry of Chile made good progress during 1910, notwithstanding the low prices prevailing for nitrate. A number of new nitrate works have been opened, and most of the well-equipped plants were run at full capacity, and seemingly at a good profit. During the first nine months of 1910, 3,942,648 tons of nitrate was produced in Chile, against 3,200,039 tons for a like period in 1909, and 3,092,506 tons exported, against 2,847,564 tons for the same time in 1909. The world consumption was 4,399,698 tons for the first nine months of 1910, against 3,612,020 tons during a like period in 1909.

Improvements in Silver-Lead and Copper Smelting—II

By L. S. Austin

***Sampling Anode Copper.**—William Wraith has presented the result of an investigation made at the Washoe plant of the Anaconda Copper Mining Co. to determine reliable methods for sampling anode copper with special reference to its silver content. The blister copper from the converters is poled in the refining furnace before casting into anodes. During the four-hour casting period four samples are taken at regular intervals which show that the charge is uniform in silver, an average result of several lots being 74.04, 73.99, 74.10, and 74.20 oz. per ton. Three methods of sampling were investigated, of which the first two, described below, proved reliable: (1) *Shot-Sample Method.*—At hourly intervals a small portion of the molten stream, as it pours from the furnace, is 'shotted' into a bucket of water by batting or striking it with a wooden paddle. Each sample is dried, particles of burnt wood removed, and the sample screened on a 10-mesh screen. The oversize of this is screened on a 4-mesh screen to remove the coarse shot, the undersize between 4-mesh and 10-mesh being the sample. The four portions of the lot thus obtained are cut to one-half by being passed over a 16-slot splitter having slots ½ in. wide. (2) *Drilling-Sample Method.*—Every fourth anode of a lot is drilled, using a 99-hole template (11 rows of 9 holes each). The holes are used in continuous order, one hole to the anode. For example, if in lot 890, holes No. 1 to 90 were used, then in lot No. 891 the sampling would begin with hole No. 91. The anodes for sampling are carefully swept clean, then drilled with ½-in. drill from the bottom side upward, reserving the drillings. These drillings are ground to pass a 16-mesh screen, and the samples thoroughly mixed and quartered to 1 lb. in weight. The 1-lb. sample is passed over a 40-mesh screen and both oversizes weighed, the same ratio being maintained in the assay-ton used for assay. (3) *Ladle-Shot Method.*—A ladleful of copper was taken from the furnace-stream, then poured over a wooden paddle into water, thus making shot which were treated as in the first method. This proved to be unsatisfactory because of segregation of the silver during the time the molten metal was held in the ladle. An average of results obtained on 29 lots gave, by the shot-sample method, 72.69 oz., and by drilling-sample method 72.61 oz. Ag per ton. The ladle-shot method gives too high results.

Electrolytic Copper Refining.—G. H. Blakemore, who had been associated with the Lithgow refining plant, Australia, has given interesting details of his experience. The depositing tanks, of Oregon pine treated with paraffin, are 4 ft. 2¾ in. long to take nine anodes 28 in. wide by 26 in. deep. Two cathode sheets, each 13 in. wide by 27 in. deep, are hung opposite each anode, or 18 in all. The tanks are lined with sheet-lead, 6 lb. per square foot, which extends over the top edges. Insulation is secured by resting the tanks on paraffined hardwood joists, and these rest on six square glass insulators. These insulators again are supported by 6 paraffined wooden blocks carried on 6 brick piers. This construction permits ready access to all parts of the tank, so that leakage may be readily detected. The copper busbar conductors are insulated from the tanks, resting in glazed porcelain holders held in brackets on the outside walls of the tank. The tanks are arranged in rows of 3 tiers of 8 tanks each, the series-parallel system having been adopted. The electrolyte flows through the 8 tanks in series, thence by the sump launder to the collecting-tanks, from which it is elevated by compressed air to sand-filters. Those in turn deliver the electrolyte to feed-tanks which supply filtered solution at about 15 lb. per minute to each 8 tanks. The sand-filter removes the small quantity of slime which floats in the electrolyte and which would otherwise tend to deposit on the cathodes. Hard-lead pipe coils, carrying waste steam, are placed in the supply tanks by which the electrolyte is heated to 120° to 130° F. This not only diminishes the resistance of the liquid, but insures a more even deposition of the copper. The electrolyte at Lithgow is carried at 12% free acid and 14% bluestone ($CuSO_4 + 5H_2O$) with a specific gravity of 1.18. Low acid increases the resistance, and if it falls to 3½%, there results a deposition on the cathode of a mixture of metallic copper and cuprous oxide instead of copper alone, while the anode mud may go as much as 80% copper. Low acid and defective circulation of the electrolyte cause the formation of brittle cathodes of low conductivity.

Starting-sheets are prepared as follows: Rolled-copper sheets ⅛ in. thick are dipped into a tank of melted tallow, then set on edge for the surplus tallow to drain off. When the tallow is set the plates are coated with graphite by moving them about in a shallow box containing finely-ground graphite. To prevent the copper adhering to the edges of the plates, these edges are dipped in a tank filled ½ in. deep with molten tallow; the copper deposits on the graphite surfaces only. Twenty-four of these plates are hung in a vat with 12 anodes and get coated with a thin sheet weighing 2 to 3 lb. The electrolyte is warm and actively circulated. There is a loss of 10% in making, and the sheets are generally quite tough. They are suspended by hooks or, better, by two loops of copper riveted to the sheet. Figuring the usual sheets at 90% of those set, with the cathodes in the 672 tanks charged every 14 days, the sheets required daily will be 960, and the output of the refinery, in theory, 157 tons weekly, or actually 150 tons per week. The quantity of copper as copper sulphate in the electrolyte tends to increase, and this, when over 14%, must be removed from time to time. For this purpose 12 tanks are provided with insoluble lead anodes, and through them a portion of the electrolyte constantly flows. In starting fresh sheets, the speed of the generator supplying current to these tanks must be carefully regulated: if run too fast, the current will buckle

*Continued from *Mining and Scientific Press*, p. 63.

the lead anodes and so cause a short circuit. The generator may run 24 hours before the ammeter will register, and until it shows about 250 amperes it is wise not to speed up too much; this taking about two days.

The anode-mud is taken from the tanks at regular intervals, being run straight to a sump where the mud is settled and the clear supernatant solution decanted. The residue is bailed into a lead-lined box on wheels, and taken to the refining-room. Here, to remove the scrap or coarse particles of copper which have fallen from the anodes, it is poured through a copper sieve into storage-tanks. The scrap remaining on the sieve is well washed, then cast into anodes for re-treatment. The percentage of scrap made at the Lithgow works is 8.5 to 9.5%; in the United States it amounts to 10 to 15%, because here all the anodes are removed at one time. The mud, washed to free it from copper sulphate, is slowly dried in steel trays, then heated to a dull red to get rid of tallow and to alter the condition of the graphite which had coated the starting-sheets. Before this practice was followed it was not possible to remove all the copper even with prolonged treatment with acid. About 400 lb. of the mud, containing 24 to 28% copper, is now boiled with 300 lb. concentrated H_2SO_4 in a cast-iron pan with a hood to remove the acid fumes. In about four hours all but about 0.3% has been extracted. The residue is washed, dried, and melted with bicarbonate of soda in a cupel-furnace to doré bullion, this bullion assaying 120 to 160 fine in gold and 820 to 860 fine in silver. No attempt was made to save the selenium, though at one time a selenium matte was produced when smelting the slime in the cupeling furnace. This matte carried about 50% copper and 10 to 14% selenium.

Silver-Lead Blast-Furnace Smelting with Charges High in Lead.—At Trail, B. C., and at the East Helena plant of the A. S. & R. Co. the charge contains 35% lead and over. At the latter plant in particular this imposes unusual conditions and difficulties. First, in order to avoid the making of excessive quantities of matte, some 95% of the ore must be roasted down to 3½ to 4% sulphur. The ore itself contains zinc so that the slag must be high in iron. Thus there is a slag of high specific gravity, while the matte, since it carries zinc as sulphide, is lighter than usual. There results peculiar difficulty in making a ready separation of the two. The slag is tapped to a rectangular fore-hearth which is changed every second day. The matte is tapped from this fore-hearth into a Kilker matte-casting machine. The slag is taken from the fore-hearth into large electrically-moved slag-pots, run to the dump, the slag-pots moved over on their frames, and the slag dumped well outside the rail. The slag-shells are saved and re-melted.

Blast-Roasting.—Blast-roasting at present is chiefly practised by the use of large pots with an upward blast of air. Because of the large body of ore, an even roast can not be expected on all portions of the charge treated; for while some parts are subjected to a heat so high as to fuse the ore and thus stop further elimination of sulphur, other parts are but little burned and remain pulverulent. It has been for this reason that machines of the Dwight-Lloyd type have been devised, where the layer of ore is thin (4 or 5 in. thick), where the ore can be continuously fired, and where a bed of uniform nature may be prepared for burning. The mechanical difficulty of roasting on such a bed has been that the ore sticks to it, a difficulty overcome by Greenawalt through the use of a layer of crushed limestone spread upon the grated pallet or bed which carries the charge. H. O. Hofman has recently published a paper, being a review of the progress of blast-roasting to date, and in particular has described the most successful of the Dwight-Lloyd machines of the endless-chain type. F. M. Smith has described the machine as used at East Helena, Montana. It is 28 ft. long over all and has an effective area of the size of the air-tight suction-box below, 2½ ft. wide by 12½ ft. long. A series of perforated pallets propelled by endless-chain and sprocket-wheels is carried over this box, and air is drawn downward through the ore. The ore is moistened and fed upon the pallets from a hopper and set on fire as it comes to the suction-box, either by a transverse trough containing a coal fire, or by a transverse pipe carrying burners supplied by gasoline under pressure. The pallets travel at the rate of 10 in. per minute, and by the time they have traversed the wind-box, roasting has been completed. As the pallet rounds the end-wheel, it slides a foot or so on the endless-chain, and with a jar brings up against the next pallet. The cake falls from it into a car set below. The ore must be of uniform texture and crushed to ¼-in. size as it is fed on the pallets, since if one part is more open or granular, then the air draws through freely, while the denser part gets insufficient air. A separate hopper delivers the ½-in. layer of crushed limestone to the pallet just before the ore is fed. The machine has a capacity of 40 tons daily. Two larger machines are being erected at the East Helena plant with a wind-box of 3½ ft. wide by 24 ft. long and a calculated capacity of 100 tons each daily. These two machines take up no more space than a single reverberatory roaster and are expected to turn out 14 times as much product.

I may add that at this works, besides the Dwight-Lloyd sintering machine, there are 12 Huntington & Heberlein pots in continuous operation. A well-sintered product is obtained.

John E. Greenawalt, of Denver, who has the basic patent for the grated bed and its non-adherent layer of limestone or other infusible material through which a down-draft of air is drawn, has been conducting experiments looking to the use of a series of trays successively charged and discharged by hand. He has been able to get satisfactory results using a bed at least 12 in. in thickness. The top of the ore contained in this tray he uniformly ignites by covering with a hood into which he momentarily injects coal-oil under 80-lb. pressure by means of 6 jets, 3 on a side, and sets fire to the entire surface of a tray of 6 by 8 ft. The ore-charge is made up

preferably to 17% sulphur, and may run to 22% and still not melt together. If too high in sulphur, too great heat causes premature fusion and the stoppage of further desulphurization. Since the rate of burning the sulphur depends on the rate at which air is drawn through the charge, the lower sulphur charges are most rapidly roasted. In the H. & H. or pot-roasting methods, the ore gets a preliminary roast down to 13% sulphur. This roasting is not needed for the down-draft processes. The product is in satisfactory sintered condition and the sulphur elimination has been much better than with the H. & H. process.

Arsenic as a By-Product in Smelting.—Where the bag-house is used in silver-lead smelting or in converting leady copper mattes, not only is the lead fume condensed and caught, but arsenic accompanies it. On account of its detrimental effect, it has been sought to remove this and sell the by-product thus obtained. Arsenic is now quoted at 2¾c. per pound, a figure too low to permit of extraction with profit. However, the smelting plants still continue to recover it for legal reasons. Where it is found in quantity in bag-house fume, this fume is roasted and a resultant product, high in arsenic, is caught in one chamber of the bag-house. This product is again roasted to obtain a commercial product. At copper plants the procedure is a little different. The flue-dust in the portion of the flue nearest to the stack contains the largest portion of arsenic. This dust is treated in a Brunton revolving roasting-furnace which gives a crude arsenic product, while the residue, thus freed from the metal, is sent to the reverberatory-furnace for smelting. The crude arsenic is again re-roasted and the pure crystals, resulting from the condensation of the vapors arising from the roasting, form in the flue specially built for such recovery.

Treatment-Costs may be summarized as follows:

	Per ton.
Reverberatory smelting, Utah Con	$ 1.40
Blast-furnace smelting, Tennessee Copper Co., coke costing $4.30 per ton, and including the cost of about 20% barren quartz for fluxing	0.96
Granby Con., blast-furnace smelting, coke costing $5.75 per ton	1.20
Cost of converting about 40% Cu matte in an acid-lined converter may be given at...	8.43

The same cost for a basic-lined converter was $7.76.

Converting, refining, and smelting-costs per ton from Western points may be taken as follows:

	Per ton.
Converting, including cost of bag-house and re-treatment of converter by-products	$ 8.43
Freight, $10; refining, $3; profit in refining, $6; selling, $6; general expense and administration, $2	32.00
Total	$40.43

This equals close to 2c. per pound of copper produced.

The Southern States from North Carolina to Georgia have all produced gold. North Carolina is said to have produced about $20,000,000.

MINING IN MOTHER LODE

Deep mining in the Mother Lode counties of California is being successfully carried on more and more vigorously and the resultant yield is increasing. The number of productive mines in these counties is comparatively small, owing to the large investments required, but their yield is great, especially where extreme depth has been attained and reduction works of suitable proportion have been installed. The average grade of ore in these mines is comparatively low, but very large quantities of ore are mined and milled. The largest quantity of ore in the Mother Lode counties is mined in Calaveras county, but the largest output of gold is from Amador county. In gold output Tuolumne county comes third, followed in order by Mariposa and Eldorado counties. These five counties produced in 1910 over 1,400,000 tons of ore from which was obtained nearly $5,000,000 in gold. On comparing these figures with those for several preceding years it is found that both tonnage and gross yield show a material increase in 1910 in these counties. In Amador county one mine has sunk a shaft to a vertical depth of 3550 ft., and the vein at the deepest level—the 3450-ft.—is of the same character as it was near the surface and equally profitable.

Zinc ore imports in 1910, according to C. E. Siebenthal of the U. S. Geological Survey, were approximately 85,084 short tons, containing about 83,000,000 lb. of zinc and worth, as invoiced, about $888,000; 116,269 tons of zinc ore was imported in 1909. The figures for 1910 do not include 10,431 short tons of lead ore from South America, containing 2,645,111 lb. of zinc, an average of less than 13%, all of which was lost in smelting the lead and thus does not properly enter into the figures of imports of zinc. Of the zinc ore imported, 80,309 tons, or 90%, came from Mexico, as compared with 106,245 tons imported from Mexico in 1909. The exports of zinc ore for the first eleven months of 1910 were 17,558 short tons, valued at $570,510, as compared with 12,455 tons in 1909. Imports of spelter were decreased over half, being estimated at 3339 short tons, valued at $282,653, as compared with 9670 tons in 1909. Exports of domestic spelter increased over 50%, being estimated at 3953 short tons, valued at $424,172, as compared with 2566 tons in 1909. The establishment of zinc smelting in bond increased the exports of foreign zinc from their previously insignificant proportions to approximately 5029 short tons, valued at $196,250, in 1910. During the first nine months of the year there were also exported, under drawback, articles manufactured from 2717 tons of foreign spelter on which duty had been paid. The exports of zinc dross amounted to 4675 short tons, valued at $377,000, as compared with 7069 tons in 1909.

Deep buried rivers, covered by débris of any kind, including lava caps, hundreds of feet in thickness, may be located as placer if on the unoccupied lands of the United States.

Recent Cyanide Practice at the Montezuma, Costa Rica

By S. F. Shaw

The Montezuma Mines of Costa Rica are situated about 15 miles from Punta Arenas, a seaport on the western coast of Costa Rica. The veins are supposed to have been worked to some extent in early days, but the earliest authentic records of work go back to only 1899 at which time two 20-stamp amalgamation mills were erected and operated. A low recovery of gold and silver was obtained, probably between 50 and 75%, as part of the gold was enclosed in the sulphides in the ore. In 1901 experiments were made with cyaniding, but along unpractical lines. In 1906 the consolidated Bella Vista and Thayer mining properties erected a 40-stamp mill which began operations in 1907, employing plate amalgamation, followed by leaching of the sands. In 1907 and 1908 earth slides and freshets carried away the slime plant then in process of erection, owing to the temporary character of the construction, which necessitated re-building. Advantage was taken at this time to introduce the latest practice in the treatment, wherein agitation in Brown tanks and filtration with Butters filters would be employed. The ore as it comes from the mine in 1-ton side-dumping cars is weighed on a 10-ton Fairbanks scale, then trammed to the mill and dumped onto a grizzly floor of 16½ by 66 ft. with bars spaced 2 in. apart. Owing to lack of head room, it became necessary to use a flat floor and to scrape the ore over the grizzly openings. The bin is 66 ft. long by 14½ ft. wide and 23 ft. deep at the lowest point; 8300 cu. ft. of space is available for the fine that has passed through the grizzly. Two 7 by 10-in. Blake crushers take the oversize, crushing same to 1 or 2 inches. Eight Challenge feeders supply the batteries with ore. The lime, amounting to 6½ lb. per ton of ore, is added to the ore as it enters the feeders. The stamps weigh 1050 lb. and drop 6 in. 96 times per minute. The screens are slotted, equivalent to 12-mesh, and last about 120 days. Double-crimped brass screen, 20-mesh, is also used at such times as the tube-mills are not in use, and last about 10 days. Crushing is done in 0.10% cyanide solution, the proportion of solution to ore being about 8:1. The percentage of material from the 8-mesh screens passing through various-sized screens is as follows:

Mesh.	Per cent.	Mesh.	Per cent.
20	26	100	6
30	13	120	2
40	6	150	1
60	16	200	4
80	6	—200	20

The pulp from the batteries flows through eight 3-in. pipes to two 60° conical settlers provided with Caldecott diaphragms, which deliver a product to the Abbé tube-mills containing 26% moisture, and sizing as follows:

Mesh.	Per cent.	Mesh.	Per cent.
40	42	120	3
60	22	150	3
80	13	200	3
100	10	—200	4

These tube-mills are 20 ft. long by 4½ ft. diam. The silex lining lasts about 10 months, and Danish pebbles are used as a grinding medium, the consumption being about 1½ lb. per ton of ore. The tube-mills are provided with a spiral feed which occasionally gives trouble by clogging, also by throwing out sand from time to time. The discharge from the mills contains 34% moisture, the amount above that in the feed being added, as pulp with only 26% moisture is too thick to discharge.

Cyanidation Plant.

Montezuma Mines.

The sizing test of the discharge is as follows:

Mesh.	Per cent.	Mesh.	Per cent.
60	3	150	6
80	7	200	15
100	18	—200	46
120	5		

The discharge from the tube-mills joins the overflow from the settlers and runs two 50-in. conical settlers through two 4-in. pipes, the underflow being returned to the tube-mills by a 6-in. Price centrifugal pump driven by an 18-in. Pelton wheel operating under a head of 470 ft. A Dorr classifier was erected to take part of the flow to these 50-in. settlers with the intention of leaching part of the sands. As it was found that the slime plant could handle all the ore that was delivered to it, the Dorr classifier was not used. For treating these sands, there are 4 tanks 28 ft. 8 in. diam. by 5 ft. deep. The overflow from the two 50-in. conical settlers and the Dorr classifier

flows through a 4-in. pipe to a cone-settler 25 ft. diam. and 25 ft. deep, having a slope of 60° and containing 5500 cu. ft. The upper 4 ft. of the settler is cylindrical. The sizing test of the pulp at this point is as follows:

Mesh.	Per cent.	Mesh.	Per cent.
60	1	150	4
80	7	200	10
100	12	—200	58
120	8		

The overflow from this settler goes to a tank 29 by 8 ft. containing 5550 cu. ft. This tank also receives the solution drawn from the sand-leaching tanks. When the settler is full, it is discharged into one of two Brown agitation tanks 15 ft. diam. by 45 ft. deep, having a conical bottom with a slope of 60°, and holding 6038 cu. ft. This pulp averages about 66% moisture. Agitation is given for 12 hr. in 0.10% cyanide solution and pulp is then drawn through an 8-in. pipe by a Butters 8-in. centrifugal pump and delivered to a cone-reservoir containing 5500 cu. ft., of the same dimensions as the first settler which discharges into the Brown tanks. The pulp is here kept in continuous agitation with air at 25-lb. pressure until all is drawn into the filter. Filtering is done in a 60-leaf Butters vacuum-filter contained in a steel box having hoppers with 60° bottom slopes. Three 3-in. overflow pipes carry off the surplus pulp, while a 6-in. Price centrifugal pump continuously delivers pulp to the filter during the time the cake is being formed, through a 4-in. pipe at the top and on the side of the filter-box, and distributed into the box by sixteen 1-in. pipes placed over the leaves, being spaced so as not to interfere with taking out the leaves. After a cake, averaging 1¼ in. thick, is formed, the pulp is discharged to two tanks 14½ by 6 ft. containing 990 cu. ft. each, from which it is returned to the conical reservoir; and when making a cake is also distributed over the filter, by the 6-in. Price centrifugal pump previously mentioned. The weight of dry pulp in a cake on each leaf averages 550 lb. Wash solution is admitted through the cake for 45 minutes, after which the box is filled with water and washed for 5 minutes; then the cake is discharged by allowing water under 40-ft. head to enter the interior of the leaf. The vacuum is maintained by a 14 by 14-in. Gould vacuum-pump running at 35 r.p.m. and driven by a 6-ft. Hug water-wheel operating under a head of 550 ft. The Butters pump is driven by a duplex Pelton water-wheel. The cycle of operations averages as follows:

	Min.
Filling with pulp	8
Making cake	60
Returning excess pulp	8
Filling with wash solution	8
Washing	45
Returning wash solution	8
Filling with water	7
Wash with water	5
Discharging cake	8
Total	157

The discharged cake contains about 30% moisture. Thirty tons of strong solution is drawn through the leaves per cake, and 18 tons of wash-solution, averaging 1.2 tons of wash-solution per ton of dry pulp. The filter-leaves are washed in an acid tank accommodating 3 leaves which is operated automatically, drawing the acid through the leaf and then forcing it out again, 0.2% hydrochloric acid solution being used for this purpose. The strong pregnant solution from the filter flows to a strong-solution gold-tank 39 by 7½ ft., containing 8960 cu. ft. This tank also receives the solution from the 29 by 8-ft. overflow tank. The weak solution is pumped to a weak-solution gold-tank 20 by 6 ft., containing 1885 cu. ft. The strong solution is drawn through 6 rows of zinc-boxes, 6 compartments in a row, each compartment being 24 by 24 by 24 in. and containing 5 cu. ft. of zinc-shaving. The weak solution flows through 3 rows of zinc-boxes, 5 in a row, having compartments of the same dimensions as the strong boxes. The strong solution, before passing through the zinc-boxes, averages $3.40 per ton, and after being precipitated averages $0.49 per ton, thus securing an extraction of 86%. No effort is made to obtain a thorough precipitation. The amount of zinc consumed is 0.85 lb. per ton of ore. The strong solution flows to a sump 35 ft. 3 in. by 7½ ft. containing 7450 cu. ft., from which it is pumped by an 8 by 8-in. Gould triplex pump driven by a 7-ft. Pelton water-wheel through a 3-in. pipe-line to the battery storage-tank, 29 ft. 4 in. by 13 ft. 8 in., containing 9215 cu. ft. The weak solution is pumped from the weak-solution sump containing 380 cu. ft. to the weak-solution storage-tank, 35 by 7½ ft., containing 7215 cu. ft., by a Price 3-in. centrifugal pump.

Air is compressed by a Rand duplex 10 by 16-in. compressor, which is relieved when making repairs by a 16 by 10-in. Clayton air-compressor. The electric lighting system is supplied with current by a 75-kw., 300-amp., 250-volt General Electric dynamo, running at 550 r.p.m. The two compressors, triplex pump, and 3-in. centrifugal pump are driven by a 7-ft. Pelton water-wheel operating under a head of 550 ft. The precipitate is drawn from the zinc-boxes to a tank 4 ft. 8 in. by 3 ft. 6 in. having a canvas filter-bottom. A vacuum is maintained under the filter, obtaining a product containing from 30 to 60% moisture.

Supplies for November were as follows:

	Pounds.
Cyanide	4.34
Zinc	0.84
Lime	6.43
Pebbles and lining	2.31

The costs for November were as follows:

Labor:	Crushing	$0.18
	Fine grinding	0.06
	Classifying	0.02
	Agitation	0.03
	Filtering	0.06
	Precipitating	0.04
	Miscellaneous	0.04
		$0.43
Supplies		1.22
Power		0.07
Assaying		0.04
General, office, etc.		0.09
Total		$1.85

Transvaal Stope-Drill Contest

The final report of the Transvaal Stope-Drill Competition has appeared. The four surviving drills made the following records:

	Footage drilled.	Inches per minute per machine over total time.	Cost in pence per foot drilled.
Holman, 2⅛	12,799	0.742	9.77
Siskol	14,083	0.818	9.90
Holman, 2¾	11,744	0.682	10.91
Chersen	11,781	0.684	11.94

The prize money was divided between the two first-named drills owing to the fact that taking everything into consideration there was little difference between the two machines. With regard to the individual drills, the committee reports that the Siskol was convenient in size, drilled fast, and was very economical. Its long stroke and feed were an advantage, while the ease with which it could be handled made it popular. Its cradle was faulty and lacked arrangement for adjustment after wear in the slides or feed-screw nut. The Holman 2⅛-in. drill was, if anything, too small; nevertheless, its maintenance costs were lower than any of the other competitors; it drilled well and was handled with ease. The Holman 2¾-in. drill and the Chersen were both handicapped by the travel of the valves being too small, which gave considerable trouble through frequent choking with dirt. The New Century 0.0. machine was too small and weak. The feed-screw and cradle were too short. In drilling a 4-ft. hole, as many as 5 drills were necessary. The committee arrived at the following general deductions as a result of the competition: (1) that hammer-drills were not suitable for the general stoping conditions prevailing on the Rand; (2) that hollow steel cannot be recommended, owing to its high cost and difficulty in tempering; (3) no new type of 'rig-up' gear submitted or used came up to the Holman type; (4) that any capable miner can efficiently supervise the working of more than two small machines; (5) that five native assistants are necessary to enable a miner to run two machines properly; (6) a good supply of drills should in all cases be easily available for the miners; (7) five natives being proved as necessary, the machines can be strengthened, as one weighing 125 lb. can under these circumstances be as easily handled as 100-lb. machines; (8) that under suitable conditions ground can be as cheaply broken with machines as with hammer boys; (9) that machines with long-stroke valve-gears are more efficient than those with short strokes, as they are less liable to get choked; (10) that machines with long piston-strokes proved themselves superior to those with a shorter stroke; (11) that provision of a feed of not less than 18 inches in length appears very desirable.

During the last twelve months many of the mines have been conducting experiments themselves with different stoping-drills, and of course have arrived at their own conclusions, which they are not likely to modify to accord with the results obtained by the Stope-Drill Competition, no matter how valuable from a competitive standpoint they may be. At the Robinson Deep mine, controlled by the Goldfields group, the supply of native labor has been anything but satisfactory, with the result that there was no alternative but to resort to the use of small drills in the stopes. Some careful experiments have been made at this mine with several makes of small stoping-drills, with the result that with small drills the cost comes out at 6s. per ton as against 5s. 11d. per ton by hammer boys. These results are interesting, and seem to show that it is possible that in the long run the mines, by a more extensive use of the stoping-drill where conditions are suitable, will be able to take a good deal of the sting out of the threatened scarcity of native labor.

MONAZITE

Monazite is a phosphate of cerium, lanthanum, praseodidymium, and neodidymium, containing silica and thoria. Its thoria content varies from 1 to 20%. Commercial monazite is recovered by mechanical and electro-magnetic processes from placer gravel and sand. In color, monazite varies from dull yellow to reddish brown, and has a resinous luster. Its specific gravity is 4.9 to 5.3, and it is readily recovered with other minerals by wet concentration. It occurs in a number of places in Idaho, notably on Grimes creek, in Boise basin, where it is found in old placer tailing, also close to bedrock in unworked placer ground, and in the adjacent granite benches. Some progress has been made here during the last year in working tailing and virgin ground for both gold and monazite. After screening and concentrating the tailing a concentrate is obtained which contains particles of magnetite, garnet, monazite, zircon, ilmenite, and a low percentage of silica. These elements are separated from each other by magnetic machines, the monazite thus obtained being nearly 90% pure, and containing about 5% thorium. In this stage of purity monazite is worth 12c. per pound. Thorium, which gives monazite its principal commercial value, is in demand for the manufacture of incandescent gas mantles.

A COPPER-ALUMINUM ALLOY

A new alloy, said to consist principally of copper and aluminum, is being placed on the market under the trade name of cupsor. In color it is like gold, polishes readily, and acquires a brilliant lustre, and is, therefore, adapted for jewelry and to all ornamental purposes. It is further claimed to be highly resistive to chemical influence. Not only is it said to be immune from the attack of the ordinary atmosphere, from salt water and salt air, but it is claimed that sulphuric acid, hydrochloric acid, lemon juice, tomato juice, vinegar, etc., have no effect on it. Cupsor can readily be machined and is easily rolled and drawn into wire. The tensile strength of cupsor in the casting is estimated to be at least 80,000 lb. to the square inch. The No. 20 gauge hard-drawn wire broke in a recent test at 138,550 lb. to the square inch. Its density is 8.11.

The Mining Industry in Korea

By T. Haga

In the mining industry, as in so many other fields of art and seienee, Japan and Korea have been in every way closely related. To go back in history to the reign of the Emperor Shomu (about 1200 years ago), the knowledge of this industry possessed by the Koreans far excelled that of the Japanese; but, while the latter, adopting the Korean art, made great progress in it, the former still remained in the primitive condition. However, after the Russo-Japanese war several legislative changes were made in Korea; and since the carrying out of the Mining Regulations in 1906, the industry has gradually been making progress, until at the end of last year it had an extraordinary development, the production for that year reaching 7,000,000 yen. Now that Korea is annexed to Japan her mining industry has come under the direct administration of Japan, and the future of the mining industry in Korea will doubtless attract the attention of the Japanese as well as foreigners.

Both vein and placer gold are among the mineral products of Korea; and there are many places well known as gold-producing districts. A book on Korea, compiled before the Russo-Japanese war, by the Russian administration of finance, mentions gold and iron ore as the principal minerals; and names a total of 98 gold mines, of which 17 are shown to be productive. According to the return at the end of last year, there are among the mine-lots, for which concessions have been granted, 117 gold mine-lots, 38 of gold and silver, and 136 of gold placer; but as the total number of mine-lots of all minerals is 565, those of gold comprise over a half of all the mine-lots. These are abundant in the northern part, especially in Ping-an; and the most famous gold mine in Korea is the Wunsan. This mine, which had been worked by Americans from about 1888 to 1895, passed to the ownership of a new company, the Oriental Consolidated Mining Co., the capital of which, all paid up, is divided into 500,000 shares of 20 yen each. This mine now occupies a most prominent place among all the mines in the Japanese empire. It has six mines, each of which has well equipped mills; the machinery is driven by power transmitted from a hydro-electric plant. According to the reports from 1903, 230,000 to 300,000 tons of ore has been annually mined and treated and $2,400,000 to $3,000,000 in gold was produced: an annual dividend was paid, the profits amounting to 930,000 yen for 1908 and 1,110,000 yen for 1909.

When the concession for this mine was first granted to Americans, people of different nationalities endeavored likewise to secure concessions, and various English, Italian, French, and Japanese companies obtained rights. However, all these attempts did not succeed as well as did the American undertaking. Other gold mines, Sakushu (Japanese spelling used for these names), Shojo, Kijo, and Sensen in the northern Ping-an and Suan in the Yellow-sea Province are developing; and among placers, Junan district in the southern Ping-an, and the districts of Zengi, Mokusen, Bugi, and Seishu in Chung-chong are famous. The methods of working are, however, primitive, with little added improvement, and there is ample room for the investigation of better practice; but working on a large scale, as carried on in America and Australia, cannot be introduced before the nature of the strata has been carefully investigated.

Limonite, magnetite, hematite, etc., are produced in numerous localities. In 1899 there were 38 iron mine-lots granted; but owing to poor means of communication, they are not all worked; indeed, only those mines convenient for shipping along the river Tai-dong and its tributaries are worked. However, iron products for 1909 amounted to about 100,000 tons, and owing to great demand from the Yawata Government Iron Foundry, gradually measures for the extension of working were taken, and 130,000 tons were produced in 1910. Moreover, as it is estimated that these mines would not supply more than half of the requirement of that foundry, it appears that the production will hereafter be increasingly larger in amount. Besides, in Angaku, Yellow-sea Province, 40,000 tons of hematite was mined, and it is estimated 50,000 tons for the year 1910, Danpyo 20,000 tons, and Sainei 40,000 tons, etc. In the same province are mines of limonite, which, at the beginning of this year, became the possession of Hachiman Iron Foundry. The ore of Kenjiho is of good quality, and being better situated for transportation the mine will be worked within this year. And the iron ore of Wakakuri in Ping-an, and the micaceous iron ore and magnetite of Shorinbo, in the Yellow-sea Province, will be mined when international conditions and means of communication shall have been improved.

The graphite-producing regions in Korea are wide in their extent. The production of this mineral is of recent date; the export of it, which amounted only to about 20,000 yen a few years ago, has now reached over 30,000 yen; and will, it is expected, still further increase in the future. Its chief producing district is northern Ping-an, where flake graphite of good quality is mined. Though graphite in powder is quite generally produced, it is unfit for electrical purposes and unsuited to the manufacture of good crucibles. When good graphite from Ceylon sold for 300 yen per ton at London, common graphite from Korea was worth but 50 yen, but as the electrical, mechanical, and engineering works are now in prosperous condition, and as graphite is cheap, it cannot be concluded that the demand will hereafter fail, and the future of Korean graphite may be considered as hopeful. According to the return at the end of 1909, the land concessions of graphite were of 109 lots, which come next to the gold mine-lots in number; one-half of the graphite concessions were to English investors.

Coal is produced in many places. The most famous coalfield is the Pying-yang coalfield, stretching 15 miles along the Tai-dong river, where is produced anthracite which is briquetted for use in the Navy. The principal of the three strata has a width of 4

to 27 shaku. There is almost no block coal, all being fine.

Besides the preceeding, Korea has copper mines, among which Kapsan in the southern Ham-kuing and Hu-chhang in Ping-an are famous. The concession for working of Kapsan was obtained by Americans, and according to their report, the ore contains 10% copper, and will, it is said, long afford profit. Besides, the gold mine at Suan in the Yellow-sea Province produces copper; 100,000 tons mined was worth 2,830,000 yen, of which 1,860,000 yen was net profit.

The above are the principal minerals of Korea, but the search for mines is not yet ended, and there is no doubt that minerals to be exploited in the future and those yet to be found are not few. In view of the result of the previous undertakings the future looks bright. For instance, though it may require abundance of capital, all expenses for development, mining, etc., per ton of ore are as follows:

	Yen*.
Development and mining expenses	3.18
Milling	1.16
Transportation	0.03
Cyaniding	0.33
General expenses	0.74
Total	5.44

This cost can not only be well compared with that of the greatest gold mines in the world, but is much less than that of the mines in Australia and Transvaal. Notwithstanding that methods are crude and require much labor, there is a net profit of about 10%, which is undoubtedly due to the low cost of production. In Korean mines, motive power is dear, and so are, of course, consumable materials, which are imported.

To look at the result of the operation of iron mines at Chai-ryong and elsewhere, as the expense of mining and placing on board ships per ton of iron ore is 2 yen, and 30 to 40 sen, while the purchase price by Yawata Government Iron Foundry is about 5 yen and 80 sen, there will be fair profit. Of graphite mines, if we deduct from 50 yen, the price at London, the freight of 12 to 18 yen, there is the balance of 32 to 38 yen; and if we again deduct from these the cost of production, it will be no difficult matter to get a profit of 25% for the capital.

The future of the mining industry of Korea depends upon the Japanese nation. Abundance of capital must be provided, the means of communication and transportation must be improved, and they must abolish the laws which fetter the development of the mining industry; but it is still more important that the habit common to those engaged in the mining industry, that of securing possession of mine-lots for mere speculation, be discontinued or prohibited. Of all the mine-lots granted 575,399 are to Japanese, 145 to natives, and 31 to foreigners; but those possesed by the Japanese, who have the greatest part, which are actually at work, do not exceed 10%, and 90% are left untouched. This is due either to the fact that they occupied so many lots, in order to sell them at high price when the opportunity offers, or to the blind belief that Korean mines could be easily worked with small capital. However, when foreigners would purchase their rights, they ask exorbitant prices for them; on which an American said: "If the Japanese continue this practice, all their mine-lots will fall into the hands of Englishmen and Americans." In short, it is, I think, far better to co-operate with foreigners by making reasonable proposals, or to sell their rights to the latter at moderate price and get the real benefit resulting from the working of such mines, than to possess a great many mine-lots without capital to work them, and thus prevent the development of the mining industry. In conclusion, I have to add that the Japanese want sincerity in the conduct of business. The director at the Wunsan gold mine, Mr. Meserve, has been there in his service for twelve years and superintended the business; and the undertaking has made a profit of about 10%. The great-mindedness of a company that entrusts the management of an enterprise involving ten million yen, and which is 10,000 miles from home, to the same man for twelve years, is admirable, yet a man of integrity and industry like Mr. Meserve, is one most needful for the future development of Korea; and affords, at the same time, a good model for the Japanese.

*Yen = 99.7 cents.

TIN MINING IN BOLIVIA

The annual report of the British legation at La Paz, Bolivia, shows continued activity in tin mining, which furnishes the most important article of export. Shipments during the first six months of 1909 amounted to $6,767,000 (U. S. currency). Among the operating companies the following is mentioned:

Andes Tin Co., an American concern, which has spent a great deal of money on the erection of a hydro-electric power-plant. Its concentration plant is now in course of erection. Patches of rich ore are found, and there is an abundance of water from the melting glaciers above the mines on the high peaks at an altitude of 18,000 ft. The mines themselves are at an altitude of 16,000 to 17,000 feet.

PLATINUM MINES IN COLOMBIA

The National Assembly of Colombia passed a law in October last in regard to platinum mining in that country. The act provides that platinum mines shall be adjudicated by the nation, and that they may be denounced by anyone on the terms and conditions established by the laws on gold and silver mining. It is provided that all adjudications in favor of foreigners in the districts of Choco and Darien shall be suspended until the completion of the work of revising the law. Mines in the beds of rivers are not to be adjudicated, and natives can continue to wash platinum in the river beds.

The tungsten ore found in Signal district, eastern San Bernadino county, California, is hübnerite and is high-grade mineral. The tungstate occurs in a quartz gangue, the vein having a comb structure.

What is Cyanamid?

By John Woods Beckman

The following, in view of some recent discussion relative to improvements in the cyanide process, is of interest to all metallurgists. It is abstracted from *Metallurgical and Chemical Engineering*:

At the present time there are three different substances that go under the name of 'cyanamid.' But only one of these has a legitimate right to the name. The substance with the right to the name is one whose chemical formula is $H_2N.CN$, and the name of cyanamid indicates to the chemist that an amid (NH_2) group is combined with a cyanogen (CN) group forming cyan-amid. It is produced in the following manners:

Cyanogen chloride is introduced into a solution of ammonia in ether, and cyanamid is formed according to the following formula:

$$CNCl + 2H_3N = CN.NH_2 + NH_4Cl$$

If tio-urea is treated with the oxides of lead or mercury in an aqueous solution, cyanamid is formed, and the reaction can be written in the following manner:

$$NH_2.CS.NH_2 = CN.NH_2 + H_2S$$

Also if a cyanamid salt be treated with an acid under special conditions cyanamid will be produced. Pure cyanamid is a white, crystalline, deliquescent mass, soluble in water, alcohol, and ether. It melts at 40° C. One characteristic feature of cyanamid is its tendency to polymerize, forming dicyandiamid, and even higher products of polymerization, such as melam. The polymerization of cyanamid takes place when a solution of cyanamid is being concentrated or being kept for any length of time. If cyanamid be heated to 150° C. it polymerizes with great violence. Chemically cyanamid can be either classed as weak acid or as a weak base. As an acid it will form salts with metals, such as silver, calcium, and others. Of these salts the calcium salt is the most important. As a base, cyanamid will form a number of salts; with acids these salts as well as most of the metal salts are very unstable. Cyanamid, as well as a number of its salts, is an unstable chemical complex that very readily transforms if conditions are right in two different directions, polymerizing forming dicyandiamid, or hydrolizing forming urea. The substance that is most generally known by the name of cyanamid is the product obtained in the process of fixing atmospheric nitrogen with calcium carbide. Cyanamid is the name most generally used for this compound, but a trade name of 'lime-nitrogen' for this product is being used. The only right lime-nitrogen has to the name of cyanamid is that one of the components of the product is a calcium salt of cyanamid.

The chemical formula for 'lime-nitrogen cyanamid' can only be expressed in the following manner:

$$xCaCN_2 + yCaO + zC + uCaC_2$$

From this formula it will be readily seen that this compound is a heterogeneous substance and of no definite chemical composition, nor do its components appear in the same ratio all the time. To explain the composition it is necessary to give, in brief, the chemistry of the formation. If calcium carbide is heated in an atmosphere of nitrogen, the carbide combines with the nitrogen with great avidity, according to the following formula:

$$CaC_2 + 2N = CaCN_2 + C$$

This reaction explains the existence of free carbon in the graphitic modification in the cyanamid, while the free CaO is an unavoidable admixture. The carbide used for the fixation of the nitrogen contains a considerable amount of free CaO as diluent, and this naturally will appear in the finished cyanamid. A small amount of carbide is unavoidable, as it is impossible with the present state of the art to totally bind all the carbide within reasonable time. The chemical nature of cyanamid or lime-nitrogen is a very complex question, and even more so than for the pure cyanamid $NH_2.CN$, on account of the unavoidable CaO. An Italian agricultural chemist by the name of Ulpiani has made some extensive researches on lime-nitrogen, and has found that lime-nitrogen is permanently changing its chemical structure, even only by storing same and under the influence of ordinary atmospheric conditions. What part the air-slacking of the lime may play in this chemical rearrangement of the chemical structure of lime-nitrogen, or, more correctly, the calcium salt of cyanamid, is hard to determine. The calcium cyanamid is of an unstable structure and forms with great ease polymerized as well as hydrolized compounds. In treating the lime-nitrogen with water, even with small amounts, still more complex phenomena take place, basic as well as acid calcium cyanamid salts are formed, with the free lime present; urea is formed; calcium cyanamid carbonate may be formed, and a quantity of others, including dicyandiamid and free ammonia. Ulpiani has made extensive research regarding the action of lime-nitrogen with various acids and in various solutions, and these are able to spread a good deal of light over an exceedingly complex chemical problem, which is growing more and more important as new uses for cyanamid are developed.

These researches of Ulpiani have also shed light on the fertilizing value of cyanamid, and he proves conclusively that it is not cyanamid or dicyandiamid that is the direct fertilizing ingredient in lime-nitrogen, but it is the result of hydrolization, the urea, which is acted upon by the bacteria, and ultimately transformed into a nitrogen compound that can be absorbed by the plant.

The third product that claims the name of cyanamid bears it only as a trade name. Lime-nitrogen is mixed with a certain percentage of sodium nitrate and with a low-grade nitrogeneous material as a diluent to regulate the nitrogen contents of the finished product, and is then called 'cyanamid.' This material is compounded exclusively for the fertilizer trade and is of no chemical importance. It is apparent from the above that the name of cyanamid is one that has lost its original meaning and has

come to indicate altogether different substances to different groups of people. The name 'cyanamid' should stand for the chemical compound known by the formula, H_2CN_2.

'Lime-nitrogen,' although a meaningless name, as meaningless as if gypsum were called 'lime-sulphur,' may remain the name for the product now generally known as 'cyanamid,' while for the third product a name like 'cyanamid compound' or 'lime-nitrogen compound' would probably answer, thus clearing up a question of names that is becoming more and more complex the wider the field stretches in which 'lime-nitrogen' can be used.

BOUNDARIES OF MEXICAN MINING CLAIMS

The Mexican mining law which went into effect January 1, 1910, contains the following, relative to marking boundaries:

Article 7. The period of one year is granted to mining proprietors who have not marked the boundaries of their mining claims with monuments in order that they may do so. The one who does not comply with this provision shall be responsible for the damage and loss which he causes a third party, and, besides he shall incur a fine of ₱100 to ₱500 ($50 to $250 American currency), which the Department of Fomento shall impose upon him on receiving verified notice of the infraction.

If, after the fine has been imposed, the responsible party should persist in the omission for a period of thirty days he shall be consigned to a judicial authority in order that he may impose upon him the penalty for disobeying legitimate order of authority, and the Department of Fomento may also have the monuments constructed at the expense of the interested party.

TEXAS GASFIELDS

Natural gas in Texas, according to a report recently issued by W. B. Phillips, is used in several cities. Dallas and Ft. Worth, with a population of about 170,000, are supplied from the Clay county fields, south of Red river. The gas is piped 110 miles and the base price is 50c. per 1000 cu. ft., with a substantial reduction to large and regular consumers. Wichita Falls, Wichita county, pipes its gas from the Clay county fields also, and the price is 9 cents. In addition to these cities, Laredo, Webb county, on the Rio Grande, also has natural gas piped for 20 miles, while Atlanta, Cass county, and Corsicana, Navarro county, have local supplies that could be much more extensively used than is the case at present. There are four known gasfields in Texas which appear to have sufficient gas for all ordinary purposes, in the counties of Clay, Cass, Navarro, and Webb. The Clay county gas comes from the same general field as the oil. The Navarro county gasfield is closely associated with the Corsicana and Powell oilfields. There is probably another large gasfield in Texas which has not been developed. It is from 15 to 20 miles south and southwest from San Antonio and lies between the San Antonio and the Medina rivers and along this latter stream from its confluence with the San Antonio. Good pressure has been observed in this field and it is likely that a large quantity of commercial gas could be secured. It would be difficult to find a more favorable locality for the introduction of natural gas than San Antonio. The price of coal in Texas runs from $5 to $6.50 per ton. Even the lignite production does not begin to supply the demand.

WHITE HORSE DISTRICT OF CANADA

White Horse is at the head of navigation on the Yukon river, or more properly the Fifty Mile, a tributary and headwater of the Yukon, and is the northern terminus of the White Pass & Yukon railway. It is the transfer point from rail to river service of the White Pass & Yukon railway, which service extends about 560 miles, from Skagway, Alaska, to Dawson, Yukon Territory. Its population in summer is about 1500 and in winter 250. The season of open navigation extends from June 5 to October 10. During winter the White Pass & Yukon railway maintains a stage service between White Horse and Dawson. There is railway service between White Horse and Skagway daily except Sundays. On the river division the service is such as facilities will permit, about four boats a week. At close of navigation the stage service commences, using wheels until sleighing is practicable, about November 15. There is a weekly service while the wheeling lasts, then a triweekly service by sleighs. The run to Dawson, 325 miles, on wheels is made in six days, on sleighs in five days. The Canadian Government has constructed a wagon-road between White Horse and Dawson, which is 125 miles shorter than the river distance.

Deposits of copper were discovered in this district in 1898, since which time efforts have been made to operate, but generally by parties without sufficient means to handle successfully the low-grade ore produced. Recently, however, the Atlas company of Spokane has expended $50,000 to $75,000 in improvements on the Pueblo mine, having installed modern machinery, erected substantial buildings, etc. The White Pass & Yukon railway has erected at Skagway ore bunkers and equipment for transferring the ore from cars to ships. By this equipment ore was handled to the ship at the rate of 300 tons per hour. The mineral belt extends for ten miles or more. The copper of this district, though of low grade, from 3 to 5%, is in demand by smelters on account of its fluxing qualities; hence a very low smelting rate is obtained. Twenty-five miles south of White Horse is the recently discovered Wheaton silver-gold quartz district, the properties in which have not yet proved their value, but so far as work has been done the outlook is promising. Fifty miles south, along the shores of Lake Atlin and arms, is an extensive section called the Conrad district, two or three mines in which are regular shippers of silver-gold ore, which goes to the Tacoma Smelting Co. The principal shipper is the Yukon District Gold Mining Co., whose mine is owned principally by William MacKenzie, a Canadian capitalist, but is managed and operated by J. H. Conrad.

Discussion

Readers of the MINING AND SCIENTIFIC PRESS are invited to use this department for the discussion of technical and other matters pertaining to mining and metallurgy. The Editor welcomes the expression of views contrary to his own, believing that careful criticism is more valuable than casual compliment. Insertion of any contribution is determined by its probable interest to the readers of this journal.

An Explanation Wanted

The Editor:

Sir—Possibly the explanation of the good results obtained by I. A. Jackson, Jr., when using potassium acetate in his cyanide solution and a mixture of lead oxide and shavings in the top-box, may be due to the fact that such a solution dissolves a little lead which would be reprecipitated on the zinc-shavings, forming a lead-zinc couple, which is known to be effective in precipitating gold from foul, or weak, solutions. If your correspondent had arranged for a small quantity of lead acetate solution to drip into the first zinc-box, he might have obtained an equally satisfactory result.

H. JONES.

Minas Geraes, Brazil, December 16.

A B C of Empire Drilling

The Editor:

Sir—In the article by Messrs. Hutchins and Stines in the January 7th issue, on the 'A B C of Empire Drilling,' the ground in which the drilling was done was apparently firm and without boulders. In company with J. J. Martin, I had occasion to use this drill on the Unuk river, British Columbia, last fall. The ground to be tested was a loose gravel and sand containing boulders up to 2 ft. diam. On account of its extreme looseness, the drill could not be started as described in the article. It was found necessary to sink a pit about 4 ft. deep and 4 by 3 ft. area. The cutting-shoe, attached to the pipe, was then placed in the centre of the hole, and the excavated material, the volume of which had been carefully measured, and which had been washed to recover the contained gold, was shoveled back into the hole, care being taken to keep the pipe vertical. At times boulders of some size were reached in sinking, usually of granite or gneiss, and even at a depth of 20 or 25 ft., owing to the looseness of the ground, the cutting-shoe would often work around the side of the boulder, throwing the whole pipe out of plumb and interfering seriously with the pumping operations. To offset this difficulty, a 'dead-man' was buried about 2 ft. deep just inside the circular path traveled by the horse pulling the sweep, exactly in the direction in which the pipe was leaning. Braced against this was laid a tree 8 to 10 in. diam. and long enough to rest against the pipe about 3 ft. above the ground. The tree was forked or notched to hold it firmly against the pipe. By nailing on a few planks as a support, it was weighted down with about 200 lb. of rock, and then, by the vigorous use of a 16-lb. sledge, was driven down until the pipe was again in vertical position. The 200-lb. weight served to keep the brace in position while the pipe was revolved, as without it the brace would work up in a few turns of the pipe. It would also be well to have plenty of cutting-shoes on hand, especially if there is any likelihood of running into boulders, as in over half the holes drilled the shoes had teeth broken off, and in one case half the shoe snapped off.

R. B. MCGINNIS.

Berkeley, California, January 18.

Amalgamation Following Fine Grinding

The Editor:

Sir—I read the contribution by C. F. Spaulding in the issue of the *Mining and Scientific Press* of December 31, on 'Amalgamation Following Fine Grinding', with great interest, and, I believe, some profit. Without doubt there are many places where a high extraction of gold from ores can be obtained by this very simple method. The suggestion which most attracted me in Mr. Spaulding's article was his proposal to utilize a revolving amalgamating-barrel provided with interior radial 'wings' which were calculated to promote the efficiency of amalgamation. That his idea is correct, I believe to be true, and also feasible. In fact, Mr. Spaulding practically describes a machine which was introduced in San Francisco about 1893, or perhaps a year or two later, which was known as the Gold King amalgamator. It consisted of a cylindrical iron shell, about 5 ft. long and 12 in. diam., so arranged that it could be tilted somewhat from a horizontal position, the grade being adjustable within the limit of 2 or 3 inches. This cylinder was divided into two parts longitudinally, the upper half being attached to the lower by several hinges, so that the interior of the machine was rendered accessible by throwing back the upper half. It was lined with silver-plated copper plates and was provided, as suggested by Mr. Spaulding, with four radial wings of copper plate which extended the full length of the machine. The cylinder rotated about its longer axis, the pulp being introduced by means of a hopper at the upper end and discharging through an aperture at the centre of the lower end. In its rotation the pulp came again and again in contact with the amalgamated surface of the plates, and, contrary to theory, did not scour if there was any gold to amalgamate. Any plate will scour from the action of passing mill-pulp, if there is no gold present to build up a layer of amalgam. The Gold King amalgamator did splendid work at a number of places, but so strong was the almost universal prejudice of boss millmen against any mechanical device to assist in amalgamation, that it was found very difficult to introduce the machines in California mills, and to keep them there until an impartial trial had been given them. I saw the gold amalgamated in this machine from concentrated black sand from an Alaska beach, and also saw the plates of a machine cleaned up that had been run on quartz-mill tailing, the machine making a very creditable saving.

W. H. STORMS.

San Francisco, January 20.

Concentrates

Most of these are in reply to questions received by mail. Our readers are invited to ask questions and give information dealing with the practice of mining, milling, and smelting.

Ocean steamships cost, per ton of capacity, an average of $71. Lake steamers cost $41.50, river tow-boats and barges suitable for carrying 10,000 tons of freight on 8½-ft. draft, $12, and railway freight cars, approximately $20 per ton of capacity.

Patent for a lode claim includes all the surface within the boundaries of the claim, not excepted in the patent itself. A subsequent locator of an overlapping placer claim acquires no rights within the limits of the lode claim.

Specular iron is very often mistaken for galena. When uncertain, scratch the mineral with the point of a knife-blade; galena makes a lead-black streak and specular iron one which is dark red. Specular iron sometimes contains gold. An instance occurs at the old Roberts mine on Castle creek at the south end of the Bradshaw mountains in Arizona, as also in Brazil, where the iron is auriferous.

A mill, or other machinery, placed on a mining location, or in the vicinity, for the treatment of ore from the claim or group of claims, is properly chargeable to 'annual labor' performed on the mines themselves. However, the machinery should be placed in position as soon as possible, or it may be construed as a subterfuge, the machinery not in place being easily movable from one site to another.

Base ore assaying but $1.10 per ton, no matter what the metal representing this, whether gold, silver, lead, zinc, copper, or other metal, is too low grade to afford a profit under ordinary working conditions in Montana, or, in all probability, anywhere else, and if there is a company in Montana operating a mine at a profit producing ore of this character this department has no knowledge of it.

Nitro powders must not be thawed rapidly, nor chilled quickly. This class of explosives should be kept constantly at as near a normal temperature as possible—70 to 80 degrees. This can usually be accomplished by storing the powder in a stone or concrete warehouse having thick walls. Only sufficient for the day's use should be kept in the mine, and no large amount at any one place underground. Where several boxes of powder are required daily, it should be distributed to as many separate places as possible, to minimize serious disaster in the event of a premature explosion.

Boiler explosions are frequently caused by the water becoming too low. Be careful that the proper amount of water is in the boilers when in service. Don't fail in this. Don't permit the water to get low. Don't depend on the automatic water-feeder. See to it yourself that the boiler gets the proper amount of water. Don't fill an empty boiler with water when there is a fire in the furnace or when the furnace walls are hot. Don't let any one else do this. Remember that water coming into contact with hot metal will crack the metal. Don't permit any person to draw water from the boiler when there is a fire under it. Your personal safety and the safety of the boiler require strict observance of this rule.

The diamond mines at Kimberly, South Africa, have now been worked by underground method for nearly twenty years. Mining was all formerly by open pits. The diamond ground is now reached by means of levels run from vertical shafts, sunk at some distance from the rudely circular deposits, in what is called the rim or edge of the pit. Mining operations at these mines are on a very extensive scale, and although thousands of tons are broken down and hoisted daily, much of the diamantiferous earth lies exposed to the weather for four years to permit disintegration before it is sent to the crushing mills.

One element of danger in shafts not kept in first-class condition arises from the liability of skips, buckets, or cages getting 'hung up' in the shaft while descending, the engine continuing to unwind the cable, which coils up about the carrier in the shaft. Sometimes this accumulating weight causes the obstruction to be forced aside and the skip takes a drop of a greater or less distance, generally with disastrous consequences. On one occasion when an accident of this character occurred, the rope continued to unwind, a loop of it descending some distance below the skip. The latter suddenly broke away and fell, passing through the loop, tying the cable in a hard firm knot which it was impossible to untie. The cable was cut above and below the knot with a hack-saw and the knotted section of cable was placed in the California State Mining Bureau, at San Francisco, California.

Horse-power is an arbitrary measure of the duty required of, or done by, a motive force, whether it be water, steam, electricity, gas, or some other form of energy capable of being controlled and utilized. Before the steam-engine was invented, either water or animals, though sometimes human beings, supplied the needed force. When the steam-engine began to be utilized, and standard for measuring the power developed by this new device was required, it was then that James Watt made experiments which resulted in fixing as the capacity of a large powerful horse the lifting of 33,000 lb. 1 ft. in one minute. This has since been the basis of estimating the power capacity of engines, water-wheels, and other devices capable of transmitting energy. To estimate the power of an engine of the piston type, a very simple formula has been devised: $Hp. = \frac{PLAN}{33{,}000}$ where P is the pressure of steam or air in pounds; L is the length of stroke of piston in feet; A is the area of the piston in inches, and N is the number of the strokes of the piston per minute. In engine design the diameter of the piston always bears a reasonable relation to the length of stroke. The latter is seldom less than the diameter of the piston, nor does it often exceed twice its diameter. High-speed engines usually have a relatively short stroke, and slow-speed engines a long stroke.

Special Correspondence

WASHINGTON, D. C.

Synopsis of Bill Providing for Leasing Alaskan Coal Lands. — Proposed Disposition of Cunningham Claims.

The one result likely to come out of the controversy over the Cunningham coal-land claims in Alaska is a definite law under which Alaska's resources may be developed. The controversy put the Alaskan situation squarely before Congress years before it might otherwise have been reached. The President recently called a number of the members of Congress and his Secretary of the Interior into a conference, and urged the necessity of prompt action on the coal lands of Alaska, the oil situation in California, and the general subject of appeals from the Department of the Interior. Those present were Knute Nelson, of Minnesota, chairman of the Senate Committee on Public Lands; Reed Smoot, senator from Utah; Frank P. Flint, senator from California; Frank W. Mondell, of Wyoming, chairman of the House Committee on Public Lands; and Herbert Parsons, of New York, also a member of the House Committee on Public Lands. As a result of this conference, five bills have been introduced in Congress—three by Senator Nelson and two by Senator Flint. They are as follows: By Mr. Nelson, to provide for the leasing of coal lands in Alaska; to provide for appeals from decisions of the Secretary of the Interior to the Court of Appeals of the District of Columbia; authorizing the validity of certain coal-land entries in Alaska to be tried and determined by the Court of Appeals of the District of Columbia. By Mr. Flint, to provide for the granting by the Secretary of the Interior of permits to prospect for oil and gas upon mineral lands of the United States, and of leases of public lands for the production of oil and gas after discovery; and a bill to protect the locators in good faith of oil and gas lands who shall have effected an actual discovery of oil or gas on the public lands. The most important of these is the bill providing for the leasing of coal lands in Alaska. It provides that all lands in Alaska to which patents have not been earned or to which vested right has not been acquired, and which contain deposits of coal, are reserved from all forms of entry, appropriation, and disposal except under the provisions of this act; that all other minerals in such lands shall be expressly reserved to the United States and from disposition under this act; that any citizen of the United States, association, or corporation of such persons may apply to the Secretary of the Interior for a license to prospect and explore for coal, or for a lease to mine and extract coal from an area of land not exceeding 3200 acres in any one license or lease. The license to explore will be for a term not exceeding two years and the compensation shall be 25c. per acre for the first year and 50c. per acre for the second year, with the privilege of leasing the coal on the lands. After the discovery of coal, the locator may obtain a lease to run 30 years, at a royalty to the United States of 5c. per ton of coal extracted if the lease is made within 10 years from date of the passage of the act; if the lease is made after that period, then at a royalty of 6c. per ton, and in addition to such royalty a rental is to be paid each year as follows: 50c. per acre for the leased premises for the first year, $1 per acre for the second year, $2 per acre for the third year, and $4 per acre for each and every year thereafter during the continuance of the lease. Such rental for any year shall be credited upon the royalty accruing during that year. Every such lease granted under the provisions of this act shall be upon the conditions that the lessee shall not monopolize, or attempt to monopolize, the trade in coal; that the lessee will at all times sell the coal extracted at just, fair, and reasonable rates, and without any discrimination in price as to persons or places, the Interstate Commerce Commission to have jurisdiction over the territory and the laws relating to common carriers to apply. The Secretary of the Interior may renew a lease for an additional period of ten years, but in such cases the royalty shall not be less than 6c. nor more than 15c. per ton run-of-mine. The lessee shall not, without the consent of the Secretary of the Interior, assign his interest in the leased premises to anyone else. The Secretary may issue a limited license granting the right to prospect and mine for domestic use, and to dispose of for local consumption, coal belonging to the United States, a specified area, not to exceed 40 acres to any one person for a period of not exceeding 10 years, on the payment of a royalty per ton of coal. It shall be the duty of the Secretary of the Interior to ascertain as soon as may be whether any of the coal deposits are suitable and well adapted for the use of the Navy of the United States, and if such deposits are found, the Secretary under the direction of the President, may withhold and withdraw the same from exploration and lease under the preceding provisions of this act. The Secretary of the Interior, in conjunction with the Secretary of the Navy, may, on behalf of the United States, lease such coal deposits for the purpose of mining the coal and supplying the same to the Navy and the revenue cutter service at an agreed price per ton, to be specified in the lease, and as to such coal furnished the United States, no rental or royalty shall be paid therefor by the lessee, but the same shall be taken into account in fixing the price at which the coal is to be supplied to the United States.

The third bill presented by Mr. Nelson provides that the Commissioner of the General Land Office shall, within 90 days after the passage of this act, certify directly to the Court of Appeals of the District of Columbia, a transcript of the entire record on file in his office of the so-called Cunningham coal claims, these claims to be finally passed upon by this court. This course is opposed by Gifford Pinchot, the former Forester, who recently stated his views on the Cunningham claims in a brief presented to Mr. Taft. Mr. Pinchot declares that no resort to a court or rehearing of the case is necessary to secure justice and protect the people's property. "The case against the claimants is already conclusive," says Mr. Pinchot. "I believe the duty of the Executive in regard to the claims is obvious and immediate. The claims should be canceled by the President forthwith." James Wickersham, of Fairbanks, Alaska, delegate to Congress, has introduced a bill dealing with the mining interests of Alaska. He would have it provided that no association placer-mining claim shall hereafter be located in Alaska in excess of 40 acres; that on every single and association placer-mining claim hereafter located in Alaska, and until a patent has been issued therefor, not less than $100 worth of labor shall be performed or improvements made during each year, including the year of location, for each and every 20 acres. He would also provide that not more than two association placer-mining claims shall be located by or for any association of persons in any month, and not more than 24 in any year. The urgent deficiencies bill, which has already become a law, carried with it $100,000 for the investigation of the mineral resources of Alaska.

JOHANNESBURG, TRANSVAAL

Development of the Cinderella. — Change in Transvaal Practice. — Artificial Methods of Ventilating Mines.

The Cinderella Consolidated, an important amalgamation of General Mining & Finance Co. and Barnato Bros. interests in the neighborhood of Boksburg on the East Rand, gives promise of becoming one of the foremost gold producers of South Africa. At present, development is progressing rapidly in order to prepare the mine for the increased scale of producing operations to which the company is pledged. In order to facilitate exploitation of the mine, sinking of a new central shaft was commenced a short time ago and good progress has been made. This shaft has seven compartments, and erection of the permanent steel headgear and ore-bin has been completed, while the depth attained in the shaft at the time of writing is between 100

and 200 ft. In the past it has been the practice in the Transvaal to erect temporary sinking headgear at the outset of sinking operations and not to proceed with the erection of the permanent structure until the bottom of the shaft is approaching its ultimate depth. Of late, however, a different practice has come into favor and at both the Government gold mining areas on Modderfontein and at the Cinderella Consolidated, the erection of the permanent headgears has been undertaken at the commencement of sinking. Practical proof of the earnest desire of the big mining companies to improve the ventilation of the underground workings along the Main Reef is to be found in the extent to which artificial methods are being introduced to increase the volume and the quality of the air circulating through the various properties. It has been charged that the Rand has been backward in the matter of artificial ventilation. Perhaps this charge has not been wholly unfounded, but, generally speaking, the conditions obtaining in the majority of mines have compared favorably with those prevailing in other gold mining districts. However that may be, the East Rand Proprietary Mines, Cinderella Deep, and Village Deep took the lead a little while back in the installation of fans, and it is now important and satisfactory to learn that at the Crown Mines, City Deep, Rose Deep, Nourse Mines, Robinson, and New Modderfontein, fans are to be installed and elaborate systems of ventilation carried into effect. The types of fans in chief favor are of the Sirocco and Ratteau makes.

BUTTE, MONTANA

Litigation Over the Parrot.— Committee of Legislators Inspects Mines to Investigate Conditions.— Affairs of Butte & Superior.

Two of the minority stockholders of the Parrot company brought a suit in the United States Court asking that the sale of the property to the Anaconda company be set aside on the ground that the property was disposed of at a price not commensurate with its value. The case came up in Judge Lynch's court when an attorney representing B. N. Richardson, H. B. Jackson, Isaac Bradford, and Mary A. Knight, all of Boston, asked that the application made several months ago for the appointment of appraisers to value the property be dismissed, as a settlement had been effected. The request was granted, and then an attorney on behalf of William F. Wall and Louis Foss of Boston asked that the matter of the application of his clients for the appointment of appraisers be continued until a suit he had just filed in the Federal court is disposed of, and it was decided to allow the question of appraisers to go over for one week. The complainant sets forth that the party to the suit owns 1210 shares of Parrot stock, and that in 1899 the Anaconda company entered into a conspiracy to deplete the assets of the Parrot and get possession. It is stated that, possession having been secured, the Parrot smelter was closed and the treatment of the ores turned over to the United Metals Selling Co., which turned it over to the Anaconda company. It is alleged that this caused a loss to the Parrot company of $500,000. It is further claimed that the smelting works at Gaylord were dismantled, causing further loss of $1,000,000. The sale of the Adventure claim to the Red Metals company is alleged to have resulted in a further loss of $1,000,000; that real estate and mining claims were sold to various parties, entailing a loss of $10,000,000. It is claimed that a reasonable value of the property is $50,000,000, and that the dumps and tailing are worth $5,000,000. In conclusion, the complaint says that at least $100,000,000 has been lost to the stockholders through the bad management of affairs, which, added to what would be a fair value of the property if handled by the company itself, would make about $200,000,000.

From time to time one hears statements to the effect that many of the underground workings of the mines in this district are not fit for a human being to work in, so when P. J. Duffy, a member of the State Legislature and a former president of the Miners' Union, introduced a resolution in the House calling for a joint committee of the two houses to investigate conditions, it was promptly passed, and just as promptly the two committees came to this city. Accompanied by the president and vice-president of the Miners' Union and officials of the Anaconda company, the committees inspected the underground workings of nine mines in two days. The secretary of the committee carried with him a thermometer and at places where it was claimed that the heat was practically unbearable, the temperature was taken. The Miners' Union representatives pointed out to the committee the worst places in the mines, and the legislators stopped and conversed with the miners at work as to the ventilation in drifts and stopes. In one place where it was reported to the law-makers from an outside source that the men could not work more than 25 minutes at a time, one of the miners was asked by a committeeman how long he could work there, and his reply, as given by a person who heard the question and answer was: "Why, I can put in my eight hours and then go out and have a h— of a time during the night." In speaking generally as to the inspection, the chairman of the committee said that none of the miners was found

Butte Mining Scene.

who had any particular complaint to make as to conditions. In several places visited the thermometer was found to register from 90 to 93 degrees, and in one place it registered 98. He said the fan system of ventilation was used in several of the mines and appeared to be successful. He believed that if the fan system was used in all the mines and that if toilet-cars to improve sanitary condition were used, the miners would not have much reason to complain. While the production of the Coalition mines has been reduced, the value of the ore coming from the Minnie Healy and Tramway mines of that company is said to be the richest ever mined in this district. It is predicted that when the time comes for increased production the Coalition property will surprise everybody. According to the statements of A. B. Wolvin of the Butte & Superior company, financial arrangements have been made for carrying on the work and that before the close of the year money sufficient to meet all obligations will come from the net earnings of the company. He says that since July 1 the company has made a net profit of $110,676.92, and the average earnings for October, November, and December were $25,000 per month, net. During December 500 tons of ore was shipped daily to the Basin concentrator, and about March, it is claimed, the output will be increased to 600 tons daily. Mr. Wolvin estimates that at the prices prevailing, with a 600-ton daily production, the property will earn $1500 net per day. The holders of bonds coming due January 1 have extended the time for one year. Reports from reliable sources say that the North Butte is showing well, and that high-grade ore is being blocked out. It is stated that only a small portion of this ore is being sent to the smelter, but it is being held in reserve.

LONDON

The Orsk Goldfields Ltd. — British Broken Hill Proprietary. — Oroya Black Range, Western Australia. — The Dunderland Iron Ore. — The El Oro.

The Orsk Goldfields Ltd., which operates the Kolchan placers, near the mouth of the Amur, Siberia, is increasing its capital from £750,000 to £920,000 by the creation of 170,000 priority shares of £1 each. These shares will be entitled, in priority to the preference and ordinary shares, to 85% of the profits of the company available for dividends in every year, and 100,000 have been offered to shareholders in proportion to their holdings. The parent company, The Siberian Proprietary Co., has guaranteed the subscription of 80,000 of the shares, the consideration being the right to subscribe at par for 60,000 other priority shares until December 31, 1912, and to subscribe for any of the 100,000 not now taken up by shareholders. The reason why new capital is required is that the steamer *Karema*, carrying the company's new dredge, was the victim of a collision when only two days out from New York, and had to put back to port for a month. The consequences was that she arrived off the coast of Siberia too late to deliver the dredge at Nicolaievsk before the winter stopped navigation, and the dredge had to be stored at Vladivostok until June 1911. The forced postponement of production and income made it necessary for the company to reconsider its financial position. Another adverse circumstance has been the delay in getting the Pokrovsky plant, consisting of a Page-Crawford excavator and sluice-box, into working order. C. W. Purington, the company's manager, was therefore recalled to consult with the directors as to the general prospects in Siberia. During the last few days cables have come from D'Arcy Weatherbe, who is in charge of the Pokrovsky plant, announcing that two trial runs had been made. In the second run 50 cu. yd. of gravel were washed and the clean-up yielded 2 roubles, or 4s. per cubic yard. Considering the conditions of work during frost this result is sufficiently notable to attract attention and foreshadows remarkable results when the plant is put in regular commission next May.

The information contained in the review of the zinc position at Broken Hill that appeared in your issue of January 7 might be supplemented by an account of what is going on at the British Broken Hill Proprietary; the review is not really complete without it. This company owns Blocks 15 and 16 on the Barrier range, situated between the properties of the Block 14 Co. and the North Broken Hill Co., and has not been so successful as others in the district on account of lower value of ore. During periods of depression in metal prices work has had to be suspended. Operations had been at a standstill since December 1907, and in the meantime the lead concentration plant has been re-built and an Elmore plant provided for the treatment of the zinc tailing. The new plant was started on June 15 last and its capacity has gradually been increased until during the 28 days ended December 10, 10,295 tons of ore was treated, yielding 1503 tons of lead concentrate, containing 954 tons lead and 37,575 oz. silver; also, 1738 tons of zinc concentrate containing 739 tons zinc, 191 tons lead, and 18,266 oz. silver. The recovery was 70% of the lead and 80% of the zinc. Further additions are being made to the plant and the extraction should be gradually increased. Development work has not yet been resumed, but plans are ready for exploratory work in the lower levels of Thompson's shaft. In order to provide additional capital for development and for additions to the concentrating plant, £30,000 debentures carrying 6% interest are to be issued. Another interesting item of Broken Hill news relates to the Broken Hill South Extended. This block has been hitherto unsuccessful and the company has been reconstructed twice. Except for a small dividend in 1891 the shareholders have received no return. The property consists of Blocks 52, 53, 89, and 90, the work being confined to the first named, and adjoins on the south the mine of the Broken Hill South Blocks. Recently a new main shaft has been sunk with the idea of exploring at greater depth. At 930 ft. the mineralization was so promising that diamond-drilling was undertaken in both eastern and western directions, and the former disclosed three bodies of zinc-lead sulphide, and a cross-cut was immediately commenced. T. G. Sweet, the manager, reports that this cross-cut is now out 330 ft. and has passed through four orebodies. Those most distant are close together and the two practically form one body 70 ft. wide. In September Mr. Sweet began to drive north and south at this point, and by the middle of November 100 ft. had been driven, all in ore. The assays show from 20 to 30% zinc, 14 to 20% lead, and 3 to 4 oz. silver per ton. The prospects of opening large amounts of profitable ore are encouraging and work is being concentrated on the 930-ft. level instead of sinking the shaft deeper.

Some of the developments in Murchison, Western Australia, are interesting English investors. One of the companies, having the advantage of the advice of H. C. Hoover, is the Oroya Black Range. This company was formed in 1906 to acquire the Sandstone leases in the Black Range district, East Murchison. Bewick, Moreing & Co. are the managers, William Pollard is superintendent, and H. C. Hoover and J. H. Cordner-James are on the board. The company is an offshoot of the Oroya Brownhill, of Kalgoorlie, and was formed when the latter was showing signs of nearing the end. The capital is £199,890, and dividends, commencing in 1908, have totaled to date 32½%. The results obtained on the third, fourth, and fifth levels are not so good as was expected, and the ore developed has not quite kept pace with the capacity of the mill. It is estimated that the reserve is sufficient for seventeen months. There are some parts of the mine where developments are hopeful. During the year ended August 31, 54,180 tons was raised and treated, yielding by amalgamation and cyanide 27,806 oz. valued at £118,072. The expenditure at the mine, including £13,495 for development, was £83,185, and after allowing for depreciation and paying London expenses and taxes, a profit was left of £24,516. The dividends for the year were 21½% and absorbed £24,986. As an offset against the disappointing results at Black Range, the company has recently acquired a useful asset in the form of 50% interest in the Youanme property, situated sixty miles to the southwest. The other half interest has been acquired by the Oroyo Exploration Co. This property measures 3900 ft.

along the outcrop, and two lodes have been found, that in the opinion of the engineers may prove to be branches of the same. A shaft has been sunk near the centre of the property and drifts commenced at 44 ft., 80 ft., and 170 ft. At the 80-ft. level, 1020 ft. is in ore, having an average width of 5 ft. 6 in., and a value of 50s. per ton. Another shaft to the south is also giving good results. It is estimated that 50,000 tons of ore averaging 50s. is ready for extraction.

I have several times referred to the Dunderland Iron Ore Co. which was formed in 1902 to acquire iron-ore deposits at Dunderland near the port of Mo, on the Ranen Fiord, west coast of Norway. It was promoted by Sir Joseph Lawrence, and many iron-masters in the North of England and South Wales lent support and subscribed capital. Subsequently the Consolidated Gold Fields of South Africa took an interest. The deposits consist of hematite and some magnetite in a gangue that contains apatite. The Edison system of crushing-rolls and electro-magnetic separators was adopted. The ore was crushed fine and the concentrate was to be made into briquettes. Unfortunately these processes were not tested thoroughly before plant on a large scale was erected, and one after another of the various parts of the plant failed to answer, and much additional capital had to be subscribed from time to time. The final collapse came about two years ago when it was found that the principle of dry crushing and concentration was not favored by the workmen. The dust was too great for safety, to say nothing of comfort, and as the population of Norway is not so great as to make it necessary for the workers to accept any terms and conditions the plant was deserted and the project abandoned. More recently the Ullrich wet magnetic concentrator has been tried and is now being tested on a small scale at the mines, under the advice and supervision of Henry Louis, who has been the technical adviser from the first. Information as to the results obtained by Mr. Louis is expected at any time. During the last few months the board has been reconstituted and the secretary has resigned. D. A. Bremner was appointed as general manager three years ago when the situation was beginning to be acute, and he still remains at his post. The share capital of the company is £2,000,000, divided equally into ordinary and 6% preference. There are £500,000 first debentures and £30,530 second debentures, £200,000 prior-lien bonds, and £81,043 funded interest certificates, all of which have been issued from time to time to keep the company going. The arrears of preference dividend represents a further £375,000.

You will have heard of the crisis in the life of the Mexico Mines of El Oro, one of the best managed and remunerative gold mines ever known in the London market. The daily papers have contained a good deal about it. The property was taken over by the Exploration company, and under the chairmanship of R. T. Bayliss and the management of R. M. Raymond, became a most profitable mine. With a low capital, £180,000, the rate of dividend has been high. A year ago French investors evinced a desire to acquire shares and the quotations of the £1 share was rushed to nearly £10. Mr. Bayliss was much averse to this great enhancement and would not do anything that savored of an encouragement of it. When the representative of the French shareholders wanted him to facilitate a quotation for the shares on the Paris Bourse he objected, knowing that such a course would only tend to raise quotations still higher. Eventually a crisis was precipitated because the French shareholders became so numerous as to be in a majority, and Lord Cowdray, better known as Sir Weetman Pearson, head of the firm of S. Pearson & Son (well known in Mexico) threw his lot in with the French shareholders because the extensive buying of these shares in France had been due to his influence. This opposition party gave the necessary notice for the convening of a meeting of shareholders and moved a resolution removing Mr. Bayliss and some of his confreres from the board. Finding himself in a minority, but only after stating his case and position very clearly, Mr. Bayliss handed in his resignation and with it the control of the company. It is a pity that two such eminent and honest engineers as Mr. Bayliss and Lord Cowdray should be at loggerheads, and that such a disruption should occur in the Exploration company's group. Mining administration is always being criticised; what can the public think of the honorable nature of mining engineers when such unnecessary bickerings between really sound men take place in this way?

NEW YORK

The Copper of the Future. — Calumet & Hecla Merger. — Porcupine and Kerr Lake.

Something like a year ago, J. Parke Channing gave out an interview covering the copper situation from the standpoint of the producer and drawing some comparisons between the copper ore reserves of the country and the standing timber available for lumber. The present temporary overproduction of copper has largely blinded both producers and consumers, and the spirit shown in most instances is very much like that of the lumberman, who, 25 years ago was wont to claim that the Michigan and Wisconsin pine forests could supply the world with white pine until the end of time. The white pine woods of the lake regions are gone and white pine has become almost a luxury; since the exhaustion of the Northern woods, the growing commercial needs of the country turned to the Southern pine forests and between turpentine and lumber, nearly every sapling in the South has succumbed to knife or axe. In view of the peculiar situation in copper, it is of interest to study our gross resources, especially with an eye to the additions made thereto within recent years. The first fact which is impressive is that within the past few years there have been no important discoveries made in the way of new big copper deposits. The attention of all copperdom has been fixed upon the development of the porphyries, but these mines are not new. The existence of the orebodies now being mined has been known to mining men for years; it is only the manner of working that is new; the application of methods, rather, for the steam-shovel has long been in use on the Mesabi range. While the proving up of the large bodies of low-grade ore makes for certainty in the life of and profit to be derived from the porphyry mines, it also makes more certain the date of exhaustion, and when the important producers are numbered and probable production estimated, even on a liberal basis, it begins to be plain why such men as J. B. Haggin have poured millions into properties in Peru, why the Guggenheims have gone into Alaska and into Chile, why the heart of the dark continent is being explored for copper, and Russia, Siberia, and China are being prospected. In our own copper districts there is really nothing new being added. In Butte there have been one or two mines made, as in the case of Tuolumne, East Butte, and Butte Ballaklava, but these can not be ranked as discoveries. The Lake Copper Co., in the Michigan copper country, comes nearer being an actual addition to known copper resources. In the Southwest, there is a splendid era of development, but little or nothing that can be called new. In the meantime, while production is increasing, consumption has also been increasing; the former is limited to our natural resources, the latter will continue to increase as long as cheap copper encourages the seeking of new uses for the metal. With statistics compiled more and more accurately all the time, it becomes more a matter of comparatively certain calculation as to the probable average life of existing mines. The life of the Calumet & Hecla is officially stated to be about 15 years. The mines of Butte are harder to estimate, but it is fairly safe to say that in the next 20 years most of them will be exhausted. The big controlling factor in the immediate future is the porphyry group, upon which fairly close estimates may be made. Taking the more important, those that will be factors in production in the next 10 years, they may be figured about as follows: Utah Copper, present tonnage, 150,000,000 tons; Nevada Consolidated, 40,000,000; Ray Consolidated, 80,000,000; Chino, 30,000,000; Inspiration, 20,000,000; Miami, 15,000,000; a total of 335,000,000 tons. Giving to these an additional hundred million tons to cover further develop-

ments and the entry into the producing ranks of such properties as Giroux, Mason Valley, and others, we have a total of about 435,000,000 to 450,000,000 tons of ore. In two years from the present time it is safe to say that the various properties in the porphyry group will be handling a total gross tonnage of 60,000 tons per day, which is equivalent to nearly 22,000,000 tons per annum. Simple division therefore fixes the life of the known important members of the porphyry group at approximately 20 years. Twenty years is a short period in the commercial life of the nation; the deplorable feature is the economic waste resulting from temporary overproduction. We are exporting 600,000,000 lb. of copper annually, all of which should bring 2 to 7c. more per pound than it does, and would do so, were it not for the prevailing abnormal conditions. Restriction of output in this view of the situation is more in the interest of the consumer than of the producer. The figures of the Director of the Mint covering precious metal production for 1910 are just published. The silver output in the United States was for the year, 56,438,695 oz., an increase over 1909 of 1,717,195 oz. The value of the production of gold fell below that of 1909, which was the record year, with an output of nearly $100,000,000. The United States, including Alaska, produced in gold in 1910, $96,055,214, a decrease of $3,618,186. Anent the production of gold, Thomas A. Edison has occasioned comment by a recently reported interview, in which he says that transmutation of base metals will yet be actually discovered; that any day may reveal the secret to busy searchers, and that the value of gold will tumble as a result.

The annual meeting of the Ray Central Copper Co. was held this week at Wilmington, Delaware. The important event was the anticipated publication of the report recently made by W. H. Weed and F. H. Probert. Following the announcement that not all of the ground had yet been proved, and that while the report had been made covering the work up to date, it was not complete and would not be given out until completed, the market was sold off sharply, evidently upon the theory that the report so far as made was not favorable and was withheld in the hope that the remaining portion yet to be made would help out the general average. Clyde A. Heller, secretary and treasurer of the Tonopah Belmont Development Co., and J. Harvey Whiteman, president of the Tonopah Mining Co., were elected directors of the Ray Central. A committee of members of the Boston Stock Exchange has been appointed to act for members of the exchange, who are besieged by clients for information and data concerning the Calumet & Hecla merger. The committee is to make a report as to whether or not the terms as proposed are fair and equitable. The action of this committee will be of especial interest to J. Parke Channing, who is supposed to have been the real appraiser of value, fixed in determining the various ratios of exchange. There has been some rumor to the effect that the merger plan was to be withdrawn, but this is emphatically denied. The Calumet & Hecla people are so far from feeling any weakness in the arrangement suggested that they are welcoming all investigation and extending every aid to stockholders or their representatives who wish to have details given them.

Pope Yeatman is to sail for Chile this week to examine the Braden Copper Co. plant, where operations are expected to begin soon. It is expected to mine a half million tons of ore this year, turning out about 15,000,000 lb. of copper, all of which will for the present be shipped to the Baltimore refinery. Later it is planned for the Braden to smelt and refine all of its own ores, which will be shipped direct to foreign markets and the output then will not figure as a part of the refinery product of the United States. Experiments are now in progress with a leaching plant, a one-fifth unit having been constructed; if the leaching process proves unsatisfactory an electrolytic refining plant will be substituted.

Goldfield Consolidated has been an active feature of the market in New York during the week by reason of the publication of J. R. Finlay's report. The controlling interests in Kerr Lake have seen a light. Heretofore it has been the invariable rule to allow no one not employed by the company to go underground on the property. No independent examinations have been permitted. Now, however, an examination has been made by Robert Livermore. Mr. Livermore says: "It is apparent that the Kerr Lake has at present some 10,000,000 oz. of silver in blocked ore; that it is positive ore as nearly as can be ascertained in ground of this nature; that there is still much ground unexplored in what I regard as a very favorable zone, lying along and under Kerr Lake from the present heading to the Drummond west boundaries; that this east drift has already opened bodies of ore, and that there is an area, as yet only slightly explored, larger in area than that already worked." Kerr Lake's underground workings aggregate something over three miles. Five branch banks have been established in Porcupine since the first of January and the Provincial Government of Ontario is to float a loan of $2,000,000 to build the branch of the Temiskaming & Northern Ontario railway into the camp. Another Canadian railway project which will run through the mining district of northern Ontario is to be taken up by the Quebec & Great Northwestern railway, which will apply for a charter to construct a road from Port Arthur to New Liskeard and Ottawa and from New Liskeard to Lake Abitibi, with a branch from Massinaibie to Michipicoten. The tonnage of the road is expected to come almost wholly from the mining district to be tapped.

TORONTO, CANADA

Initiative Taken to Revise Mining Code. — Little Money for Non-Dividend Paying Stocks.—Cobalt Mines.—Porcupine News.

The need of a uniform mining law for Canada has long been apparent, and the agitation, with that object, carried on by the Canadian Mining Institute has resulted in the matter being taken up by the Government. J. M. Clark, of Toronto, has been appointed to draft a mining bill, which it is hoped to have ready to submit to Parliament next spring. While the older provinces have jurisdiction over their own mining lands, the mineral resources of Manitoba, Alberta, Saskatchewan, the Yukon, and the unorganized territories are controlled by the Federal Government, which also has jurisdiction over the railway belt of British Columbia and some areas, especially Indian lands, in the other provinces. Hitherto all mining operations in the provinces and territories under Federal control have been regulated by orders-in-council passed by the administration to suit emergencies as they arose, the single exception being the Yukon Placer Mining Act. The result has been unsatisfactory, leading to a good deal of uncertainty and difficulty in ascertaining the requirements of the law, and the system, while defensible in a sparsely settled country where the mining interests were insignificant, is altogether inadequate in view of the progress of the mining industry in late years. It is hoped to secure a model mining code, to which end the Canadian Mining Institute is inviting suggestions. It is regarded as desirable to secure uniformity as far as possible between the provisions of the Federal mining law and the legislation of the older provinces, but that can only be done provided the latter are willing to make the necessary changes with such modifications as local conditions may render necessary.

The Porcupine boom is fairly launched so far as alluring prospectuses and brokers' entreaties to 'get in early' are concerned, but the public has so far not proved responsive to the extent anticipated, and the earlier flotations do not show any upward movement. It will require actual results, in dividends, to create an interest. There is little money available for speculation, owing to the conservative policy of the banks and the heavy losses sustained last year in Cobalt trading. Operations in Cobalt shares in 1910 show the market value of the stocks of 36 companies which were traded in to have depreciated to the extent of $11,000,000. Since the New Year the market has been quiet, with slight fluctuations.

General Mining News

ALASKA

The report of the Alaska United Gold M. Co. for the month ended December 15, 1910, is as follows: Mill time, 30 days. The Ready Bullion 120-stamp mill operated 29 days, 9 hr., 51 min.; water-power, 22 hr., 40 min.; steam-power, 28 days, 11 hr., 11 min. Ore crushed, 18,450 tons; concentrate saved, 352 tons. Estimated gross value of free gold, $19,701; estimated gross value of concentrate, $13,804.05. Total, $33,505.05; realizable value, $33,170. Operating expense, $30,876.04; net operating profit, 2293.96; construction, $1585.06. Yield per ton of ore milled, $1.81. Development, 465 ft., 289 ft. in ore, 89 ft. in waste. Stock of ore broken, 1212 tons. The 700 Ft. Claim 100-stamp mill operated 29 days, 13 hr., 9½ min.; water-power, 1 day, 9 hr., 4½ min.; steam-power, 28 days, 4 hr., 5 min. Ore crushed, 16,721 tons; concentrate saved, 272 tons. Estimated gross value of free gold, $20,287.58; estimated gross value of concentrate, $17,050.62. Total, $37,338.20; total realizable value, $36,964.82. Operating expense, $27,132.88; net operating profit, $9831.94. Construction, $2185.57; yield per ton of ore milled, $2.23. Development, 255 ft., 242 ft. in ore. Assay-value of ore, new development, $0.48 to $4.31 in Ready Bullion; in 700 Ft. Claim, $2.89 to $5.06. Stock of ore broken in latter, 11,538 tons.

ARIZONA

COCHISE COUNTY

The mines of the Tombstone Con. Mines Co., at Tombstone, are reported to have closed down for an indefinite period. The cause is found in the enormous expense entailed in pumping water from the mines. The ores are not high grade. The Mag shaft of the Calumet & Arizona, at Bisbee, has workings whereby 29,830 tons of oxidized ore is exposed, assaying 11.26% copper. This refers to orebodies in new territory. The Oliver mine of this company contains developed ore amounting to 647,000 tons, assaying 5.21% copper. These figures are from an official of the company.

GILA COUNTY

(Special Correspondence.)—The workings of the Miami Copper Co. are such that with a little more work the mine will be ready for production, and the concentrator will be finished in two weeks. It is estimated that when the mill starts about 400 tons per day will be hoisted from the main level, and 1600 tons daily will be taken from the stock-piles at No. 2 and No. 4 shafts. This stock accumulated in the course of development and blocking-out of the ore, and the preparation of the mine for production. When the mill is running at full capacity about 400 men will be employed on the surface and underground, as it is estimated that for every 1000 tons of ore mined it will require approximately 200 men, 25 on surface and 175 underground. The shipments of ore from the Warrior have been increased from 100 to 125 tons per day. Returns during the past month show that the ore has been running over 10% copper. It is expected that churn-drilling will be started soon on the property of the Arizona-Cananea company, the drills having been moved to the eastern end of the Montezuma group, adjoining the Live Oak. This property was formerly owned by the Boston-Miami company, and is situated west of the Miami townsite. The former owners did some churn-drilling in the southwestern part of the property. The annual meeting of the stockholders of the Arizona Michigan company will be held in Globe shortly to determine what further exploration work will be undertaken. It is expected that the station being cut at 1000-ft. depth in the McGaw shaft of the Superior & Boston Copper Co. will be completed by February 15. Then a cross-cut will be started west to cut the orebody that was found on the sixth level, and which is being opened on the eighth. The cross-cut being driven east toward the Iron lode is in 320 ft. Driving westward on the eighth level, along the Great Eastern vein, continues in rich ore that contains more copper glance than formerly. A raise is being made from the 800-ft. level at a place 425 ft. west of the McGaw shaft. Of the five churn-drills in use on the property of the Live Oak Development Co., four will be started on new holes, having drilled through the orebody. Drill-hole No. 44, which was started last week, is down 225 ft. in the surface capping. This hole is 1300 ft. south, and 2200 ft. west of the vertical shaft, and is in the most southwesterly hole that has been drilled on Live Oak ground. Hole No. 35, 300 ft. east and 500 ft. south of the shaft, was discontinued at 490 ft., the drill having gone through the orebody. In drill-hole No. 42, sunk 1300 ft. south of the shaft, the drill cut through 300 ft. of ore, striking the main orebody at 45 ft. Drilling was stopped in hole No. 43 at 510 ft., and in drill-hole No. 41 at 850 ft. The results in the latter two holes were satisfactory. With the exception of hole

Arizona.

No. 38, which was sunk to a depth of 900 ft., at which depth the drill was still in ore when drilling was stopped, hole No. 41 is the deepest that has been sunk in the Miami district. Ore was found in the latter at 580 ft. and continued to the 850-ft. mark, where drilling was discontinued. A force of 50 men is employed on the churn-drills, no mine development being undertaken at this time.

Globe, January 21.

GRAHAM COUNTY

Stockholders in the Arizona Copper Co., who reside at Clifton and vicinity, have petitioned the board of directors of that company to appoint James Colquhoun chairman of the board. Mr. Colquhoun was for many years the company's general manager. The mines are at Morenci and Metcalf; the smelter and two mills are at Clifton, with one mill at Morenci.

PINAL COUNTY

The Ray Consolidated, according to latest estimates, has 80,000,000 tons of ore developed, having an average copper content of 2.17%. The exploration was performed by 141,000 ft. of churn-drilling, and 45,000 ft. of development. The concentrating plant, under construction, is to have a capacity of 8000 tons of ore daily.

CALIFORNIA

GOLD OUTPUT

California took the lead at the close of 1910 in gold production, surpassing Colorado, which had held first place for several years. This State's output for 1910 is estimated at $21,146,150; that of Colorado at $20,577,942. The

figures showing the gold production of all the States and Territories were published in our issue of January 7.

OIL PRODUCTION

The oil production of California for December, and for the year 1910, is given below in district subdivisions, the figures being those of the *California Oil World*, of Bakersfield:

San Joaquin Valley:

Districts.	December (bbl.)	Output, 1910 (bbl.)
Coalinga	1,550,000	17,938,205
Kern River	1,018,300	13,789,272
Midway	1,167,605	10,498,006
Maricopa	427,177	8,749,047
McKittrick	514,600	5,431,936
Total	4,677,682	56,405,466

Southern Fields:

Districts.	December (bbl.)	Output, 1910 (bbl.)
Salt Lake-Sherman	240,000	3,228,262
Los Angeles City	36,000	453,330
Whittier-Coyotes	102,000	1,182,988
Fullerton, Puente & Brea.	410,000	5,018,720
Ventura County	41,000	491,842
Newhall	14,500	148,757
Total	843,500	10,623,899

Coast Fields:

Districts.	December (bbl.)	Output, 1910 (bbl.)
Santa Maria	585,000	7,750,423
Summerland	5,625	69,912
Total	590,625	7,820,335
Total, all districts	6,111,807	74,849,700

INYO COUNTY

The report of the Skidoo Mines Co. for December 1910 shows that the mill operated 20¼ days, treated 1155 tons of ore, from which was recovered bullion of the value of $19,517.75, and concentrate estimated at $375, making a production of $19,892.75 for the month. Operating costs were $7514.86; those of development, $817.41. Total expenditure, $8332.27; net profit for the month, $11,560.48.

MONO COUNTY

(Special Correspondence.)—At a meeting of the board of directors of the Standard Con. M. Co., held at Bodie on December 13, 1910, dividend No. 119, of 10c. per share, was declared, payable December 29.

Bodie, January 10.

SAN BENITO COUNTY

The New Idria Quicksilver Co., of San Francisco, operating the New Idria quicksilver mine, situated 12 miles from Hernandez, produces 800 to 900 flasks of quicksilver per month from a vein on the contact of serpentine and shale. This mine lies on the east side of the serpentine belt; while the Florence Mac, which has been partly developed by C. P. Smith and D. D. Hoag, lies on the west side. The latter property is on a similar contact. Other properties in that vicinity have veins in the serpentine.

TRINITY COUNTY

(Special Correspondence.)—The installation of the Bonanza King power plant, on the east fork of Trinity river, to replace the plant that was destroyed by fire more than a year ago, is completed, and power is now available for all purposes. No extensive operations are contemplated this winter. Most of the work will he done in adit No. 3, where a station has been cut and a hoist installed preparatory to sinking a winze on what is known to be a rich ore-shoot. The Poeth mine on Boulder creek has passed into the hands of the Gold Ridge M. & M. Co. It is the intention of the new management to install a three-drill air-compressor in the spring and begin sinking. Talbert Williams and Lester Yancey have taken a lease on the Meader mine, owned by Macliwaine & Bridge.

Carrville, January 20.

TUOLUMNE COUNTY

(Special Correspondence.)—The shoot of rich ore found in the Gianelli mine at Arastraville, four miles from Tuolumne, has been opened sufficiently to warrant the belief that the property will yield a fortune to its owners. The orebody, of fair size, is impregnated with gold throughout its length, the richest streak being estimated at hundreds of dollars per ton. The property adjoins the Duffield and is not far from the well known Dreisam. It is understood that work will be commenced at the Starr King mine, four miles east of Tuolumne, by those who lately have taken a bond on it. The shaft is 500 ft. deep, but no ore has been extracted below 350 ft., except that taken out in development, althongh the vein is opened on the two lower levels by 800 ft. of drifts. Sinking has been discontinued at the Black Oak and work is now confined to driving on the lowest level. Another rich shoot has been opened in the Soulsby mine. The mill continues operating on good ore. It is expected that the 10-stamp mill being installed at the Contention mine will be ready for operation by March 1. Most of the machinery has been delivered. C. F. Summers is superintendent. The Longfellow mill is again in operation on rich ore being taken from the shoot recently opened on the bottom level. Several men are employed at the Mulock mine, near Tuttletown, and prospects are reported to be encouraging. J. Whitney employs eight men at the Water Lily placer mine, near Reynold's Ferry. An adit is being driven to tap the gravel deposit. A prospect is being developed in the western part of the Basin district by R. Whipple, who has a 3-ft. vein, the ore in which assays from a few dollars to $100 per ton.

Tuolumne, January 21.

(Special Correspondence.)—The owners of the Dutch & Sweeney mines at Quartz have decided to add 20 stamps to their present 100-ton mill, and have purchased the equipment for this purpose. The old mill is in operation.

Quartz, January 20.

COLORADO

Vanadium ore was discovered in the mine of the General Vanadium Co., near Naturita, in Montrose county, in April 1910. Similar ore was found on the San Miguel river, near Sawpit. Ore shipped from the former property to Liverpool is said to have contained 3% metallic vanadium, and brought $60 per ton. A carload of ore mined at the latter property was shipped to the same market. In those properties the vanadium occurs as an impregnation of sandstone, and is designated as kentsmithite. The Primos Chemical Co. is mining roscoelite in San Miguel county, which is converted into ferro-vanadium in the leased mill at Newmire. The roscoelite is micaceous.

CLEAR CREEK COUNTY

(Special Correspondence.)—A shipment of 20 tons of ore made last week by Couverry & Co., leasing on the Capital mine, brought $1800 net. The Ohio claims, on Kelso, were sold by C. Howard and W. S. Hale to a party of Denver men for $25,000. Development is in progress. Mont Tong has taken a lease on a block of ground in the east drift of the Aetna vein owned by the Capital M. & T. Co. Stoping is being done on an 8-in. streak of $28 ore. Shipments will be started next week. W. P. Aikire, leasing on the Seven-Thirty mine, is shipping first-class ore that mills 420 oz. silver; his second class samples 180 oz. silver per ton. Mottschall & Co., leasing on the Pelican mine, have opened an 8-in. streak of galena that mills $52 per ton in silver and lead. Winters & Charles, leasing on the Gambetta mine, have 12 in. of zinc ore that mills without sorting 52% in that metal. Shipments are to begin next month. Stewart & Co., leasing on the East Griffith mine, are shipping galena ore, returns of $35 per ton being received.

Georgetown, January 20.

GILPIN COUNTY

(Special Correspondence.)—The Running Lode mine has been taken under a 10-year lease by a company composed of Denver and Silverton mining men. Ore shipments are being made from the Old Town mine, the principal part of the product being taken from the 600-ft. level. One carload recently shipped brought $125 per ton in gold, silver, and copper. An average of eight carloads per month is being shipped from the Chase mine at Russell Gulch, returns of $60 per ton being realized. Regular shipments of ore are made at the Cashier mine. A new shaft-house is being erected on the Gilpin-Orion property, and work has been resumed on the Federal Gold property in Moon gulch. Steady shipments are going out from the Kokomo mine. The ore mills $25 per ton.

Central City January 17.

LAKE COUNTY

The fissure veins of Leadville district are attracting much interest, and some deep-level exploration is going on to open a number of them. Burton, Thielen, and White are operating extensively on Fryer hill, having leases on the Hayden, Seneca, South Seneca, Anderson, and Pittsburg. The chief purpose of their prospecting work is to open bodies of zinc-carbonate ore. One feature of this work is the sinking of an incline winze from the bottom of the Anderson's 200-ft. shaft, with the expectation of opening a vein of zinc ore. The Silver Spoon shaft, Prospect mountain, is being repaired and supplied with new surface equipment. It has a depth of 350 ft., and as soon as everything is in working order, sinking is to be commenced. Lessees on the Climax, Fryer hill, have opened a body of lead ore, are prospecting for zinc ore, and have built ore-bins. John Nord and partners are shipping lead ore from the Stone shaft, Rock hill, on which they have a lease. J. Simpson and associates have driven 600 ft. on the Oro City claim, California gulch, and the heading of their adit is now in iron-silver ore; driving is to be continued into the Vining claim, on which they expect to open a vein.

SAN JUAN COUNTY

The ore shipped from San Juan county mines to the smelting plant of the A. S. & R. Co., during 1910, amounted to 33,528 tons, which yielded 16,429 oz. gold, 734,506 oz. silver, 7,201,950 lb. lead, and 1,070,880 lb. copper. The value of those products was as follows: gold, $339,578.43; silver, $392,740.36; lead, $323,367.56; copper, $135,252.14, making a total of $1,190,947.49. As an average, this tonnage of ore contained 1.59% copper, 10.88% lead, 21.9 oz. silver, and 0.49 oz. gold per ton. Practically all of it was sent to the Durango plant of this company. The smelting charge was $7.75 per ton. Small ore shipments were sent to the Salida smelter, the exact figures not being available.

SUMMIT COUNTY

(Special Correspondence.)—The Colorado-Toledo M. Co., with principal offices at Chicago, is opening the veins of ore in Collier mountain at depths of 1000 to 2200 ft. by driving a cross-cut adit, the heading of which is now in over 3000 ft. Several veins have been intersected, the driving on them aggregating about 1200 ft. The ore found contains silver, lead, and zinc. The expectation is to open other veins by extending the cross-cut. The mine is situated at Argentine. The mill being erected to concentrate this ore is expected to be in operation by next March, the initial capacity to be 100 tons per day. The 500-ton mill built at the St. John mine, at Montezuma, will not begin operating till next spring. The Automatic Transportation Co. of Buffalo, N. Y., is planning the construction of an electric railway from Keystone to various mines of Argentine and Montezuma.

Argentine, January 20.

The Wilson Mining Co. is operating its mine and mill at Robinson with a force of 150 men. The camp is close to the summit, between Leadville and Kokomo. The ore consists of heavy sulphide, and the work of the mill is to separate the metals of different specific gravity rather than to concentrate. Some equally interesting work has been performed in the mine. In making an incline raise from the lower workings of the Wilson toward the Felicia Grace, an idle property, the miners broke into a body of water in the latter's workings, and had to make their escape at once; two other drillers, in another part of the mine, were rescued by H. W. Shepherd, the superintendent, and as the three reached the shaft and gave the signal to hoist, the water was up to their shoulders. The pump-station of the Wilson was quickly submerged. The mine is to be unwatered, and in the meantime mining will be done on the levels above water.

TELLER COUNTY

A mill of 100 tons capacity is being constructed for the Ajax mine, Cripple Creek district, in which the Clancy cyanide process is being provided for. The Clancy method is controlled by the Moore Filter Co., and is usually installed in combination with the Moore slime process. The Gold Sovereign mine has been leased for three years to the Union Leasing Co. The Gold Dollar Consolidated M. Co. has installed a new hoist and air-compressor at its main shaft on Beacon hill, and sinking is to be resumed at the 650-ft. station. This is only one of the numerous mines in Cripple Creek district in which sinking is to keep pace with the receding water-level caused by drainage through the Roosevelt adit.

MONTANA

BROADWATER COUNTY

An explosion of powder on the 200-ft. level of the Keating mine at Radersburg, which occurred on January 18, resulted in the death of six miners and the serious injury of two others. Those who were working at the time below the 300-ft. level were not injured, and were taken out through another shaft. Those killed were Ed and Dan Ryan, Dan White, Percy Way, Louis Tucker, and Harry Abott; those injured, John Russell and Alex Westlake. William Walsh, State Mine Inspector, has made an investigation.

(Special Correspondence.)—The Blue Bird M. Co., operating in Radersburg district, will arrange to use electric power for hoisting and driving the air-compressor. The shaft, now at a depth of 200 ft., is to be sunk 300 ft. lower, and a cross-cut will then be driven to the ore from the 500-ft. station. By driving to the vein at 136-ft. depth a 6-ft. body of ore was opened, one foot of which sampled $32 per ton. The directors of the company are: P. F. and J. S. Bradshaw of Duluth; J. B. Foraker, Jr., of Cincinnati; and A. P. Nipgen and Barton Mitchell of Butte. The last 21 cars of ore shipped by the Keating Gold M. Co. to a Butte smelter returned $32 per ton, net, in gold and silver; besides, the iron content brought $2.50 per ton. The cost of mining, wagon-haul to Toston, railroad transportation, and treatment, amounts to a little over $10 per ton. Excellent ore is being mined on the 400 and 500-ft. levels.

Radersburg, January 20.

NEVADA

HUMBOLDT COUNTY

The National Mines Co. of National, paid a dividend of $120,000 on January 1, 1911, which makes $345,000 paid in the last six months. The number of men on the company's payroll is about 100. Most of the gold is recovered on amalgamating plates, although some concentrate is being hauled to the railroad for shipment to a smelter.

(Special Correspondence.)—A new shaft-house, 40 by 40 ft. in size, has been built at the Mazuma Hills mine by the Darby Gold Reduction Co., which is understood to have an option on the majority of the stock of the Mazuma Hills company. The Darby company is operating a mill at Mazuma by which the metals are extracted by amalgamation, concentration, and cyanidation. The properties are in Seven Troughs district.

Mazuma, January 20.

NYE COUNTY

(Special Correspondence.)—In Tonopah district, the finding of good ore is reported from the California, which lies

south of the Jim Butler. After a period of idleness it was taken on a bond and lease, three months ago. Its past history is that of the expenditure of a large sum for a limited amount of ore. Rapid progress is being made in driving the southeast drift on the 600-ft. level of the Jim Butler. Two shifts are employed, and the drift is a third of the way to the Stone Cabin fault, beyond which it will enter virgin territory on the company's ground. R. J. King is directing the work. The two large producers ended the year with increased net earnings for the last month; those of the Tonopah Mining Co. being $194,000, and those of the Belmont $155,000. The increase of the former was due mainly to the fact that the mill treated over 15,300 tons, or a monthly average of 153 tons per stamp. The increase in the Belmont was due chiefly to the cessation of construction work and the economy effected by the new surface plant. During January the Belmont has opened and mined high-grade ore in the stopes on the 1166-ft. level. Much of this ore contains bands of native silver, some of which are nearly half an inch thick.

Tonopah, January 20.

Ore production of the Tonopah mines for the week ended January 21 was as follows: Tonopah M. Co., 3650 tons; Belmont, 2000; Montana-Tonopah, 1018; Tonopah Extension, 980; West End, 325; MacNamara, 300 tons; total, 8273 tons.

WASHOE COUNTY

A vein of ore rich in silver was recently discovered at a depth of 150 ft. on the Grey Eagle claim in Olinghouse district. Previous to this, practically no silver ore had been found in that camp.

NEW MEXICO

SOCORRO COUNTY

(Special Correspondence.)—The seventh level has been established in the Socorro mine, and only a short cross-cut is necessary to be made to open the vein at this depth; and it is calculated that the vein will be cut on its dip by the shaft at 800 ft. The Ernestine M. Co. mined and milled 540 tons of ore for the week ended January 14, from which was extracted 6431 oz. of silver and gold bullion, and 46 sacks of concentrate. The mill at the Deadwood mines is ready to begin operating. This plant was built in 160 days, and the work included grading, laying foundations, hauling in of material, and installation of machinery, involving a wagon haul of 80 miles over a mountainous country.

Mogollon, January 18.

OREGON

BAKER COUNTY

(Special Correspondence.)—The Sumpter smelter, which has been idle since 1908 on account of the inability of the management to secure a sufficient tonnage of suitable ore to justify its operation, is now being overhauled and put in condition to operate. The management believes that enough ore will be available to justify it in 'blowing in' the plant by midsummer, and hopes for a sufficient supply to keep the smelter in continuous operation. The copper ores will come from the Seven Devils district, in Idaho, while the bulk of the product received will consist of the gold and silver ores and concentrates from eastern Oregon. The capacity of the plant is 150 tons daily. Since the closing of the Sumpter smelter, the ore product of the region, embracing eastern Oregon and western Idaho, has been purchased by the Oregon-Idaho Investment Co., which samples the same at its plant in Baker and re-ships to the smelter at Tacoma. The Imperial mine in Cable Cove district recently was taken over by Spokane capitalists who are now working a crew of 20 men on the property, under the management of W. A. Harvey. At the Dixie Meadows mine, which was purchased outright for cash a short time ago by L. Vogelstein & Co., work is in progress with a crew of 50 men. The Ben Harrison mine, in the Greenhorn district, which was purchased last fall by A. L. White and associates, of Lima, Ohio, has been operating since the property was transferred. W. C. Fellows, late of Kingman, Ariz., is in charge of the property and is accomplishing good results. A large amount of high-grade ore has been exposed since he took charge of the mine. He is driving a cross-cut about 600 ft. to tap the vein at a lower level. The Cougar mine, in Granite district, was examined by the United States S. R. & M. Co., and those in position to know, claim that a sale of the property is probable.

In Mormon Basin district the Rainbow and Humboldt mines are being developed on a large scale. This district will increase the production of its mines during the year by bringing in electric power, and by the installation of additional machinery. The Seven Devils district, in Idaho, is developing in a small way, and considerable copper ore is being taken out, so that good shipments are expected the coming summer. The Iron Dyke mine, on Snake river, is idle at present, but arrangements have been made to install a 200-ton concentrator on the mine next spring, when the property will be worked to its capacity. In the territory surrounding Baker, as a whole, the mining industry looks better now than at any time heretofore. This is due to the fact that the principal properties are being taken over by strong concerns, by which they are being developed and equipped.

Baker City, January 20.

JACKSON COUNTY

The Southern Oregon and Northern California Mining Congress met at Ashland on January 17. The State legislature of Oregon was asked to create and equip a mining bureau in the State Agricultural College at Corvallis. The delegates protested against the 'lease bills' now before Congress; also against the system of exacting fees from domestic and foreign corporations which have for their object the development of mines and other industries. The congress elected officers as follows: O. L. Young, Ashland, president; H. L. Herzinger, Grants Pass, vice-president; H. L. Andrews, Grants Pass, secretary; F. J. Newman, Medford, treasurer. The next session is to be held at Grants Pass on July 18, 1911.

UTAH

JUAB COUNTY

The shaft of the Yankee Con., near Eureka, was sunk from the 1300 to the 1400-ft. point by Kellogg & Scott, under contract. The sinking is to be continued to the depth of 1700 ft. Deep levels are to be established. The bottom of the shaft is now in dolomite. During the week ended January 14, the shipments of ore from the Grand Central mine, at Mammoth, amounted to 12 carloads. This ore was mined from stopes on and above the 2000 and 2100-ft. levels, where a new body of ore has been opened. The ore contains copper, accompanied by gold and silver. After operating the mine-pumps at full capacity for 60 days in the Centennial-Eureka shaft, the water has been lowered sufficiently to enable the operators to mine ore on the 2200-ft. level. By reducing the volume of water in this property, it is believed the water in adjacent mines will recede considerably. The Dragon shaft has reached a depth of 1065 ft. The ore-zone is to be opened by driving from the 800 and 1065-ft. stations. L. E. Riter is directing the work. The Chief Consolidated, at Eureka, has been equipped with a new double-drum hoisting engine, new steam boilers, capable of operating the two 3-deck cages to a depth of 2500 ft. Also, a new air-compressor is to be installed.

SUMMIT COUNTY

Free & Taylor, who are driving the Snake creek drainage tunnel to the Daly-Judge ground, in Park City district, advanced the heading 355 ft. between December 2 and January 2, and 13 shifts were lost in that time. At the latter date the heading was in 2423 feet.

(Special Correspondence.)—The Silver King Coalition Co. has purchased the property of the Uintah Treasure Hill for the sum of $100,000. Two 6% notes, each for $50,000, one payable January 1 and the other July 1, 1911, were given in payment. The two companies owned 12 claims jointly and the Uintah Treasure Hill had brought suit against the Silver King for extracting ore illegally from

the jointly-owned ground. In order to quiet title, the court had ordered a sale of the jointly-owned claims, but the two parties settled the matter as stated above. The Tintic Combination has been financed and work has been resumed. It is the intention to get electric power to the shaft, install electric equipment, and extend the workings that already exist. The shaft, which is in porphyry, will be sunk to the limestone. The South Utah treated 34,971 tons of ore during October and November, from which the yield was 2848 tons of concentrate averaging 10.5% copper. This is an average for the two months of less than 600 tons of ore per day, but the tonnage has been increased, and it was expected that the mill would be handling about 1000 tons per day after the first of the year. At Frisco the Horn Silver is remodeling its old mill and adding some new equipment, and the plant is expected to be ready for operation by the middle of January. It will have a capacity of 100 tons per day and is expected to save 75 to 80% of the value in the ore. The Utah Mine of Fish Springs has posted a dividend of 2c. per share. This mine paid small dividends regularly for a number of years, but ceased in February 1909. This was due to a large extent to the fact that the company was extending its holdings, but the dividends are expected to come regularly in the future. The report comes from the San Juan oilfields that the Standard Oil Co. has quietly bought a number of wells, done work on them, and capped them as soon as oil was struck. Also that a pipe-line has been surveyed by this company from those fields to Gallup, N. M. The Nephi Plaster Co. put off a successful large shot at its quarry at Nephi recently, and a hole 700 ft. long and 300 ft. wide opened, 15,000 tons of gypsum being loosened.

Park City, January 21.

CANADA

BRITISH COLUMBIA

(Special Correspondence.)—The agent for a syndicate of London investors has been negotiating to obtain a bond on the Queen mine, and has been to Marillan, Wisconsin, to consult with the owners. The 20-stamp mill on this property operated during the past year on ore averaging $12 per ton, treating nearly 13,000 tons, and making a good profit. If the deal goes through, at a high price for the mine and plant, the property will be worked on a much larger scale than heretofore. The owners of the McAllister mine, at Sandon, are shipping a small tonnage of ore and are figuring on plans to operate on a larger scale. Silver ore is being made ready for shipment by the lessees of the Sweetgrass, near Silverton. The Van Roi people have completed the tramway from the mine to the mill, and the work of installing the balance of the machinery in the mill will be undertaken. This is one of the leading silver-lead-zinc producers of the Silverton district. Shipments of ore from the California and Rambler-Cariboo mines continue. At the Utica mine a small force of men is stoping on a block of ore 100 ft. long and 25 ft. high. The operators may install a concentrator next spring. The owners of the Kootenay Belle mine, adjoining the Queen, have made final payment on their $90,000 bond. Arrangements are being made to mill a large tonnage during 1911. The Vancouver mine, Sheep Creek district, has been leased, and ore production will begin soon. The last few cars of ore shipped sampled $86.50 to $159 per ton.

The St. Eugene mine, Moyie, is now in charge of C. H. McDougall, who has planned much work for 1911. F. W. Guernsey, until recently in charge of the Consolidated properties at Williams, is in charge of the anthracite coal mines of the Canadian Pacific Railway Co. at Bankhead. Ore recently opened in the Society Girl mine, Moyie, is proving up well under development. Two cars of ore recently were shipped to the Trail smelter. In a recent article by your correspondent on the Consolidated company, the total production figures were included for the year 1910, instead of the figures for the fiscal year ended June 30, 1910. These figures should have been: Production for the Centre Star mines, 194,013 tons, at $9.90; the Snowshoe, 153,311 tons, at $5.60; St. Eugene, 140,000, at, say, $8.78; Sullivan, 5656 tons, at $20.96; Richmond Eureka, 3731 tons at $42.05; Queen Victoria, 778 tons at $9.94. It might be stated that in addition to the above tonnage 78,773 tons of custom ore was treated at Trail smelter; also 19,195 tons of concentrate from the St. Eugene mine.

Nelson, January 18.

(Special Correspondence.)—The Granby company has planned for heavy production during 1911. It is exploring with diamond-drills at the Phoenix mines. This company produced in November, 1,410,261 lb. of copper, containing 36,228 oz. silver and 2578 oz. gold. The six furnaces of its Grand Forks smelter are in blast. A fire at the Rawhide mine of the New Dominion Copper Co. destroyed the office and machine-shops, but has not interrupted ore shipments. The B. C. Copper Co. has resumed shipments of ore from its Oro Denoro mine. It is stated that the stock of this company will be placed on a dividend basis at the meeting of the directors to be held in New York this month. A dividend fund of $300,000 has accumulated. In November this company produced 917,994 lb. copper at its Greenwood smelter. This contained 2846 oz. gold, and 10,794 oz. silver. Net profits amounted to $35,221.

Granby Smelter, Greenwood.

Phoenix, January 20.

MEXICO

CHIHUAHUA

(Special Correspondence.)—El Rayo mine, situated 10 miles from Santa Barbara, is one of the properties of the Mines Company of America, and is under the management of James S. Colbath. The production since October 1907 amounted to $1,725,000, out of which dividends amounting to $85,385 were paid. Within that period a mill was built, and a large amount of development was performed. The Dolores, also a property of this company, is situated in the southwestern part of Chihuahua. Operations began there in 1905, and from that date to October 31, 1910, the gross production was $4,736,000, the dividends paid having amounted to $1,044,000.

Santa Barbara, January 10.

(Special Correspondence.)—La Republica Mining Co., operating at Sanz, out from Ocampo, in the month of December 1910 milled 1109 tons of ore, and extracted metals worth ₱73,210.94. The operating and development costs were ₱48,312.56, construction costs having amounted to ₱4583.60. J. Gordon Hardy is consulting engineer.

SONORA

(Special Correspondence.)—The Creston-Colorado mine, at Minas Prietas, which was acquired by the Mines Company of America in 1902, has produced ore valued at $9,299,000 from the date of its purchase to September 30, 1910, and has paid dividends amounting to $3,845,000 in that time. The same company owns La Dura mine, for which quarterly dividends are paid, the last one having been at the rate of 90c. per share.

Minas Prietas, January 18.

Personal

Professional men are invited to send news of their engagements and travels. Such news is interesting to friends.

GEORGE WINFIELD is ill in a hospital at San Francisco.

J. M. BOUTWELL resides at Santa Barbara, California.

F. M. HARRIS is on his way to Colombia, South America.

F. B. WEEKS is examining properties in Mariposa county, California.

J. NELSON NEVIUS is in San Francisco from mine examinations in Oregon.

W. H. HUTCHINGS is mine manager for the Ohio Mining Co., at Pearl, Idaho.

GEORGE E. FAAISH was in San Francisco and is now in southern California.

CLARENCE C. BOYDSTON is at the Casados mine, Hostotipaquillo, Jalisco, Mexico.

J. MORGAN CLEMENTS is in Arizona, having returned from the west coast of Mexico.

JOHN T. MILLIKEN, of the Golden Cycle mines of Cripple Creek, was recently in London.

H. A. JONES, superintendent for the Belmont Milling Co., at Millers, Nevada, is in San Francisco.

J. D. HUBBARD, a director of the Goldfield Consolidated mine, was at the St. Francis, San Francisco.

F. W. NOBS has resigned from the Santa Maria Mines, Ltd., at Minillas, Zacatecas, and is now at Leon, Nicaragua.

C. H. REPATH, chief engineer for the International Smelting & Refining Co., Utah, is visiting various places in Montana.

J. H. BAKER, a mining engineer of Courtland and San Francisco, was married on January 20 to Miss H. C. Whitehead, of London, England.

JOSEPH F. THORNE, until recently assistant manager, has succeeded J. R. FINLAY as manager for the Goldfield Consolidated Gold Mining Company.

WILLIAM R. JEWELL is making an inspection in the oilfields to obtain data from every company operating between and including Sunset and Coalinga, California.

FRED. SOLOMON, assistant superintendent of the concentrator of the Steptoe Valley Smelting & Mining Co., has gone on a tour of inspection of the various concentrators in Arizona, particularly the Miami plant.

OBITUARY

JOHN O. NORBOM, a mining engineer of Berkeley, California, was instantly killed on an Oakland ferryboat on the evening of January 13, by the explosion of some substance presumably carried in his pocket. The regrettable affair was of undoubted accidental origin. Mr. Norbom was operating a mine in Shasta county, and had had world-wide experience as a mining engineer. This untimely and strange ending of a useful life is regretted by his wide circle of acquaintance in the profession, all of whom will join us in extending their sympathy to his family.

HENRY JANIN died in London, January 6. He was one of the best known of the early California engineers. He graduated from Yale with his brother Louis, in the class of '58, and both took a post-graduate course at Freiberg. Henry Janin came to California in 1861 with his brother Louis, and both quickly took a prominent position in the mining world. Henry was for some time at the Enriquita quicksilver mine in Santa Clara county, of which Louis was manager. Later he had extensive experience in sliver mining in Mexico. He made money rapidly and gave up professional work to travel. He was closely associated with such men as Hamilton Smith, J. P. Morgan, J. B. Haggin, and others of the prominent mining engineers, mine owners, and financiers of his younger days, and financed a number of large mining propositions. In recent years he has made his home in London.

Market Reports

LOCAL METAL PRICES.

San Francisco, January 26.

Antimony	12—12¾c	Quicksilver (flask)	44½
Electrolytic Copper	14½—15¼c	Tin	42½—44c
Pig Lead	4.75—5.70c	Spelter	7—7¾c

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

METAL PRICES.

By wire from New York.

Average daily prices in cents per pound.

Date.	Electrolytic Copper.	Lead.	Spelter.	Silver, per oz.
Jan. 19	12.32	4.47	5.43	53⅛
" 20	12.25	4.47	5.42	53¼
" 21	12.25	4.47	5.40	53
" 22	Sunday.		No market.	
" 23	12.22	4.47	5.38	53¼
" 24	12.22	4.47	5.38	53¼
" 25	12.22	4.47	5.38	53¼

ANGLO-AMERICAN SHARES.

Cabled from London.

	Jan. 19. £ s. d.	Jan. 26. £ s. d.
Camp Bird	1 17 0	1 17 1½
El Oro	1 7 9	1 6 10½
Esperanza	1 15 6	1 13 9
Dolores	1 5 0	1 5 0
Oroville Dredging	0 6 9	0 7 0
Mexico Mines	7 16 3	7 16 3
Tomboy	0 15 0	0 15 0

(By courtesy of W. P. Bonbright & Co., 24 Broad St., N. Y.)

COPPER SHARES—BOSTON.

	Closing prices, Jan. 21.		Closing prices. Jan. 26.
Adventure	$ 6	Mohawk	$ 44½
Allouez	33	North Butte	27½
Atlantic	4	Old Dominion	39⅝
Calumet & Arizona	48¾	Osceola	110
Calumet & Hecla	510	Parrot	11
Centennial	12	Santa Fe	1¼
Copper Range	66½	Shannon	11
Daly West	3	Superior & Pittsburg	14
Franklin	7	Tamarack	44
Granby	29	Trinity	4
Greene Cananea, ctf	6⅜	Utah Con	
Isle-Royale	13¼	Victoria	1⅝
La Salle	4¼	Winona	7½
Mass Copper	7	Wolverine	118

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

MINING STOCK QUOTATIONS—NEW YORK.

(By wire from Catlin & Powell Co., New York.)

	Closing prices, Jan. 26.		Closing prices, Jan. 26.
Amalgamated Copper	$ 63¾	Miami Copper	$ 18⅞
Arizona-Cananea		Mines Co. of America	5⅛
A. S. & R. Co.	78	Montgomery-Shoshone	⅛
Braden Copper	8⅞	Nevada Con	18¾
B. C. Copper Co.	4⅛	Nevada Utah	
Butte Coalition	18⅞	Nipissing	10¾
Chino	21¼	Ohio Copper	1¾
Davis Daly	1⅜	Ray Central	1⅝
Dolores	5⅝	Ray Con	17⅞
Ely Central	1/16	South Utah	⅞
First National	1⅞	Superior & Pittsburg	14⅛
Giroux	6½	Tenn. Copper	35⅝
Guanajuato Con	⅛	Trinity	4¼
Inspiration	8⅜	Tuolumne Copper	4⅛
Kerr Lake	7⅜	United Copper	4¼
La Rose	4¾	Utah Copper	45¼
Mason Valley	9¾	Yukon Gold	3¾

SOUTHERN NEVADA STOCKS.

San Francisco, January 26.

Atlanta	$ 13	MacNamara	$ 17
Belmont	6.00	Mayflower	4
Booth	6	Midway	17
Columbia Mtn	2	Montana Tonopah	1.00
Combination Fraction	15	Pittsburg Silver Peak	77
Fairview Eagle	35	Rawhide Coalition	3
Florence	1.55	Round Mountain	38
Goldfield Con	6.55	Silver Pick	5
Gold Kewenas	7	St. Ives	16
Great Bend	2	Tonopah Extension	1.02
Jim Butler	30	Tonopah of Nevada	8.12
Jumbo Extension	27	West End	56

(By courtesy of San Francisco Stock Exchange.)

Decisions Relating to Mining

Specially reported for the MINING AND SCIENTIFIC PRESS.

SECOND LOCATION OF MINING CLAIM

A second or subsequent valid location of a mining claim in Idaho cannot be made on mineral land already covered by a valid location.

Flynn Groupe Mining Co. *v.* Murphy, (Idaho) 109 Pac. 851. June, 1910.

DEVISE OF UNDIVIDED INTEREST OF COAL LANDS—RIGHT TO PARTITION

Where a testator who owned an undivided interest in coal lands devised the same by will and blended his real and personal estate together for the purpose of distribution, his executors, and not the legatees under the will, were the proper parties to maintain partition against the owners of the other undivided interest.

Ramsey *v.* Ramsey, (Pa.) 75 Atlantic 421. Jan. 1910.

LIABILITY OF MINE OWNER FOR INJURY TO SERVANT OF INDEPENDENT CONTRACTOR

The owner of a mine who employed an independent contractor to work the same, but retained control over the operation of the hoisting apparatus, was held liable for an injury to a servant of such independent contractor, who was on the premises and in the position he occupied when injured, under an implied invitation from the owner and for a purpose connected with the business which the owner was not only engaged in but which he permitted to be there carried on. While there was no privity between the owner and the servant, and no contractual duty from the owner to the servant, yet there was a mutuality of interest between the servant of the independent contractor and the owner, and the law imposes upon the latter the duty to such servant to use due care to employ a reasonably qualified hoister to handle the hoisting apparatus.

Sloss-Sheffield Steel & Iron Co. *v.* Bibb, (Ala.) 51 Southern 545. Jan. 1910.

CONTRACT FOR SALE AND PURCHASE OF COAL

A written proposition from the owner of a coal mine to the president of a railroad company, suggesting the building by it of an 8-mile branch line from its road to his coal mines, he to receive a guarantee of tonnage of freight that would be satisfactory to the company, and an answer from the president of the company to the effect that the company would build the line for any parties who would furnish the right-of-way and put in a coal plant of not less than 1000 tons of coal per day, and would furnish the coal at the same price as that furnished by the Pocahontas people, and that the company would take from such persons at that price whatever amount of coal they would agree to furnish not less than 100,000 tons per year, or if they preferred to ship it themselves, the company would give them the same rate made to other parties. Thereupon the offer was accepted by the owner of the coal lands who stated that he would commence immediately to make leases and push his part of the contract with all promptness. And leases were accordingly made, the mines developed, the right-of-way for the road furnished and the branch road was built. The mines were operated by lessees who sold their coal to the company, but after a number of years it refused to receive any more of the coal. In an action to enforce the agreement it was held by the Federal Court that the correspondence created a contract for purchasing the coal, and was not merely a proposal on the part of the railroad company to negotiate future contracts, and that such contract construed in the light of the situation of the parties and the language of the letters, did not limit the company to take such coal as the land owner personally should mine, but included all coal that should be mined by lessees of such mine owner.

McKell *v.* Chesapeake, etc., R. Co., 175 Federal 321. Jan. 1910.

GOLDFIELD CONSOLIDATED FOR DECEMBER

The following figures showing the results of operation of the Goldfield Consolidated Mines for the month of December 1910, are submitted by J. R. Finlay, manager:

TONNAGE PRODUCED

	Dry Tons.	Average per Ton.
Combination	5,173	0.86
Mohawk	8,061	1.08
Red Top	3,607	1.42
Jumbo	8,709	2.05
Total	25,550	1.41

The gross value to be credited to the various mines is as follows:

Combination	$ 91,975
Mohawk	179,921
Red Top	105,865
Jumbo	369,000
Total	$746,761

The performance of the mill was as follows:

Dry tons milled	25,550
Average value per ton	$29.23
Total value	$746,761.00
Loss in tailing (actual mill tails)	43,339.00
Value realized	703,422.00
Percentage extracted	94.20

EXPENSES

		Amount.	Average per Ton.
General:			
Bullion tax and marketing bullion	$ 13,000		
Administration, etc.	21,000		
		$ 34,000	$ 1.33
Mining		95,000	3.72
Transportation		2,500	0.10
Milling:			
Milling and cyaniding	$60,740		
Marketing concentrate, residues, and by-products	6,971		
		$ 67,721	2.65
Construction		4,600	0.18
Net cost		$203,821	$ 7.98
Loss in tailing (actual mill tails)		43,339	1.70
Estimate for treating concentrate tailing dumped		10,893	0.42
Total costs and losses		$258,053	$10.10
Profit per ton			$19.13
Total value of ore per ton			$29.23
Total profit for month			$488,708
Percentage of profit			$65.44

It will be noted that the total costs and losses are lower than for any month in the past year. They will be lower still. It should also be noted that the grade of ore treated has been lower and that no high-grade ore was shipped to smelters. The lowering of the grade of ore is the principal factor in lowering the costs and losses, but there are other factors that are just beginning to have this effect.

The mill is steadily improving its extraction. The weather has been cold for the last half of the month. Cold weather has heretofore interfered with a thorough precipitation of the gold in the solutions; but the enlarged heating plant has obviated this difficulty and the precipitation has been excellent.

The company which has been operating the Grizzly Bear lease suspended operations at the close of the month. They have sunk a shaft 1200 ft. and explored to some extent on the 1160-ft. level, but without success. We are now taking over their operations on company account and will continue opening the 1160-ft. level without delay.

COMMERCIAL PARAGRAPHS

The Pelton Water Wheel Co. has moved its San Francisco office from 1093 Monadnock Bdg. to its works at 2229 Harrison street.

The A. Van Der Naillen School of Practical Engineering of Oakland, California, on the first of January entered upon its forty-seventh year.

Edgar Allen & Co. Ltd. Imperial Steel Works, Sheffield, England, whose chief American office and warehouse is at 434 West Randolph street, Chicago, announces that agency arrangements have just been completed with the following firms at whose warehouses large stocks of Allen's high speed and carbon tool steels will be carried: Roehm & Davison, Detroit, Michigan; J. L. Osgood, Erie County Bank building, Buffalo, New York; and John J. Greer & Co., Inc., 207 West Pratt street, Baltimore, Maryland.

George W. Myers, for many years the Pacific Coast representative of the Chrome Steel Works of Chrome, N. J., has again succeeded in closing on the two large annual contracts with the Alaska Treadwell Gold Mining Co. of Treadwell, Alaska, for their yearly requirements in shoes and stamp-mill parts, such as bossheads, cams, and tappets. The shoe award is the largest that is given by any company in North America, and this year's contract makes the eighth consecutive annual agreement secured by Mr. Myers for his company.

One of the strongest connections of kindred industries recently effected is that of the Ingersoll-Rand Co. and the A. S. Cameron Steam Pump Works, the former having purchased a controlling interest in the latter, yet the connection between these two companies can not be looked upon as a merger in any sense of the word. The A. S. Cameron Steam Pump Works will continue under the management of George W. Fuller as in the past, and there will be no change in the policy of the company, but a greater expansion is contemplated. Mr. Fuller has been associated with the Cameron for many years, entering its employ in 1883 as office manager and entrusted with its general management in 1899. With improved and increased facilities for manufacture, and the advantage of the large and splendidly equipped selling force of the Ingersoll-Rand Co., it is predicted that the business will develop to still larger proportions.

The Stephens-Adamson Mfg. Co., of Aurora, Illinois, has recently strengthened its organization by securing the services of G. H. Stephens. Mr. Stephens has obtained substantial interests in this company, and will assume at once the management of the Eastern business. The Eastern office is located at 50 Church street, New York City. Mr. Stephens has been a prominent factor in the conveying industry for over twenty years. The engineering department of the Stephens-Adamson Mfg. Co.'s New York office is under the charge of J. G. Marcrum, who was formerly associated with Mr. Stephens in business and is recognized as a conveying engineer of unusual ability. Earl D. Stearns, who has ably represented the Stephens-Adamson company in the East for the past two years, will henceforth take charge of the company's Chicago office in the First National Bank building. The Stephens-Adamson Mfg. Co. manufactures a complete line of conveying, elevating, screening, and power transmitting machinery. Its main office and shops are at Aurora, Illinois, on the main line of the Burlington. These shops are thoroughly modern in every respect, and the company is prepared to design and manufacture a high grade of machinery in the least time and in the most efficient manner. Its new steel shop, which has just been completed, is one of the largest and most finely equipped for this purpose in the country.

Smith, Emery & Co., engineers and chemists, announce the completion of a reorganization of their business, made necessary by its rapid growth and development. The capital stock has been increased to $100,000, and the latest bookkeeping and filing systems are being installed. The Los Angeles establishment, which has hitherto been a separate corporation, under the name of Smith-Emery Co., now becomes a part of Smith, Emery & Co., the parent organization. The personnel of the directing forces of the firm are now A. L. Emery, president; Emory E. Smith, vice-president and general manager; E. O. Slater, second vice-president and manager, Los Angeles; M. T. MacDonald, secretary; B. R. Putnam, treasurer and manager mining department; W. C. Bass, manager mining department, Los Angeles; Duncan Anderson, chief chemist; Frank Riordan, superintendent cement department; and A. E. Roberts, designing engineer. The laboratories and offices of the company occupy the building at 651-3 Howard street, San Francisco, and the Los Angeles branch occupies the building, owned by the company, at 245 South Los Angeles street, in that city. The firm has at present on its regular staff twenty-two engineers, chemists, and assistants, and a staff of six associate engineers, and has extensive Eastern, Canadian, and European connections. This firm is playing an important part in the development of the large construction and manufacturing business of the State.

CATALOGUES RECEIVED

Sutton, Steele & Steele, Inc., Dallas, Texas. Bulletin T4. 'Dry Concentrating Tables.' Illustrated. 6 pages. 6 by 9½ inches.

Colorado Iron Works Co., Denver. Pamphlet No. 28. 'The Portland Continuous Filter.' Illustrated. 8 pages. 6 by 9 inches.

The Bristol Co., Waterbury, Connecticut. Bulletin No. 130. 'Wm. H. Bristol Electric Pyrometers.' Illustrated. 56 pages. 8 by 10½ inches.

The Braeckel Concentrator Co., Joplin, Mo. 'The Dunham Concentrator.' A description of this well known table. Illustrated. 24 pages. 9 by 6 inches.

Dean Bros. Steam Pump Works, Indianapolis, Indiana. Catalogue No. 83. 'Special Boiler Feeders on Pressure Pumps.' Illustrated. 28 pages. 6 by 7¼ inches.

W. & L. E. Gurley, Troy, N. Y. 'Gurley's Manual.' Forty-fifth edition. This complete volume is out in a more attractive form than ever, and its usefulness is too well known to need comment. Illustrated with beautiful three-color halftones. 516 pages. 4½ by 6½ inches.

Ingersoll-Rand Co., New York. Bulletin No. 3007. 'Class "PB" Duplex Power Driven Air Compressors.' Illustrated. 24 pages. 6 by 9 inches. Bulletin No. 5003. 'Radialaxe Air-Driven Coal Cutters.' Illustrated. 20 pages. 6 by 9 inches. Bulletin No. 9008. 'Pneumatic Tamping Machines.' Illustrated. 12 pages. 6 by 9 inches.

The Jeffrey Mfg. Co., Columbus, Ohio. Catalogue No. 26A. 'Mine Fans.' A handsome catalogue showing centrifugal fans for mine ventilation and numerous photographs showing installations where Jeffrey fans are in use. Several pages of engineering data and formulas of interest to those having ventilating problems under consideration are included. Illustrated. 36 pages. 6 by 9 inches.

Chas. C. Moore & Co. Engineers Pacific Coast representatives announce the following catalogues: 'Air Compressors,' catalogue 549 of the Piatt Iron Works, Dayton, Ohio; 'General Service Pumps,' catalogue 555 of the Platt Iron Works, Dayton, Ohio; 'Power Pumps,' catalogue No. 115 of the Hoover, Owens Reutschler Co., Hamilton, Ohio; 'Boiler Tube Cleaners,' catalogue L of the Lagonda Mfg. Co., Springfield, Ohio.

A NEW FINE-GRINDING MILL

The Marathon mill is advanced by the Johnson Engineering Works, First National Bank building, Chicago, as a fine-grinding device which successfully solves most of the difficulties in present practice. It consists of a tube or ball-mill in which the grinders are longitudinal iron rods. The fineness of the discharge and the capacity may be varied by tilting the whole mill about a transverse axis. A few minor alterations change the mill from dry to wet grinding. The makers claim to be able to reduce ore from a crusher to a 200-mesh product in one operation with very small expenditure of power.

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EDITORIAL

BASIC copper ores are in demand where they can be delivered at low cost at Pacific coast tidewater. Southeastern Alaska affords a promising field in this connection.

MEXICAN political troubles are apparently becoming more serious in Chihuahua and the north central States. So far, quiet has prevailed in the West Coast cities and towns, but much unrest is reported in the mountain villages and there has been trouble along the Arizona border.

ENGINEERS have read with much pleasure the report of the board of army engineers that has been studying the work of the Reclamation Service. The tone of the report is highly and deservedly commendatory, and Mr. F. H. Newell, the director, and his associates, may well feel complimented. In his attacks on the Reclamation Service the Secretary of the Interior has not represented the better sentiment of the country, and he has done much harm to a great clean branch of the public service.

NATOMAS No. 8, the first of the 16-cubic foot dredges of the Natomas Consolidated, has begun work at Folsom, California. It is an excellent boat and is expected to break records. By contrast the early Oroville boats look like toys, and yet dredge builders are already planning for larger capacity. Indeed, Mr. Newton Cleaveland, of the Yuba Construction Company, confesses privately to ambitions for a 27-cubic foot boat, and we hope sometime to print the account of the launching and operation of such a monster.

IT has long been the dream of the American Institute of Mining Engineers to visit Japan. But, like many individuals who have entertained similar dreams, the carrying out of a plan involving so great an expenditure of time, has had to be postponed until its execution appeared unlikely. The forthcoming autumn meeting of the Institute will be held in San Francisco, a natural point of departure for the more extended trip, and it is probable that an excursion to Japan, with a three weeks stay in Nippon, will be one of the chief features of the meeting. Fortunately the most important mines in Japan are near places of scenic interest, so that even so brief a visit will suffice for a very comprehensive view of the land of the cherry blossom and chrysanthemum. Plans for the excursion are necessarily only tentative as yet, but a definite announcement will be made in time for members to arrange plans for visiting a country so full of interest to all Americans.

TIN at its present high price is stimulating the owners of tin prospects and mines to renewed endeavor to put their properties on a working basis. Unusual activity is noticeable in the tin camps of the Black Hills of South Dakota, both in the Bear Gulch and the Harney Peak districts. A great deal of development has been done and much money spent in the experimental concentration of the ores which occur in pegmatite veins. It is now claimed that the problem has been satisfactorily solved, which we sincerely hope to be the case.

WARNING is issued by the Chamber of Mines and Oil of Los Angeles against a man named Williams who has been selling fake specimens to the unsuspecting. He is rather heavily set, has blue eyes, light sandy hair, a pallid look, and he walks with a limp. He has the general appearance of having either been seriously ill or confined in prison. He claims that the specimens offered for sale are high-grade sylvanite from Cripple Creek, Colorado. The ore has the appearance of having been roasted and is covered with small globules of supposed gold. Cutting these globules and examining them under a glass shows that they are false, and an assay will show that their gold content amounts to nothing.

GOOD news comes from the Comstock, where the work done by Mr. Whitman Symmes in developing the deep levels of these old mines, seems now likely to bear fruit. In the Mexican ground far east of any of the old workings of either that mine or the Ophir, a body of ore 10 feet wide has been found on the 2500-foot level, 700 feet below any ore above. The new orebody is a breccia of quartz cemented by metallic sulphides of lead, zinc, and iron, and is similar in character to that of the old Consolidated Virginia bonanza. Last week 15 cars averaged $44.41 per ton in value, about half gold, and later tests yield $65 per ton. The vein is well defined, but naturally the extent of the orebody is not yet known. While it may be only small, it at least indicates the probability of rich ore being present in these lower levels.

NEGOTIATIONS for the sale of the Golden Cycle mine and mill at Cripple Creek to the Consolidated Gold Fields of South Africa have been concluded, we understand, and formal announcement of the change of ownership will be made soon. The entry of this well known company into the Cripple Creek district has a double interest, derived from the importance of the two companies concerned. The Consolidated Gold Fields of South Africa is the largest of the African gold mining corporations, and is perhaps best known in America for its important holdings in the United States Smelting, Refining & Mining Company, Oroville Dredging, and Yuba Consolidated. The Golden Cycle mine is known as an important producer and the mill at Colorado City has many features of interest. With a capacity of 1000 tons per day, it treats more than half of the custom ore of the district as well as that from its own mine, with conspicuous success. When the mill was totally destroyed by fire in 1907, Mr. John T. Milliken, then the superintendent, began treating ore again within one hundred days, and after a very brief period the mill was in full operation. We congratulate the Consolidated Gold Fields upon the addition to its American holdings.

Goldfield Consolidated

Nevada's premier gold mine has been much in the public eye since the first of the year. We published last week an abstract from the manager's report for December, and in this issue we give the bulk of Mr. J. R. Finlay's report for the fiscal year, made public January 9. It is unnecessary to go into details, as excellent monthly reports issued through the year have kept everyone informed who cared to know. The Goldfield is a great, a truly phenomenal, mine, and it has been managed with unusual success and skill under conditions, many of which are adverse. Yet the stock has never sold at a high price when measured, as are other stocks, against current dividends, and has dropped recently from $8.45 per share at the end of December to $6.55 at the end of January. Shortly after the annual meeting Mr. Finlay resigned and there has been much speculation as to why stock paying 30 per cent dividends, at current price, should be available for purchase in any amount. The price naturally reflects the judgment of the public as to its value, but one important factor is that there is so much of the stock. There have been issued 3,559,148 shares of a par value of $10 each; a truly remarkable capitalization for a young mining corporation dependent practically on a single, though large, mine. In the second place, both the president of the company, Mr. George Wingfield, and the general manager, Mr. J. R. Finlay, state frankly in their reports that the four extra dividends of twenty cents per share came from sale of rich ore and that the continuance of such dividends is uncertain. There is also no attempt to disguise the facts that the orebody is exceedingly irregular, that differences between rich ore and barren rock are sharp, and that the property is not one where it is wise to block out large reserves in advance of stoping. Mr. Finlay's remarks on the subject of ore reserves are particularly illuminating, and stockholders in the enterprise must expect sudden and disquieting changes in the amount of ore in sight. Exploration on upper levels near and under the old stopes of lessees may be expected, for some time at least, to develop ore rapidly and cheaply. Less is known about ore-shoots at lower levels, though high-grade ore is present in quantity. Naturally, prospecting at these levels is less certain, though equally necessary, and it may not be always possible to keep the balance even. Development in 1910 was unusual, in that an actual profit was realized from the ore won in the mere process of driving drifts, winzes, and raises. The total development cost $379,493 and yielded 41,896 ounces of gold. Apparently, too, the work of the year brought much ore into sight, though the December report alone was discouraging in that regard. These unusual conditions furnish sufficient

reasons for rapid variations in the price of the stock, but there is another and more fundamental one. The management has not yet won the confidence of the general buying public, though many steps have been taken to establish that confidence. The largest holding of stock is that of Mr. George Wingfield, amounting, according to the last published account, to 461,202 shares. He and his friends naturally dominate the company. The second largest holding is that of Mr. Thomas D. Jones of Chicago, amounting to 100,000 shares, his brother, Mr. David B. Jones, having in addition 53,700. Probably the third largest interest is that represented by the 73,550 shares scattered among a half-dozen persons, all receiving their dividends through the Crocker National Bank, in San Francisco. Mr. M. J. Johnson of New York holds 71,000 shares, Mr. Arthur Winslow, 22,700, the Untermeyers, 38,000, and in all there are over 5000 shareholders. The list includes many excellent names, but evidently many of the best known stockholders take little part in the management of the property. With so many uncertainties inherent in the situation, it is not surprising that Eastern investors are slow to buy stock in a heavy capitalized concern paying abnormal dividends, and dominated by a man not already favorably known to them. It will take time, even with the excellent policy of frank statement that the Goldfield Consolidated management has adopted, to win the confidence already held, for example, by the Tonopah Mining Company and the Camp Bird Limited.

Vulcan Copper Mine

New and remarkable light has been thrown on the geology of Shasta county, California, by a 'Geological Report of the Vulcan Mine,' by Alexander Roy, "Geologist." Just how remarkable his conclusions are may be best shown by a quotation or two.

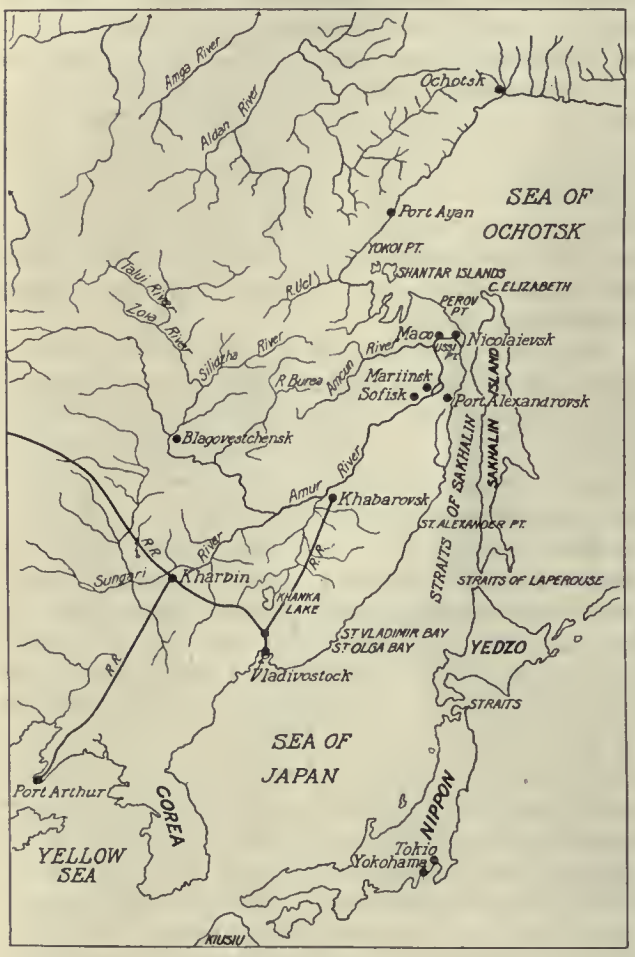
Following a lurid description of the Archean, Mr. Roy says: "When the earth was sufficiently cooled to precipitate the vapors as water, and formed an ocean above these formations, the copper solution, because of its greater density, formed a layer above this formation and percolated through the small fissures leading to it, and filled the basins, thus being primary deposition. The other salts, such as iron sulphides, etc., because of their density, also partly filled this great fissure, and together they formed the copper beds of Shasta county, in this neighborhood. Above this, and caused by their ability to remain in solution for a longer period of years, was eventually crystallized out of the solution, a weaker form of basalt, which here formed the Cambrian era. The deposition of the copper solution followed this age. The movements of these rocks on each other formed a sediment of basalt and andesite, which make the bed of conglomerate, which I have marked Ordovician ocean bed. Above this a similar occurrence took place over the Cambrian, which formed another bed above it," and so the story is continued up to the Devonian, which "is as high in the order of eras as the folds on the Vulcan properties ascend." There is geology for you! No wonder that the author feels the need at about this point of a heading, **REMARKABLE GEOLOGICAL PHENOMENA**—nothing less would be adequately descriptive. Following it, he says: "The folds at the widest are not more than 200 feet in thickness, with the exception of the Devonian, so that one gets in Vulcan Ground a point for reading these great ages which exposes them seriatum in a manner not found elsewhere in America." We believe this to be a conservative statement. It is doubtful whether "these great ages" could be read in this manners elsewhere in America or anywhere in the world. Enough has been quoted, however, to show what a mere string of misunderstood and misused words this 'report' is, yet it is being circulated in sober earnest in an effort to raise money for developing copper mines. With it is distributed an elaborate sheet of reproductions of commendatory letters from various persons who have visited the property or own shares in the enterprise, and who seem to make up in faith what they may lack in skill and experience in estimating a mine. These features naturally condemn the venture to any experienced investor, and yet a bad report or unwise methods of flotation do not necessarily condemn a property.

The holdings of the Vulcan Copper Mining Company are in Shasta county, California, adjacent to those of the Balaklala Consolidated and the Trinity. They lie within the area that is legitimate territory for prospecting for copper. We know of no reason why the claims may not prove rich in copper; there is some evidence that they may. It is, however, a matter to be determined by careful, intelligent work with the drill and by underground exploration. If any large body of valuable ore has yet been found, it is not shown by the documents made public. The circulation of such as have been given out casts doubt on the business judgment at least, of those directing the venture; and good judgment is as essential to developing a successful mining enterprise as is integrity. While we fear there is small hope for profit to one buying these shares, there are certain features of the prospectus worthy of being copied in those issued by more ambitious concerns. The statements for which the company assumes responsibility are carefully discriminated and expressed clearly, the plans for selling stock and for using the resulting funds are detailed, and the exact amount allotted to the promoters in return for the property is frankly stated. There is, however, no apparent provision against promoters' stock being dumped on the market, and the shares are not under-written, nor is working capital guaranteed by any responsible financial concern. Profit to each buyer of the stock is therefore contingent upon the promoters' success in raising all the capital required, as well as on the ordinary and natural risks incident to finding ore and conducting the business. The whole set of documents brings out sharply once more the difference between the possibility or even probability of the presence of ore in a given piece of ground, and any reasonable certainty of a buyer of shares realizing a profit.

Sluicing at the Kolchan Mines, East Siberia—I

By Chester W. Purington

***Situation and Character.**—In the year 1907 I left London for the purpose of a general inspection of conditions in East Siberia, and partieularly to examine the gold placer mining property, now known as the Kolehan property, belonging to the Oehotsk Gold Mining Co., situated near the mouth of the Amur river. The route traveled was as follows: Leaving rail head at Habarovsk on the Amur river, my party proeeeded by steamer 600 miles down the



Eastern Siberia.

Amur, through a country of magnifieent forests, wild and unpeopled, exeept as the sparse fishing villages of mingled Russians, Chinese, and Giliaks occasionally broke the wilderness. Two days saw us at Nikolaievsk, the prineipal supply point near the mouth of the Amur. Good stores, notably of the important Siberian firm of Churin, a Government assay and receiving offiee for the local gold from the Oehotsk and Amgoon mines, the steel barges and steamers of the Amur navigation companies, a transient fishing and mining population of ten thousand, an electric lighting plant, and a telegraph office represent the progressive elements of this frontier community. One hundred Japanese fishing sehoon-

*The rouble, which is used in this article, is equivalent to $0.515; the kopeck is one-hundredth part of one rouble.

ers from Hakodate, refrigerator steamers from England, mail steamers from Vladivostok, and trading boats from Hamburg lie at anehor in the river, off the town. One hundred million pounds of salmon is annually taken in the Amur, between Nikolaievsk and the Straits of Tartary, 25 miles below. The eargoes depart for Japan and Europe, and the fishing population leaves in late Oetober, in the river and sea steamers.

I was impressed with the fact that here the 'dark eontinent' of Siberia has a window open to the world. A eountry of magnifieent wealth in timber, in animal produets, and in gold lies behind, and before is the open sea.

One day's journey northwest from Nikolaievsk lies the extensive gold mining property known as the Oehotsk, or more reeently the Kolehan. This property is at 53° 30′ north latitude, or almost that of the city of Liverpool, England. Six hundred thousand pounds sterling in alluvial gold dust was taken from three miles of the Stretensky elaim in a

Nikolaievsk Mining Region.

creek bed, known by the Giliaks as the Kolehan, by a Russian company between the years 1898 and 1906. The work went on in the old Russian way, by extremely primitive and expensive methods, as is proved by the faet that in 1907 the company mortgaged its property to the Russo-Chinese Bank, which formed a reeeivership to carry on the mining operations. At about this time, June 1907, I visited the property, and althongh I fonnd the area too extensive to be sampled as a whole by myself and J. B. Landfield, my assistant, in a single season, the possibilities for gold dredging impressed me so that I undertook to sample a portion of it in detail. One hundred and sixteen pits from 10 to 25 ft. deep were sunk under my direction during ten weeks' stay on the property, and about 300 cu. yd. of gravel from fifty additional cuts and trenehes were washed in sluiee-boxes. As a result I established the presenee, in the small portion of the property which I was able to thoroughly examine, of five million cubie yards of gravel earrying a recoverable gross value of 80 kopeeks per cubie yard. About 200 acres of the bottom land along the stream were sampled in

1907, and 3000 acres, containing approximately 20,000 cu. yd. per acre, remain to be sampled.

The remarkably high tenor of the Upper Kolchan tailing and fresh gravel, namely 80 kopecks, is an indication that the great areas of gravel lying between the lower end of the Stretensky claim and the sea, carry gold. The fact that the alluvial gold, in shot-like and not flat particles, extends to the sea, and is present in the beach sand, has been determined. As the flats or meadows lying adjacent to the sea are all gravel and consist of the White mountain float, and as gold is found in every case where surface gravel is visible, it is justifiable to assume that further sampling will prove a certain proportion of the area profitable for dredging. As a proof that dredgeable gold exists in the lower meadows, may be cited the fact that pit No. 3092, one of the lowest line sunk on the Kolchan in 1907, four miles below the lowest limit of the positive reserves, showed a value of 90 kopecks per cubic yard in fine rounded gold.

The main physical features of the area are as follows:

1. Owing to processes of erosion, White mountain, a peak of gold-bearing volcanic rock, possibly itself an extinct volcano, had been nearly worn away.

2. Its débris in the shape of rhyolite fragments had been distributed to the north toward the ocean shore, over an area of fifteen to twenty square miles.

3. Wherever the previous configuration of the country allowed this débris to accumulate, it was invariably accompanied by residual gold in a fine and rounded condition.

4. Owing to the peculiar nature of the original gold deposit, the particles were never flat and were never large, but the gold for the most part occurred in the form of a clean powder, of which every piece, however small in size, had three dimensions; this, by the way, is unusual in gold-dredging areas, as in California and elsewhere the gold is of so flaky a character that some of it floats on water; moreover, I determined that the gold of the Kolchan river easily amalgamates, and there is rarely a particle of it which is not attacked by quicksilver. Coarse nuggets never occur, and pieces of pure gold weighing more than one-tenth of an ounce are seldom, if ever, found.

5. As a further result of the wide distribution of the rhyolite gravel the material is extremely small and well rounded; in fact, at a distance of four miles or more away from the source it resembles small eggs or beach pebbles. Although the excessive amount of alumina liberated by the decomposition of the rhyolite causes some clay layers to form on the slopes of the mountain itself, this also, at a distance of three miles from the mountain, almost entirely disappears, and the gravel becomes as free and loose as on the sea beach itself. This remarkable

Company Hospital, Old Russian Buildings.

Filling the Bucket.

Cutting Into the Bank.

Dumping the Bucket.

character continues over the level gravel flats for a length of ten and a width of one-half mile to three miles.

6. The depth of this gravel sheet, lying between the White mountain and the sea, is also extremely regular. As far as the lowest line of pits previously referred to, some seven miles to the north of the White mountain, the depth does not exceed 18 ft. So far it has been impossible to sink pits farther north than this for lack of time and money assigned to prospecting alone, but I am confident that drilling will substantiate the fact that none of the ground exceeds 25 ft. in depth to bedrock, even as far as the sea beach itself.

7. Although at a latitude of 53° 30′ N., and in a region where extreme winter cold occurs, yet the gravel is not frozen to an extent which will cause difficulties. No permanent frost has been noted at a distance greater than one-half mile to the south of the actual beach, but annual frost penetrates the ground to the depth of the turf or peat overburden; this frost is said not to penetrate the underlying gravel, and my own experience in hand-shoveling bears out this assertion. The annual frost does not leave the ground sometimes until the middle of July, and is occasionally a detriment to hand operations. Recent dredging experience in the Klondike and near Cape Nome, however, shows that such a comparatively small amount of frost will have practically no effect in delaying the operations of dredges.

Operations of the First Two Years.—In 1908 a so-called 'staratel' or 'tributer' arrangement was made with the local Russian manager. By this I was permitted to have a share in the gold which was being taken from the property by 1000 tributers, Chinese and Koreans. I was also allowed to work a small block of ground, about a quarter of an acre in extent, for myself, paying a very high royalty of 33% to the Russian company. In a period of 40 days, nearly £4000 was received from the Chinese operations and my own string of sluice-boxes. Actually, without the help of the tributers' gold, I obtained the sum of 14,500 Rs., roughly £1500, from 2000 cu. yd. of material. This work was done by hand-shoveling without the use of machinery, except a small centrifugal pump which raised water about 10 ft. Everything on the property was in poor shape for work, and it was even necessary to make wheels for the wheel-

Map of Kolchan Mines.

barrows, used for transferring the gravel to the sluice. The operations of 1909 resulted in returns of 126,441 Rs., for a season extending from July 26 to September 30.

The relative depth of the deepest mines as compared with the diameter of the earth may be appreciated by stacking up 8000 sheets of paper; one of these to represent a mile, the approximate depth of the deepest mine shafts. It will at once be seen that the deepest mines and bore-holes are but mere pin-prieks and the highest mountains only a slight roughening of the surface. The coating of varnish on a 2-ft. globe representing the earth is relatively thicker than the deepest ocean.

Employment of inexperienced immigrants in the coal mines of this country is suggested as the probable cause of many serious accidents, in a report of the Immigration Commission. The report deals with the economic condition of about 88,000 soft-coal miners. Of the 88,000 men, 54,000 were foreign born, and nearly 40% had been in this country less than five years.

Goldfield Consolidated

By J. R. Finlay

*Production, expenses, and profits for the year may be summarized as below:

PRODUCTION

			Per ton.
265,352	tons milled	$9,842,122.84	
1,515	tons shipped	1,024,629.61	
266,867	tons total product	$10,866,752.45	$40.72
	Loss in tailing	592,818.28	2.22
	Amount realized	$10,273,934.17	$38.50

EXPENSES

Mining:			
Stoping	$652,565.67		
Development	379,492.91		
	$1,032,058.58		$3.86
Transportation	36,799.51		0.14
Milling	562,881.07		2.11
Treating concentrate	82,712.74		0.31
Marketing:			
Bullion	61,314.72		0.23
Concentrate residues and mill by-products	221,443.92		0.83
High-grade ore	89,371.49		0.34
Bullion tax	130,807.82		0.49
General expense:			
Administration, legal, office, corporation, damages, association dues, property taxes, general maintenance, automobiles, sundries	238,306.10		0.89
Total expenses	$2,455,695.95		$9.20
Miscellaneous earnings	48,181.52		0.18
Net operating expense		2,407,514.43	9.02
Operating profit		$7,866,419.74	$29.48
Less:			
100-stamp mill addition	$75,952.20		
Mill refinery and other mill construction	34,058.99		
Replacement of fire loss	156,446.50		
Fire protection	49,191.13		
Electric storage battery and other electrical equipment	60,964.93		
Assay office, Laguna shaft, and railroad construction	53,061.54		
Miscellaneous construction, furniture, real estate, and equipment	16,189.11		
Income tax	72,863.50		
		518,727.93	1.95
Net operating profit for year		$7,347,691.81	$27.53

PRODUCTION

	Dry tons.	Value per ton.	Total value.	Amount realized.	Per cent extracted.
Mill ore	265,352	$36.99	$9,842,123	$9,249,305	93.98
Shipping ore	1,515	676.05	1,024,629		
Total	266,867	$10.72	$10,866,752		

At the beginning of the fiscal year J. H. Mackenzie, then general manager, had under way an addition to the new 100-stamp mill designed to increase its capacity about 30%, or, in other words, to make up doubly the loss of capacity caused by the dismantling of the old Combination 20-stamp mill. This improvement was not completed until the end of December, so that the maximum treatment capacity for the last two months of 1909 was 20,000 tons, while, beginning with January 1910, the capacity was 25,000 tons for the month, and the tonnage for the year was expected to be 290,000. There was, however, a serious interruption for the three months of April, May, and June, caused by a bad fire on the night of April 8. This fire at first appeared to be more disastrous than it afterward proved, for it seemed almost certain that the Merrill precipitating presses in the refinery were destroyed. Had this been the case, the entire plant would have been shut down for at least two months. It proved, however, that the presses were intact, and the mill was started with 70 stamps after a shut-down of seven days. The 30 stamps and a portion of the ore-bins and the inclined belt conveyor, all of which had been destroyed, were replaced by July 1. This accident cost $156,446.50 in supplies and reconstruction, besides diminishing the ore milled for the year by 25,000 tons.

Comparison with last year's report will show that there has been no decrease of operating costs coincident with increased tonnage at the 100-stamp mill. This is accounted for wholly by increased cyanide consumption, caused by the constantly diminishing proportion of oxidized ores and increase of sulphides from the lower levels. Leaving this factor out of consideration, the plant has worked exceedingly well. In crushing efficiency, cost of operating, and recovery of gold, it has fully met all expectations. Mining costs have tended to diminish during the year. The highest month was November 1909, when the mining and development cost was $4.64 per ton. The lowest month was October 1910, when the cost was $3.34. The working costs for mining, transportation, and milling are given in the subjoined tables, together with statistics of the output and development work at the various mines. In addition to the 41,938 ft. of development done by the company, 1298 ft. was done by lessees, making the total on the property for the year 43,236 feet.

PRODUCTION.

October 31, 1909, to November 1, 1910.

	Development.		Stoping.	
Mine.	Tons.	Ounces.	Tons.	Ounces.
Combination	3,949.35	5,337.86	56,183.25	68,597.79
Mohawk	10,076.59	12,644.82	74,079.97	82,106.83
Red Top	7,876.91	6,708.89	49,595.90	89,020.09
Jumbo	12,796.00	17,204.81	52,308.66	244,104.67
All mines	34,698.85	41,896.38	232,167.78	483,829.38

TOTAL PRODUCTION

	Tons.	Ounces.
Combination	60,132.60	73,935.65
Mohawk	84,156.56	94,751.65
Red Top	57,472.81	95,728.98
Jumbo	65,104.66	261,309.48
All mines	266,866.63	525,725.76

The total value of the ore was $10,866,752.45, made up as follows: Combination, $1,528,241.09; Mohawk, $1,958,517.08; Red Top, $1,978,722.47; and Jumbo, $5,401,271.81.

AVERAGE ASSAY OF ORE PER TON

	Ounces.
From development	1.21
From stopes	2.08
Produced	1.97

TOTAL MINING COSTS

Mine.	Development.	Stoping.	Total.
Combination	$48,423.63	$128,264.80	$176,688.43
Mohawk	101,391.63	229,358.84	330,750.47
Red Top	64,986.95	128,564.09	193,551.04
Jumbo	164,690.70	166,377.91	331,068.61
All mines	$379,492.91	$652,565.67	$1,032,058.58

*Abstract from annual report as general manager for the year ended October 31, 1910. Report made at the stockholders meeting, January 9, 1911.

COST PER TON OF ORE PRODUCED

Mine.	Development.	Stoping.	Total.
Combination	$0.80	$2.13	$2.93
Mohawk	1.20	2.72	3.92
Red Top	1.13	2.23	3.36
Jumbo	2.52	2.55	5.07
All mines	$1.42	$2.45	$3.87

DEVELOPMENT

Mine.	Feet advance.	Cost per foot.
Combination	6,297	$7.72
Mohawk	12,248	8.27
Red Top	8,806	7.38
Jumbo	14,587	11.29
All mines	41,938	$9.05

OPERATING COSTS

October 31, 1909, to November 1, 1910.

Item.	Cost per ton.	Total.	
Mining—266,866.63 tons.			
Labor	$2.08	$553,206.17	
Supplies	1.28	342,382.72	
Power	0.046	12,492.80	
General charges	0.464	123,977.69	
Totals	$3.87		$1,032,058.58
Transportation—265,351.80 tons.			
Railroad operation	$0.079	21,029.76	
Railroad maintenance	0.057	15,769.75	
Totals	$0.136		36,799.51
Milling—265,351.80 tons.			
Labor	$0.558	$147,991.10	
Supplies	1.258	333,854.38	
Power	0.305	81,035.59	
Totals	$2.121		562,881.07
Concentrate treatment.			
Labor	$0.050	$13,146.19	
Supplies	0.236	62,744.14	
Power	0.026	6,822.41	
Totals	$0.312		82,712.74
Total operating	$6.439		$1,714,451.90

CONCENTRATE TREATMENT COSTS.

Tons treated, 14,151.83.

Labor	$0.93	$13,146.19
Supplies	4.44	62,744.14
Power	0.48	6,822.41
Totals	$5.85	$82,712.74

Remembering the well known fact that the orebodies are irregular in size, shape, and grade, and that the ore is valuable enough to warrant careful handling, the management has never strained after low mining costs. Special effort is made to mine the ore cleanly, that is, to minimize the mixing of waste with the ore. Since much barren vein-matter looks exactly like the ore, it is possible to prevent mixing only by incessant sampling and assaying. Of course, any waste that goes into the ore is mined and milled at a dead loss, whether the resulting mixture is still of a pay grade or not. It will be observed that one foot of development work was done for every 6⅓ tons mined. This compares with one foot for a trifle over 7 tons mined during the year 1909.

Estimates of ore in sight have been made quarterly during the year, but these estimates are at best inaccurate and unsatisfactory, for the following reasons: (1) Estimates of tonnage have been found to vary between wide limits, according to the methods used in making the estimates, and according to the engineer's conception of what is 'ore in sight.' It should be remembered in this connection that it is impossible in the normal conduct of mining to expose any large percentage of the ore on more than two sides; much of it is exposed only on one side. (2) It is useless to fix a tonnage without also fixing a value for the reserves. This is exceedingly difficult, and must necessarily be somewhat in the nature of guesswork, on account of the presence of some extraordinarily high-grade ore in the midst of large bodies of average ore. One shipment of 150 tons averaged $1400 per ton. One ton of 50-oz. ore is equal in value to 50 tons of 1-oz. ore, and a mistake of 1000 tons of 50-oz. ore is equal to a mistake of 50,000 tons of 1-oz. ore. In the Consolidated mine the high-grade ore is far more erratic than the average ore, and there is enough of it to make quite possible a mistake of several thousand tons in estimating it. At the end of the fiscal year 1909, a very high-grade orebody had just been exposed in the Clermont shaft. After development had proceeded on this ore for several months, it was decided by the company that it would be the most profitable policy to extract this high-grade ore as rapidly as good mining would permit, so as to let the shareholders have their profits at once, rather than to spread them out over a longer period. This policy was announced in February. It was not the intention to convey the impression that the grade of ore maintained under this decision was the average grade of the mine. The extra 20c. dividend per quarter was in each case declared as an extra. Five of these extra dividends have been declared, amounting in all to $1 per share. While these extraordinary profits have thus far exceeded expectations, and may still do so, it is not reasonable to expect them to continue indefinitely. There is reason to believe that the mine can produce from the ore now exposed a tonnage equal to about twice that of the year just closed. This does not measure the possibilities, for the prospect for further development is good, and there is as yet no logical ground for fixing any term as the probable life of the mine.

As stated above, at the beginning of this fiscal year, the work of adding to the capacity of the 100-stamp mill was under way. This work, as well as other construction undertaken at the mill, is described as follows by the mill superintendent, J. W. Hutchinson: "To increase the tonnage from 650 to 850 tons per day, six 6-ft. L. C. Trent Chilean mills and 24 No. 3 Deister slime tables were added, which, with other minor changes, cost approximately $75,000. The change has been highly beneficial, and the cost of mechanical operation materially reduced. This reduction in cost of operation has been masked by a material increase in the cost of chemicals used, due to changes in the ore supplied to the mill. Were the same amount of chemicals being used now as during the last year's operation, the total cost of milling would be reduced 35c. per ton below last year's figures. When the mill was designed it was not known that the concentrate would be treated at the plant, which accounts for the inadequate facilities in the present refinery, as it was designed for an output not exceeding $300,000 per month. Approximately 70% of the recovery is made on concentrators, and consequently the cyanide bullion output has averaged over $600,000 per month. In order to handle this amount of product with the equip-

ment at hand, it was found necessary to drive the furnaces to the limit. After trying both fuel oil and coke, with indifferent success, it was found necessary to fire with distillate. By so doing it was possible to keep up the output, but at excessive cost. A defective bushing in this fuel line started the fire of April 8. A new refinery of reinforced concrete is now well under way. It will cost approximately $25,000, and will effect a saving of $5000 per month. For the purpose of heating the plant in cold weather, and for holding the mill solutions at a uniform temperature, two boilers have been installed. For obtaining more uniform agitation, there has been installed one Laidlaw-Dunn-Gordon low-pressure air-compressor."

In March it was decided to undertake the building of an electric storage-battery plant. The occasion for this was principally that the hoists at the Mohawk and Clermont shafts were run by compressed air. The compressors were taxed to the utmost to supply enough air for this and also to take care of the machine-drills. The outlook for increased hoisting requirements from greater depths made it necessary to look around for some other means of operating these hoists. Investigation showed that electricity was far to be preferred over any other form of power available; but under the existing contract with the Nevada-California Power Co. the large motors required for hoisting could not be employed without raising the peak-load to a prohibitive point. A thorough investigation of this subject was made by L. T. Merwin, whose conclusion was that a storage-battery system could be installed that would so equalize the load that the plant would pay for itself in the visible life of the mine, and also provide for all probable power requirements. The plan was accordingly adopted, the contract with the power company was extended to cover a period of seven and one-half years, beginning April 1, 1910, and construction begun.

Other construction undertaken at the mine was an equipment for the Laguna shaft, consisting of a steel head-frame, ore-bins, and hoist, a new roundhouse for the two locomotives, a new oil-storage arrangement for the railroad, and some changes in the tracks. A second-hand locomotive was bought early in the year. A new assay office has also been built and a new vault for the engineering department. It remains also to mention the fire-protection system. This has been made as thorough as possible. A concrete reservoir has been built on top of Columbia mountain, between the mine and the mill. A good pipe-line was built connecting all plants, and a thorough equipment of stationary monitors, hydrants, and hose, provided. A further system of automatic sprinklers was put in to guard vital points in the mill where even a small fire might cause a delay of operations. Before the main plant could be completed, temporary equipment, such as chemical engines and temporary fire lines, was put in. The whole expense of fire protection was $49,903. The system does the additional valuable service of reinforcing the water supply for milling purposes.

Unloading of Compressors

The modern air-compressor is a device that can be operated under direct and automatic control. In earlier days compressors were driven by a steam-engine or by water-power, the power being applied by belts or by means of gears. The first compressor was upright, that is, after the marine-engine type. An improvement was made when the straight-line compressors were introduced, as the steam-engine piston-rod extended from the steam cylinder into the cylinder of the compressor, which was in direct line with the former, thus increasing the efficiency of the machine. The load upon compressors is nearly always variable, and for many years various devices have been employed to either stop and start the machines automatically under the varying conditions of high and low pressure, or to manipulate the valves so that the machine would run at decreased load.

With water or steam-driven compressors various attachments have long been in use for this purpose. The devices on the steam-driven compressors usually depended upon the automatic movement of a lever, actuated by the air when it reached a certain pressure, this lever shutting off the steam either wholly or in part, thus stopping the compressor. When the pressure in the air-pipe diminished, because of the use of the air in operation of drills, in ventilation, by leakage, or otherwise, the same lever turned on the steam, and the compressor then ran as before until the cut-off pressure was again reached, when the compressor would stop again.

One of the earliest forms of unloaders was that of Clayton, 1866. In this, the discharge air was side-tracked. Instead of going into the reservoir against the stored pressure, it was diverted by a valve into the atmosphere, where it escaped without resistance. In this arrangement the machine during the period of no work continued to pump air, all parts, valves, etc., remaining in operation. However, it ran light, as there was no discharge pressure. There was, nevertheless, considerable power taken to force the large bulk of the uncompressed air through the valves, ports, and pipes, which were designed only to accommodate the air after its bulk had been reduced by compression. The noise of the escaping air was very disagreeable. Only a few machines with this attachment survive, and, although now free for all, it is only occasionally put on new outfits.

Another method of handling the discharge air and stopping the further compression was brought out by Sergent and Cullingworth. The discharge valves were held wide open, and thus the cylinder was filled with air of high pressure from the air reservoir. This kept the intake valves closed and no air could be taken into the machine. As the piston continued to reciprocate, the heavy pressure air was churned back and forth through the discharge ports. There were numerous other devices for unloading compressors. In the water-driven compressor a device is in use consisting of two cylinders, one vertically above the other, each having an interior piston, one, the smaller, for water pressure, the other for air.

By a system of small pipes connecting the respective cylinders with air and water, the compressor was held under automatic control, and would run or stop as required for hours without an attendant. By use of this ingenious arrangement the range of air-pressure could be regulated to within 3 to 5 lb. For instance, when the compressor was in operation, if it had a greater capacity for compression of air than the demand upon it, the gauge would indicate an increasingly greater pressure until at, for example, 100 lb. per sq. in., the pressure of air on the piston of the larger cylinder of the automatic cut-off would give an aggregate of pressure greater than that upon the piston of the water cylinder, upon which the air cylinder would be forced downward a few inches, causing the piston of the water cylinder to be carried down at the same time, thus, by connection with the valve, shutting off the water from the wheel. When the air-pressure decreased, say to 95 lb., from use, the aggregate pressure on the water cylinder then being greater, the water piston would be forced upward, re-opening the water valve, and pushing the air cylinder back to the position it occupied before, ready to repeat the same function when the air-pressure again reached 100 pounds.

The application of electricity to the operation of air-compressors required a somewhat different arrangement to control the compressor, as it is necessary that the motive power be applied constantly. The real problem to be solved is to consider the compressor as continuously running at maximum speed, yet having the amount of air compressed vary according to demand, and the power employed vary practically in proportion to the amount of air actually delivered.

A desirable unloader, as will be readily understood without elaborate explanation, should be free from undue friction; it should not promote conditions inviting explosions; it should not throw extra strain or load on the machine at the moment when valves are being changed to resume work. When unloaded, the compressor should run free and should take up or drop its work easily and quickly. Furthermore, it should be able to work with only partial capacity as well at full load as at no load, and when so working, at less than full capacity, each of the cylinders of a compound or two-stage compressor should do its proper proportion of the total work, so that the same economical and safe conditions are obtained at partial load, as are designed for full load under normal working conditions.

This is the problem solved by Hill and Morgan and developed satisfactorily by the designers and testing engineers of The Norwalk Iron Works Co. Unloading is accomplished by an air-control valve, an apparatus somewhat resembling a safety-valve, which, when the air has reached the predetermined point, allows the air-pressure to act on a plunger which trips a catch on the air valve-stem, thus releasing the valve from the driving mechanism and holding it open. Therefore, on the return of the piston the air which was taken in on the advance is rejected and returned to the atmosphere. This, of course, stops compression, and as the air passes out through a wide-open port specially designed for the purpose, there is practically no resistance to its entrance or egress. In fact, the indicator diagram from the unloaded cylinder, taken with the same spring as for the regular work, is a straight line drawn at the line of the atmosphere. There are no explanations or figures to be made; it shows practically no power consumed and is near perfection.

The Norwalk compressor unloads progressively, there being the exact degree of unloading that is necessary at any particular time. In a compound compressor both cylinders, when unloaded, are relieved simultaneously and in the same proportion. First, the inside ends of both cylinders are unloaded, leaving the outside ends still acting, working in perfect balance, and each cylinder doing its share of the two-serial compression. Second, if conditions require it, the outside ends of both cylinders unload, leaving the machine to coast without load and with no friction on the journals due to a vacuum or pressure in the cylinder. For a slight degree of unloading, one-half of a cylinder of air is dropped at intervals. As the degree of desired unloading becomes greater, these intervals increase until the amount of unloading becomes 50%, when the valves of the inside ends of the cylinders remain fixed at no load, and variations are then made on the load for the outside ends of cylinders. These changes of load can affect only one-half of a cylinder full of air at any time, and under the steadying action of the heavy and rapidly moving flywheel, changes in power and in compressor effort are effected smoothly and without jerk on motor, gears, or driving belt.

In many systems of power, such as gas engines and electric motors, it is of the utmost importance that they be started without load and the load thrown on only after full speed is attained. Frequently compressors are called on to start against pressure in the reservoir, either from a previous run or from other compressors then at work. As the cylinder of a compressor is full of air before the start, it is obvious that this air must be driven out at the first revolution. If it goes by way of the discharge valves it encounters resistance, and hence loads up the machine at the start. If the unloading scheme depends upon the plan of forming a vacuum in the cylinder, then the formation of this vacuum is a starting load.

In the Norwalk compressors, as has been explained, the intake valves are held open; hence the start is effected without load, for the air flows back into the atmosphere without compression and without vacuum.

Ancient miners used occasionally to resort to the waving of blankets in mine workings for the purpose of starting the air currents in motion to improve ventilation. The miner of today is amused at the suggestion, while he runs his bucket, skip, or cage up and down the shaft rapidly a few times for the very same purpose.

Bisbee—A Geological Sketch

By William L. Tovote

Bisbee was studied and described by F. L. Ransome nearly ten years ago. His report, published by the U. S. Geological Survey, has been ever since the main guide of the mining men in this camp, a sure proof of its excellence. But, if it is remembered that his investigation could cover only that part of the mining area then under operation, namely from the Queen incline to the Irish Mag shaft, then just opened, an area that represents less than one-half of the present field of mining activity, and that progress has since extended even more, relatively, in depth, than laterally, it is not surprising that new facts have appeared which tend to modify some of his deductions. To rehearse concisely the established facts: There are represented in the Bisbee quadrangle at least three maritime and three continental periods. The maritime epochs are:

1. Pre-Cambrian (pinal schist).
2. Paleozoic (quartzite and limestones covering the time from Cambrian to late Carboniferous).
3. Mesozoic (Cretaceous conglomerate, sandstone, shales, and limestones).

The maritime periods may have been longer, but if there were any later sediments, they have been eroded. Continental changes seem to be accompanied by volcanic activity, which is not surprising, as relatively deep movement and stress must open channels which extend down to depths where the volcanic forces are at rest, imprisoned by the superincumbent burden. If these fissuring forces act under or near great bodies of water, they will produce volcanoes, as all active volcanoes seem to emanate on continental fracture-zones, in or near oceanic bodies of water. If these fracture-zones are inland, they give vent to the more quiet volcanic activity, as evidenced by the eruptive rocks. The explosive force of sea-water suddenly transformed into gas, is probably the reason for the more instantaneous and explosive types of eruption. As it is, there are in this district three phases of eruptive activity which apparently occurred during the three continental periods: 1. The Juniper Flat granite, which I am inclined to consider as pre-Cambrian, correlating it with the undoubtedly pre-Cambrian granite at Clifton-Morenci, Globe, and other points in the Southwest. Mr. Ransome places this tentatively as post-Carboniferous, and roughly contemporaneous with the granite-porphyry intrusion, on account of the similarity in magma, and this in spite of the fact that the granite is cut by a later granite-porphyry dike. Similarity in magma is hardly a proof for contemporanity, as practically the same magmatic combinations extend over tremendous periods, and seem to change from the more silicious magmas to the more basic as our planet ages, perhaps because the easily fluxing and light silica is being exhausted in the deep sources of the dormant magma.

Mines at Bisbee, Arizona.

2. During the second continental epoch, between Carboniferous and Cretaceous age, occurred the most important eruption in this district, that of the granite-porphyry, with its main mass, the Sacramento hill stock, and numerous intrusive dikes.

3. The third continental period corresponding to the great porphyry intrusion in the vicinity of Morenci, is represented only by lesser activity in this camp, as shown in the Glance porphyry dike, that cuts the Cretaceous conglomerate. Perhaps a few other dikes inside of the present mining area, relatively little altered and approaching the quartz-diorite type, might be classed with this one. More

recent volcanic activity elsewhere in Arizona, represented mainly by basaltic and rhyolitic lava-flows of Tertiary age, is not in evidence in the Bisbee district.

The metallic content of the orebodies of Bisbee district are: 1. Bodies of lean pyrite with slight admixture of finely disseminated copper sulphide, of no economic value at present. (Original stage.) 2. These same pyrite bodies enriched by chalcopyrite (ascending solutions), and chalcocite (descending solutions), workable. (Secondary stage.) 3. Oxidized orebodies as last stage, containing copper salts and iron oxide and sometimes residual kernels of pyrite, accompanied by masses of ferruginous clay and pure kaolin (ledge matter). The copper ores for this group are chalcocite, native copper, and cuprite for the lower horizons, and the copper carbonates for the upper, most thoroughly oxidized horizons. Azurite seems to be the final product. Tenorite and chrysocolla, the latter rather inconspicuous in this district, seem to maintain an intermediate stage, together with several copper salts of lesser economic importance. The rocks that are intimately connected with the copper deposits, which are of present economic importance, are the Paleozoic series of limestones, the Cambrian (Abrigo), the Devonian (Martin), the Lower Carboniferous (Escabrosa), the Upper Carboniferous (Naco limestone), and the post-Carboniferous intrusion of granite porphyry. The Escabrosa limestone has maintained its position as the main ore-bearing horizon, but even here the lower strata seem more favored than the upper ones. The Escabrosa is chemically the purest member of the limestone series. The Naco limestone, in spite of exceeding in thickness the lower members (Abrigo and Martin) is less favored by ore deposition. The orebodies encountered in the Naco are very few, but the Martin and Abrigo limestones have been proved ore-bearing. The Lower Carboniferous limestones have long been recognized as ore carriers in different districts, notably Leadville, Clifton-Morenci, and Bisbee, which is something that seems to defy explanation. Contemporaneous deposition of metallic sulphides seems to be rare in Bisbee, for if such were the case a more general distribution (dissemination) throughout the rock would be noticeable, whereas in the present day copper deposits the lean pyrite occurs in large irregular bodies in the sediment. They have thus far been regarded as typically of metasomatic origin. In these lenses pyrite has replaced the feldspar and micaceous minerals in the porphyry, and it also invaded the country-rock at the contacts, changing the porphyry and the Pinal schist to a mixture of quartz and pyrite with disseminated sericite. The contact action on the limestones is not nearly as conspicuous in this camp as is often observed elsewhere, where limestones have been cut by eruptive magmas, and outside of a contact-zone around the Sacramento hill stock, the changes are mainly microscopic. Primary contact-metamorphism seems to consist mainly in silicification of the limestone, re-crystallization to pure white marble, and the development of heavy silicates, such as garnet (grossularite), tremolite, diopside, and vesuvianite. The oxidation of garnet furnishes iron oxide, to which may be attributed the rusty color of the cavernous siliceous rock, where the contact-zone is exposed at the surface. A later process that might, perhaps, still be called contact-action, seems to extend from porphyry dikes along certain shaly layers in the limestones, mainly the lower Martin and Abrigo limestones, and develops well-defined pyrite crystals, and small bunches of pyrite. This process must have continued for a long time, as pure white kaolin is also developed and traverses adjoining limestone beds along small cracks, which latter process is apparently later than the contact-metamorphism. The limestone beds thus affected show frequently flat crystallized pyrite individuals along cleavage and bedding planes. This pyritization of the limestone does not extend far from porphyry dikes or the aforesaid shaly layers. The changes in porphyry and sediments seem to indicate a large addition of silica and iron sulphide from ascending solutions subsequent to the intrusion of the porphyry into the disturbed area, following channels opened by the intrusion and in consequence of it. These additions removed large amounts of alumina and calcium carbonate. The calcium carbonate was more readily disposed of by circulating waters and that portion not redeposited was carried off. The alumina, on account of its greater insolubility, remained in the disturbed area and furnished the material for the so-called ledge matter. A process akin to magmatic segregation must be a strong factor in nature's laboratory. It causes copper to accumulate about a copper nucleus, iron about iron, and so on, so it is no surprise that there are found many porphyry dikes that consist practically of quartz and pyrite, while others, or even the same dikes in other places, consist principally of soft aluminous minerals of a clayey nature, with imbedded quartz grains, and still others that are mostly masses of kaolin, that exhibit only indistinct evidences of a former porphyritic structure, and as a last development, masses of kaolin that might either represent original porphyry or the deposition of kaolin in fissures and cavities. In the last case I have assumed that open channels for rapid water circulation existed. This is easily deduced from the generally disturbed condition of the district and is evident in faults representing relative lateral as well as vertical movement of adjoining blocks of ground. Great lateral stress must have continued for a long period, that culminated in the Glance overthrust fault of late Cretaceous age, described by Ransome. Other overthrust and lateral movements are traceable. This lateral stress was certainly to some extent active during the period of porphyry intrusion and helped to create lines of weakness for intrusion of the porphyry that frequently occurs along bedding planes in the form of sills.

Vertical stress manifests itself in numerous faults of different types, which have divided the rocks of the district into small blocks. Of these faults there can be discerned at least three main groups: the first antedating the porphyry intrusion, its main representative being the Dividend fault with a throw of at

least 5000 ft. It was followed by the intrusion of the porphyry stock of Sacramento hill. Many of the porphyry dikes seem to follow other pre-existing fault-planes. The second system of faults may represent a re-adjustment of equilibrium after the porphyry eruption, which, with fissures in the cooling magma, resulted in the creation of channels for the ascension of heated solutions initiating silicification and pyritization and providing cavities for the deposition of the pyrite bodies. The third group, perhaps to be identified with faults that cut the Cretaceous strata, traverses and dislocates the solid pyrite bodies, and furnishes channels for enriching solution both from below (chalcopyrite), and above (chalcocite). The study and identification of faults is rendered very difficult in this camp by the extended covering of undisturbed Cretaceous sediments and by the homogeneous character of the limestones, that make the establishment of certain horizons difficult; also by reason of the thorough alteration which large portions of the formation have undergone. My idea of cavities for the deposition of original pyrite is somewhat at variance with the generally accepted theory of metasomatic deposition. Metasomatic deposition, as heretofore accepted, would imply the dissolution of the limestone, grain by grain, and its replacement by ferric sulphide. Now, even if this replacement should start from an original fissure, it would grow in offshoots from this fissure along cracks and bedding planes, and the ultimate orebody would necessarily represent a central body with radiating branches and change gradually from solid pyrite through partly replaced to unaffected country-rock, as, for example, in the deposits of the Mississippi Valley, if my conception, gained only from the literature, is correct. (See Fig. I.) I doubt if there is any pyritic orebody to be found in Bisbee district that would indicate an origin along these lines. On the contrary, the pyritic bodies appear as solid masses, usually surrounded by a rather thin clay selvage with pyrite and copper sulphide as an impregnation. This in turn is surrounded by hard solid limestone which, if it shows any change at all, is only that of the usual contact metamorphism, such as its recrystallization to pure white marble or silicification and the development of heavy silicates. Metasomatic orebodies would start along fissures and cracks, but their growths would most likely spread along bedding planes. In Bisbee are found many orebodies, especially in the oxidized zone, that seem to follow bedding planes, but in almost every case it is possible to trace along their extension the remnants of an intruded porphyry sill, and the orebody is observed to cross the limestone beds wherever the dike changed its course and crossed the strata. Special consideration ought to be given those orebodies that have long been covered by permanent ground-water, as their features are the least likely to be obliterated by the action of the oxidizing solutions from above. At the Junction mine is an instance where, probably, a local basin of permanent water, cut off from circulation by earth movements, has been drained by years of pumping, and here are found conditions which are most valuable in tracing genetic relations. The Junction shows orebodies that approach closely the type of fissure-vein filling. The orebodies traverse the limestone beds, and show enrichment, widening out at cross-fissures and terminating, as a rule, in clay-filled fissures. These latter are most easily explained on the theory that they are altered porphyry dikes, and they are very frequently found connected with unmistakable porphyry dikes.

The extensions of these orebodies are decidedly more nearly vertical and normal to the bedding planes than lateral along the bedding planes. As a rule, they show a very sharp and distinct hanging wall of unaltered limestone, the foot-wall showing less abrupt changes.

One orebody, that particularly represents these features, I wish to describe more in detail. It rises from below the 1500-ft. level, the lowest point thus far exposed, to nearly the 1200-ft. level; but its extension is interrupted by faults and deflections along bedding planes. Its average width might, perhaps, be 20 ft., but it is very irregular, sometimes thin and sometimes widening out where cross-fissures cut it. The original body is solid pyrite. It has been enriched by chalcopyrite and chalcocite. The richest parts are along cross-fissures and at the foot and hanging walls. Within the orebody the chalcopyrite enrichment extends farther than the chalcocite, and has intergrown more commonly with the pyrite, owing to its earlier beginning and longer duration, but it still shows clearly its origin from feeding fissures. The chalcocite is generally limited to a coating of the primary sulphides along cracks and planes of crystallization, with a more solid replacement along the walls. The hanging wall is hard limestone separated from the solid pyrite by a thin band of clay which is impregnated with sulphides. The foot-wall is remarkably irregular, presenting a contorted, almost wave-like appearance. The limestone at the foot-wall shows signs of leaching, but it changes in a short distance to hard solid rock. Above it rests a layer, several feet thick, composed of earthy chalk and clayey material conforming to the foot-wall.

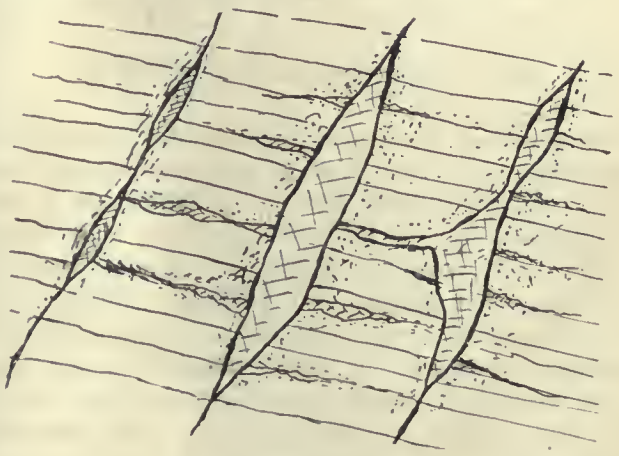


Fig. 1.

A seam, often increasing to about 2 ft. in thickness, of sooty or granular chalcocite, separates it from the solid pyrite body, which also follows the outline of the foot-wall. (See Fig. 2.) The

pyrite shows no crushing and re-cementing, so that the conclusion impresses itself that the sulphide has been deposited after the foot-wall had assumed approximately its present shape, and would therefore constitute a filling of pre-existing cavities; or, following the theory of metasomatism, that a porphyry dike, remnants of which are represented in the clayey material, followed existing openings in the

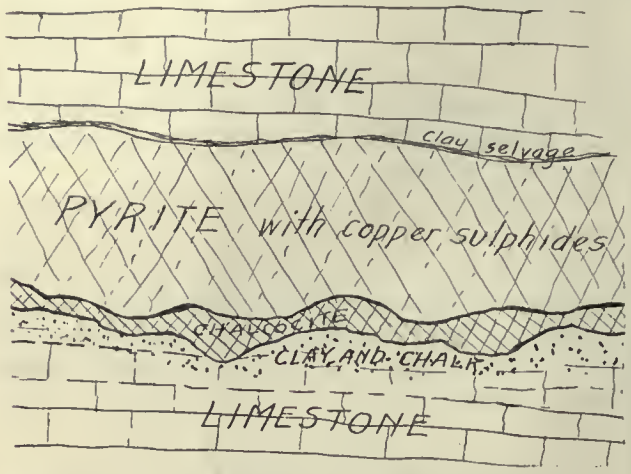


Fig. 2. Cross-Section of Orebody at Junction.

limestone and was replaced by pyrite from ascending solutions. That it is the porphyry and not the limestone that lends itself most readily to metasomatism is shown time and again, even in the most thoroughly oxidized orebodies, where large boulders and masses of slightly altered limestone intrude into the ferruginous clay and kaolin, being sometimes entirely enveloped by them. Considering the contact action of porphyry on limestone, this is only natural, because the impregnation of the limestone

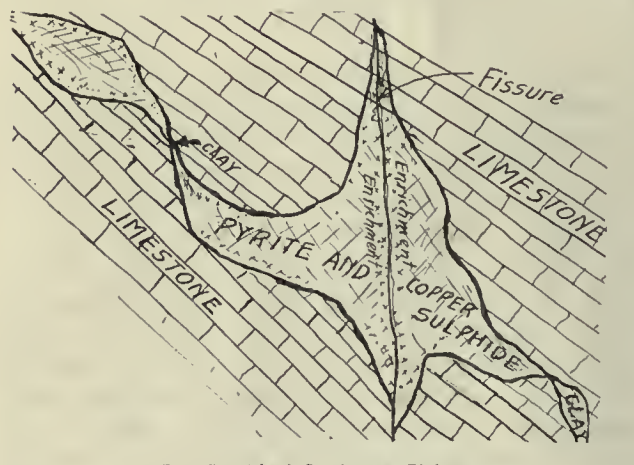


Fig. 3. Ideal Section at Bisbee.

with heavy silicates and silica renders the limestone dense, hard, and impregnable to aqueous solutions.

Alumina could not possibly be derived from the limestones of Bisbee, except, perhaps, in case of the Martin and Abrigo limestones. Its source points rather strongly to the porphyry, and clay is in evidence everywhere that orebodies are found; more particularly with the oxidized orebodies than with the sulphide masses. These orebodies occur mostly in the Escabrosa limestone, which, in its representative development, is practically pure calcium carbonate, according to Ransome. In due course, limestone also will be replaced, but apparently it resists metasomatism for a long time. The condition is represented by the accompanying sketches, Fig. 2 and 3.

Delafossite is a mineral that constitutes an important copper ore in certain horizons. It is practically 50% copper oxide and occurs in black shiny flakes resembling graphite. It is very soft, and will

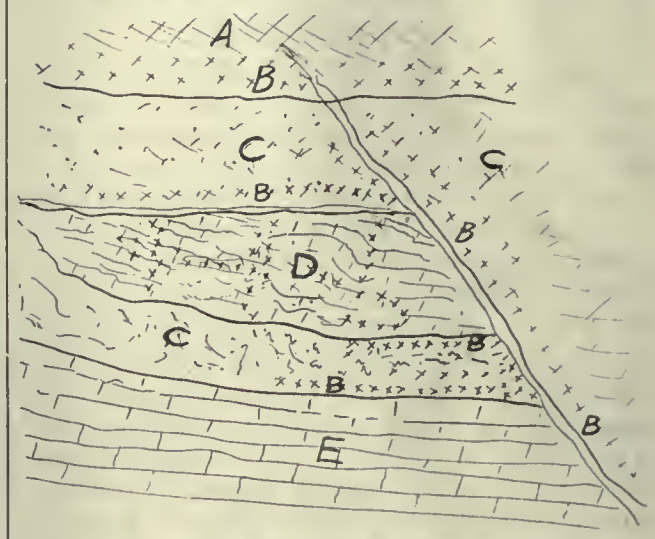


Fig. 4. Section at Lowell.

A, solid iron oxide with residual pyrite and chalcocite; B, sooty chalcocite; C, kaolin; D, fractured limestone with kaolin and chalcocite along fractures and bedding planes; E, limestone, altered and iron-stained, and containing an admixture of clay in upper levels.

blacken paper. The definite establishment of its identity is pending.

As to the time when the copper was introduced in the Bisbee area, it must have followed closely the porphyry intrusions. Even the lean pyrite shows admixture of copper mineral, and in places favored

Fig. 5. Section at Hoatson Mine.

A, hard limestone with cuprite and malachite along cracks; B, chalcocite; C, ferruginous clay with native copper, cuprite, and delafossite.

by conditions hard to understand, solid bodies of chalcopyrite are found that seem to represent an original deposit; as, for instance, the contact-zone near the Gardner, Holbrook, and Oliver mines. A secondary enrichment appears in these chalcopyrite bodies, in the development of bornite, which sometimes has intergrown with the chalcopyrite, forming an intimate mixture, while in other places it appears as a cement surrounding and binding pieces

of fractured chalcopyrite. As contact metamorphism is more the action of heated solutions in consequence of magmatic eruption, than the action of the liquid magma itself, there orebodies may be considered as workable, primary contact-deposits.

If the deduction be accepted that the porphyry was the main seat of metasomatism, the character of the ledge matter, that has been puzzling the geologists a good deal, is easily explained. Even the freakish oxidation that stops sometimes a few hundred feet below the surface, and in other places nearby descends a thousand feet or more, is more easily understood as it may be assumed that oxidizing solutions traveled mostly in lateral directions until they reached strong porphyry dikes, such as the Shattuck and Lowell dikes, where they were deflected downward along these dikes. Even the original Copper Queen orebody, with its nearly cylindrical shape, and its walls of hard, solid limestone, points naturally to its origin as a replacement of

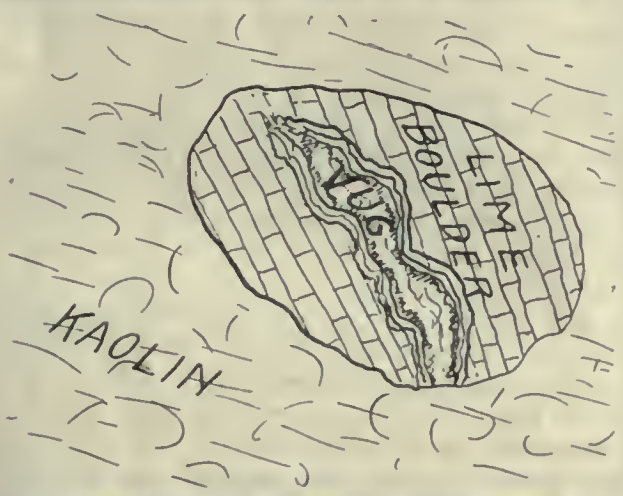


Fig. 6. Large Boulder of Hard Limestone Imbedded in Masses of Kaolin and Ferruginous Clay at the Hoatson.

The clay contains tenorite, native copper, and delafossite. The vug contains calcite and native copper intergrown.

a volcanic funnel, the porphyry being, most likely, an extension of the sill that originated the great southwest orebody. The disposition of porphyry dikes to follow planes of bedding, forming sills along limestone beds, has long been established. It takes only the application of this fact to prove that the clayey masses are derived from the porphyry.

Limestone, if altered, will have a dry, earthy appearance, and in case of siliceous limestone, will disintegrate to loose quartz grains and recrystallized calcite. Iron oxide and copper carbonates will be in evidence. Parts of orebodies represent this feature. Iron carbonate (siderite) seems to me a logical intermediate development, but I have not been able to identify it in Bisbee. For the oxidized orebodies I wish to suggest a subdivision:

1. Those that were transformed in place. All orebodies that show residual kernels of pyrite belong undoubtedly to this group, and even where pyrite is absent in higher levels, solid masses of iron oxide would point to its former existence.

2. Those that might have undergone transformation, chemical as well as mechanical. These would not necessarily be connected with a traceable porphyry dike. They are apt to show a certain stratification, and $CaCO_3$ will be more in evidence. They would be represented by the filling of cavities in limestone or wherever natural conditions favored deposition.

Returning to the problem of the favored position for ore deposition maintained by the lower limestones as against the Naco limestone, an explanation might be found in the theory that fracturing and faulting started in early Carboniferous age, introducing the continental uplift to the close of that period, and that the Naco limestone might have been deposited after much of this fracturing force had spent itself and therefore did not afford as easy channels for the magmatic eruption as the lower members of the sedimentary series. The Dividend fault is plainly later than the Naco limestone, and it gave rise to the main porphyry stock, but the mineralizing solutions seem to have been more deflected by branching dikes as far as they did not follow fissures in the cooling magma itself, and the flat

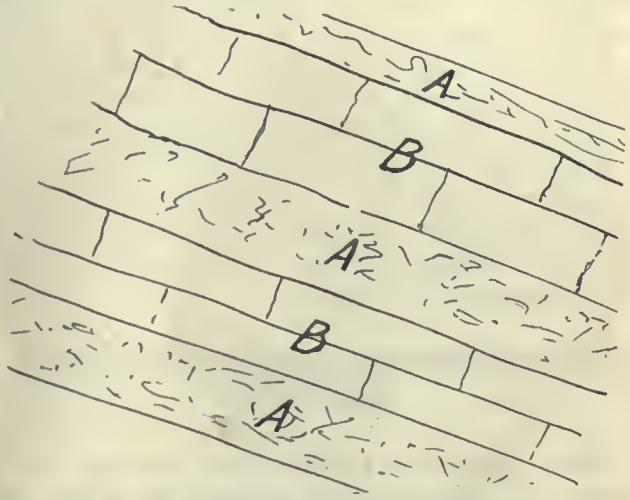


Fig. 7. Ferruginous Clay and White Kaolin.

A, with native copper, chalcotrichite, and delafossite, at the Hoatson mine alternating with slightly altered limestone. B, containing native copper in flat dendritic aggregates along cleavage and bedding planes.

porphyry sills lend themselves naturally more to the collecting and mingling of aqueous solutions with the resulting ore deposition. That leads me to believe that disseminated chalcocite (concentrating ore) has been found in the Sacramento hill stock, that for a long time had been considered barren. This fact opens a wide field for the future of the district. The porphyry and the Pinal schist, resembling it closely in composition, afford the same possibilities as in other porphyritic copper camps. The copper solutions of Miami district have, without doubt, penetrated these rocks; pyritization and silicification are in evidence everywhere, and strong lodes or vein systems are traceable in their outcrops. Many surface prospects disclose more encouraging indications than, for example, the barren surface of Copper mountain at Morenci. It is my firm belief that Bisbee needs only careful prospecting to disclose 'porphyritic' deposits in Sacramento hill and east of the Dividend fault, where money and effort have been wasted prospecting in depth for 'metasomatic' orebodies, while the prospecting should have been done laterally at a reasonable depth, for 'porphyritic' ore. The properties of the Cochise and Copper King development companies, together with

the claims held by the Calumet & Arizona around Johnson Addition and the territory of the Denn-Arizona east of the Dividend fault constitute promising ground for prospecting, and I hope yet to see great mines developed here when, or better before, threatening exhaustion of present resources directs the energy of prospecting into new fields. As to the exhaustion of the present type of ore deposits, there is hardly as yet any general indication, even locally, though the great production of these past years might have been expected to leave deep traces of such exhaustion. There is especially the great, hardly-opened territory of the Superior & Pittsburg and the area extending south and west under the covering of Cenozoic agglomerates. But, will the orebodies continue workable with increasing depth? How soon will be encountered horizons where lean pyrite, hardly affected by secondary enrichment, will defy exploitation under present conditions? These considerations, besides many others, seem to make it almost impossible to determine a fair basis of comparison for consolidation of Calumet & Arizona and Superior & Pittsburg. On the one hand is a small but rich territory, thoroughly exploited and having paid astonishing returns for years; on the other, a great territory with proved rich sections, which has struggled through great adversities to a paying basis, and the resources of which it is impossible to estimate.

SINKING THE LIGHTNER SHAFT, ANGELS, CALIFORNIA.

The Lightner Gold Mining Co., which has taken over the Lightner mine at Angels Camp, Calaveras county, California, heretofore operated by the Lightner Mining Co., is sinking a new three-compartment main working shaft, and the following particulars will be of interest, showing work done upon the Mother Lode. The shaft is being sunk in the hanging wall 'greenstone' (the seams of which are nearly vertical), for the reason that a layer of talc-schist with a dip to the southeast comes in from the footwall side of the main fissure. The shaft is 17 by 7 ft. outside the timbers, and, being intended for permanent work, is being heavily timbered with 12 by 12-in. mountain red spruce. For the first 60 ft. the sets were at 2-ft. centres; 4-ft. centres for the next 100 ft., and then 6-ft. centres. Sinking by hand was commenced October 20, 1910, and by the end of the following month, a period of 40 days, an even 100 ft. had been sunk and timbered. Meantime, the 150-hp. compressor had been moved over and installed, and drilling with machine started. Twelve miners, divided into three 8-hour shifts, were employed, and four 'baby' Pacific drills put into operation, and during the month of December 117½ ft. was sunk and timbered. To date, January 24, a further 80 ft. has been sunk and timbered, besides drilling at the 200-ft. station for an ore-pocket with a capacity of 300 tons. The gross cost, with timbers at $22 per M., has been $28.20 per foot. To date the hoisting has been done with a small winze-hoist of capacity only for the shaft work, but the main hoist has been transferred from its old site, set in place, and would be in full operation now but for a delay in erecting the 60-ft. head-frame, caused by the beneficent rains of the past fortnight. It is expected that the shaft will have reached the 400-ft. station, cross-cuts extended at 200, 300, and 400-ft. levels, to connect with the mine workings, and that the 60-stamp mill will be in full operation by April 1 next. Besides the sinking of the shaft, the 200-hp. hoist, the compressor and building, blacksmith and machine shops have been moved across the claim and set in place. A new 500-ton ore-bin has been built alongside the head-frame, and 25 ft. below the collar of the shaft, which the contour of the ground permitted, and two 10 by 12-in. Blake crushers set on the bin 10 ft. above the ground; this allows the discarding of any large pieces of waste that may be mixed with the ore, and the removal of which will increase the milling grade probably 50c. per ton, at a monthly cost of $150. The bin is unloaded by a direct rope-haulage tram 450 ft. long on an even 10% grade to the mill ore-bins.

The shaft will cut the vein at a depth of 800 ft. and the work has been designed so that it may be continued to 2000 ft. All machinery is driven by electric power. As an illustration of the possibilities of Mother Lode mining, it may be stated that at 243 ft. in the shaft the apex and northern limit of a new vertical vein of ore was discovered which has since persistently continued, showing 4 ft. of quartz in the shaft, and more lying to the west of it, of highly payable ore. If the shaft had been commenced 10 ft. either north or east of its site, this orebody, which adds materially to the value of the mine, would possibly have been missed. The cost of sinking this new shaft is shown in detail in the following statement:

DISTRIBUTION COSTS, LIGHTNER SHAFT

	Per foot.
Labor	$15.70
Timbers	4.65
Explosives	2.12
Supplies and candles	1.72
Electric power	1.68
Carting and miscellaneous	0.63
Superintendent (apportioned)	1.70
Total	$28.20

ELECTRIFICATION OF KONGO RAILWAY

A study is being made of conditions on the Kongo river between Matadi, near the mouth of the Congo, and Leopoldville, for obtaining power to electrify the railway between the two places operated by the Compagnie du Chemin de Fer du Kongo. This railway is the connecting link between the Upper and Lower Kongo, and is about 250 miles in length. The river has numerous rapids and falls between the two places, from which it is expected to obtain the necessary power. Freight and passenger rates are at present high, accommodations inadequate, and two days are required to make the trip from Leopoldville to Matadi.

Discussion

Readers of the MINING AND SCIENTIFIC PRESS are invited to use this department for the discussion of technical and other matters pertaining to mining and metallurgy. The Editor welcomes the expression of views contrary to his own, believing that careful criticism is more valuable than casual compliment. Insertion of any contribution is determined by its probable interest to the readers of this journal.

Thin Rock Sections

The Editor:

Sir—Perhaps one of your readers, who has made rock-sections for use under the microscope, while abroad, would be kind enough to give a short article describing the most convenient apparatus to employ and the way to arrive at the best results in the least time.

INQUIRER.

Medellen, Colombia, S. A., December 26.

A Word of Caution

The Editor:

Sir—I have received information from various sources that a man representing himself to be Frank C. Loring, mining engineer, of Toronto, Canada, has been obtaining loans and securing favors from engineers and others in Utah, Colorado, and elsewhere, on this representation. I have not been in the Western States and Territories for the past four years, all of my work having been confined to eastern Canada. Consequently this person is making false representations, and is perpetrating a fraud in my name.

FRANK C. LORING.

Toronto, Canada, January 15.

No. Keep on Prospecting

The Editor:

Sir—Through the magazines and newspapers, Mr. Edison advances some startling prophecies as to gold: (1) That science, 'any day,' may manufacture gold at a suggested or possible cost of $25 per ton; but from what, is not clearly intimated. (2) That by further cheapening of processes there will be overwhelming production from limitless quantities of low-grade ore, clay deposits, the very oceans—gold everywhere. The result would be that the finances of the world would be overturned and wrecked by the flood of this to-be worthless metal.

What do you think, Mr. Editor? How are we to stand from under? Abandon our gold mines on the impending contingency? Invent (and patent) some new basis of values? Or, if lucky enough to sell before the rush, what to take in exchange?

DR RAY SMITH.

Oakland, California, January 16.

A Creditable Annual

The Editor:

Sir—This is to congratulate you upon your splendid issue of January 7. It makes me feel proud of being a miner and serves to foreshadow, by the universal extent of our work, the general acknowledgment of the brotherhood of man. Mr. Rickard's review of the London mining market is a great piece of work, with its array of startling facts. These facts, if kept in mind, should have a salutary effect upon the editorial writers of the *Press* and *Magazine* who occasionally treat us to illogical praise of an advocate of a distorted righteousness, or to a dissertation upon an economic problem outside of mining in which the multiplication table is not permitted to play its proper part. Even these lapses are not without compensation, as, wherever read, in the frozen North, or South, or on the burning deserts where a few of us are gathered, and these 'by the ways' are discussed, we do not protest. I wish there could be found some way in which the wealth of affection that you gentlemen have so well earned could be made manifest.

To return to Mr. Rickard's figures for Great Britain: In 1910 exports were £530,000,000, imports £666,000,000, or an excess of imports of $680,000,000. These figures are treated in that benighted country with great joy, as *trade has veritably boomed*; while we Americans, of the United States at least, still insist that when our imports exceed our exports we have an unfavorable balance of trade. The Britishers, however, seem to have been able to invest more new capital in foreign countries during 1910, to the amount of $500,000,000, and to have made other investments during the same year, of $580,000,000, all from the earnings of their investments. From other sources than Mr. Rickard's letter, it is learned that a good measure of present British prosperity can be fairly credited to the fiscal measures introduced and now made operative by the British Radicals who have just been returned to power by the British people, notwithstanding our advice that radical measures should be made operative or applied by Conservatives.

One of the articles in your issue of January 7 recalls an ancient philosophy that with its theory of the universe attempts to satisfy the logical mind. The physical universe, with all it contains, is said to be an expression of divine will, or at the moment it is said to be the Day of Brahma. Eventually contraction or concentration will take place until the material universe becomes a mathematical point. We will then have the Night of Brahma. This philosophy is recalled by your story of the Comstock for 1910. The great Lode, in the light of your report, has contracted so that there seems to be but the Mexican Mine, and this mine, by the way, is far from being 50 years old. It is not the mine of that name that plays an important part in making the old Comstock famous, but a secondary product of a period of more or less frenzied finance that formed an epoch in the Comstock history. The activities of the present Mexican seem to be confined to an east mineral-bearing formation, and to general criticism, while the great Comstock Lode is left untouched.

MINER.

San Francisco, January 20.

Never abandon a prospect, no matter how poor, that continues to improve with work. It may develop into a valuable mine.

Special Correspondence

LONDON

Tin Mining in the Malay Peninsula. — Tanganyika Concessions.— The Corocoro Copper Mines.

I have heretofore mentioned the fact that Cornishmen who have knowledge of tin mining are more ready to invest in ventures abroad than in those in their own country. James Wickett, the veteran stockbroker of Redruth, can more easily raise capital among his local friends for new ventures in the Malay than for resuscitations of mines in Cornwall. Much discussion is continually taking place with regard to the soundness of this policy. The results at Gopeng, however, fully endorse Mr. Wickett. This company was organized in 1901 to work tin gravel at Gopeng in the Kinta district of the Province of Perak, Federated Malay States. The issued capital is 71,200 shares of £1 each. The company has been successful and the profits have been sufficient to pay over 200% on the capital. During the year ended July 31, six monitors were at work continuously. One of them has been used as an elevator since March, and the treatment of the low-lying ground has been greatly improved thereby. The output of tin concentrate at Gopeng during the year was 383 tons, which sold for £32,953. The cost of working was only £6976. At the subsidiary Ulu Gopeng property 93 tons of concentrate sold for £8027 and the cost was £4826. After paying office expenses and income tax, the profit available for distribution was £28,733, which is the largest figure yet recorded. Out of this £24,920 has been distributed as a dividend at the rate of 35%. The managers, Osborne & Chappel, report that prospects for the future are excellent. The low cost of operation and of administration is specially notable. The directors' fees, secretary's remuneration, auditors' fees, office rent and expenditure, postage, and cables only totaled £490, and the manager's fees were included in the local expenses. The list of directors contains such names as Wickett, Bain, Lanyon, and Pearce, all long connected with Cornish mining and metallurgy.

Another Malay tin-mining company, the Pahang Consolidated, has not done so well. This is not owned in Cornwall, but in London. It was formed in 1906 for the purpose of consolidating the business of the Pahang Corporation with that of adjoining tin-mining companies, all operating on the eastern side of the Malay Peninsula. The management is in the hands of the Borneo company. Two years ago it was found that the ore reserve had been greatly overestimated and that the lodes required energetic development. Many of the tin properties in the East are alluvial, but these are vein mines, and the tin is accompanied by many other minerals, such as pyrite, arsenopyrite, chalcopyrite, and blende, which introduce complications in concentration. When it was found that some active steps must at once be taken to develop the mines, Reginald Pawle was sent by the Borneo company to take charge of operations, and early in the present year, when it became obvious that additional capital was required, William Frecheville was asked to make an independent examination. His recommendations coincided with those of Mr. Pawle, so £250,000 new capital was created and £125,000 subscribed. At the same time the Borneo company, which advanced funds amounting to £39,000 as working capital, accepted debentures to secure the debt. During the year ended July 31 last, 80,736 tons of ore was mined and milled, producing 908½ tons of tin concentrate; in addition the alluvial mines operated on tribute produced 54½ tons. The receipts derived from the sale of the 963 tons were £90,376, and the expenses at the mine were £87,425. London expenses, debenture interest, etc., extinguished the balance of profit and the net result of the year's operations was a loss of £7296. Of the expenses, development accounted for a large part, the sum being £20,208; the distance driven was 12,527 ft. Unfortunately this work has not resulted in any important discovery. Mr. Pawle gives some interesting information relating to experiments with an Elmore flotation plant which was erected for the purpose of eliminating the sulphides, thus obviating the necessity for roasting. Unfortunately the quality of oil used was unsuited for the purpose, and in spite of many variations it is not possible to effect so complete a separation as to make the roasting operation unnecessary. Other oils are now being tried with the hope that the flotation process may yet be successfully applied to these ores.

The great copper venture at Katanga in Congo, Central Africa, that is being pushed forward by Robert Williams, is being followed keenly by English investors. Much criticism has been showered on Mr. Williams in years past, but he has in a masterful way overcome all objections. The deposit is undoubtedly vast, consisting so far of oxides and carbonates, thus making the smelting proposition a difficult one, but more than all, the great distance from civilization was the drawback. Gradually Mr. Williams' energy has resulted in securing railway communication, as a branch now connects the Star of the Congo mine with the Rhodesian railways, and a new railway is being built to connect with the west coast of Africa at Lobita Bay. Some official details of the Tanganyika Concessions, the English company involved, will be of interest. It was formed in 1899 to acquire exploring rights in the central part of Africa, including tracts in the Belgian Congo and Northern Rhodesia. The chief mining asset is a 45% interest in the Belgian company, the Union Miniere du Haut Katanga, which owns the copper belt in Katanga in Belgian Congo, just over the border from Rhodesia. The company also owns shares in the Benguella Railway Co., which is being built to connect the copper mines with Lobita Bay on the west coast, and shares and debentures in the Rhodesia Katanga Junction Railway & Mineral Co. The last named company built the railway line from Rhodesia Broken Hill to the Star of the Congo copper mine, and it owns the Kansanshi copper mine in Rhodesia. The Belgian Katanga company owns an extensive copper belt in which are situated the Star of the Congo and Kambove mines, and also a tin belt farther north. Mr. Williams announces that they began to ship the new smelting plant to the Star of the Congo mine in September, and that the first unit, capable of producing 1000 tons of copper per month will be ready to start operations in April. Additional plant with a capacity of 1500 tons copper per month is now being shipped. Though the European coke costs £10 per ton, delivered at the mines, it is estimated that the cost of production of copper will be £32 per ton. When the Benguella railway is finished the coke will be much cheaper. The ore reserves at the Star, Kambove, and other mines, are so great that it is estimated that there will be no difficulty, when fully equipped, in producing sufficient ore regularly to insure an output of 200,000 tons of copper per year. The exploration of the tin properties is postponed until railway communication has been improved, and the diamond interests are to be sold to a subsidiary company.

We are continually on the watch for copper developments in the Andes. I have not seen hitherto any mention in American papers of the Corocoro copper properties in Bolivia, to the south of La Paz. A company was formed in England in August 1909 to consolidate a number of copper properties at Corocoro belonging to J. K. Child & Co., Carreras Brothers, Compania Sud Americana de Cobre de Corocoro, and Noel Berthin's heirs. The control is held in France. Rene de Batz is chairman and Isidore Brun is general manager. During the 11 months to June 30 last, the output was 57,947 tons of ore averaging 2.35% copper, and from this 1790 tons of concentrate containing 76% native copper was produced. This output is small, as work was practically suspended with a view to reorganizing the business of the various companies coming into the consolidation. The mining and metallurgical plant also require a general overhauling. Nevertheless, a profit of £13,240 was made, and after deduction of administration expenses, a net profit of £8382 was carried to the balance sheet. As regards cost, based on the production of 76% concentrate, it is figured that the cost per ton of copper at Corocoro is £3S. Railway freight to Mollendo is £5, and that by sea is £4.

A new main shaft is to be sunk and used instead of the numerous small shafts of the individual properties, and an aerial ropeway is being built. A great convenience will be gained by the completion of the new railway line from Arica to La Paz. It is now being constructed from both ends and should be finished next summer. The issued capital of the Corocoro company is £636,107.

The vicissitudes of the Frontino & Bolivia gold mine in Colombia have been many during recent years. The company was formed in 1864 to work the Silencio and other gold mines in Colombia, South America. Results were good for a long period of years, but from 1901 onward a variety of causes placed the company in an unsatisfactory position. The costs were high and it was decided to electrify the plant with a view to making operations cheaper. Unfortunately, however, the water-supply used for generating current was found to be unreliable. The directors considering that the mine had arrived at a period when altered conditions made further advice necessary, commissioned Pellew Harvey & Fell to examine and report, and a year ago George P. Chaplin was appointed manager. During the six months ended June 30 affairs improved. The ore sent to the mill was 13,140 tons from which gold to the value of £60,440 was recovered by amalgamation and cyanidation. This was an increase of £19,675 as compared with the previous half-year. At the same time the expenses advanced $8202. The working profit was £10,137, as compared with a previous loss of £1303. Out of the profit debenture interest was paid to the amount of £2256 and the remainder used to partly extinguish the adverse balance brought forward from the previous half-year. Mr. Chaplin reported that an increased amount of development work has been done, and with good results, but he foreshadowed the expenditure of further money in order that development may be brought well ahead of the mill. He commenced to overhaul the surface plant with the idea of raising more ore at a less cost. Unfortunately Mr. Chaplin has been obliged to resign after being there only one year, as the directors did not see their way to adopt his very proper suggestions.

MEXICO

Official Data on Mexico's Gold and Silver Production. — Real del Monte Mills. — Santa Gertrudis. — Sales of Mines. — New Oil Wells.—The Amparo Mine.

In the budget statement sent to the Mexican Congress, the Finance Department shows that in the first quarter of the present fiscal year, from July 1 to September 30, 1910, the gold production of Mexico increased ₱1,969,545.65, as compared with the corresponding period of the preceding fiscal year. The increase in silver production was ₱52,020.53. The quarter's output of gold was ₱12,388,151.43, that of silver being ₱19,023,570.38. The department's revised figures on the gold and silver production of Mexico in the fiscal year 1909-1910, place the former at ₱48,428,841.71, and the latter at ₱76,405,754.15. The gold output shows an increase of ₱3,413,887.46, as compared with that of the preceding year; and the silver output shows a decrease of about ₱700,000. In addition to the gold exported in the last fiscal year, the Exchange and Currency Commission purchased bullion for coinage to the value of ₱5,668,296.30; and the gold consumed in arts and trades had a value of ₱133,333.33. The silver purchased for coinage in the fiscal year had a value of only ₱107,603.45, and that used in arts and trades a value of only ₱33,870.

Incidental to the enlargement of the Loreto and Guerrero mills of the Compañía Minera Real del Monte y Pachuca, in Pachuca district, the treatment system is being brought up to the standard of modern practice. In the Loreto, a gyratory crusher, with automatic conveying, sampling, and weighing arrangements, has replaced the old jaw-breaker plant with car distribution. The new stamps weigh 1450 lb. each, and crush to 3-mesh. Nine additional tube-mills have been installed, making now 13, and instead of the elaborate concentration formerly practised, stage-crushing in tube-mills is employed, with concentration of only a small selected portion of the pulp. Pachuca tanks have taken the place of the agitation and decantation tanks heretofore used. The Loreto plant has been increased from 400 to 700 tons daily, and that of the Guerrero from 350 to 650 tons, the latter being nearly similar to the former in operation. The Real del Monte was successful in its development during 1910, and started the present year with ore reserves ten times greater than at the beginning of the preceding year. The mine improvements carried out include the reconstruction of the San Ignacio shaft, which is connected with the Guerrero mill by aerial tramway. This shaft, which has been equipped with a 250-hp. hoist, is the one through which the bulk of the Real del Monte ores will be handled, connection having been established on the 400-metre level. A Bleichert tramway, with a capacity of 400 tons in 10 hours, is being built between the Barron mine and the Loreto mill. The stamps of the new 600-ton plant of the Santa Gertrudis Co. (Camp Bird) are the heaviest thus far built for a Mexican mill, weighing 1550 lb. each. There will be 10 tube-mills for regrinding. The plant may not be ready to operate until next May. The San Guillermo, of the Santa Gertrudis mines, idle for several years, is to be the main working shaft; it will be equipped with a 350-hp. hoist.

A transaction of importance was the sale to American interests of the properties of the Seguranza Mining Co.,

Pachuca, Mexico.

in the Zacualpan district, State of Mexico, for ₱1,960,000. The Guggenheims are reported to be the purchasers. The sale was on the basis of ₱28 per share for the company's 70,000 shares. The Seguranza company was organized several years ago to acquire the old Coronas properties in the Zacualpan district, and in 1909 a stamp-mill and concentrating plant were built. The work of installing a cyanide annex was only recently completed. Shipments of rich ore have been made during the period of development. All machinery is operated by electric power transmitted by the Suitepec Electric Light & Power Co. Announcement is made of the sale of the Julieta gold-silver mine, in the Almoloya camp, State of Chihuahua, to Denny Bros., English mining engineers, who have been for some time giving attention to Mexican mining enterprises. The purchase price is stated to be ₱2,000,000. The mine has been under bond to Paul Ginther, of Santa Rosalia. The Quimica y Anexas mines, low-grade properties at Suitepec, State of Mexico, will not be purchased by the Exploration Co. of England and Mexico. A working option, arranged last year, has been surrendered, and the mines have been turned back to their owners, German Roth and associates, of Toluca.

Early in January the Pearsons brought in a great oil gusher at Potrero del Llano, State of Veracruz. The flow of the well, estimated at over 100,000 bbl. daily, has been forced to a height of several hundred feet. The new gusher outclasses that of Dos Bocas, also a Pearson well, and which was accidentally fired and burned out. Efforts have

been made to save the oil by the construction of earth dams, but, due to the tremendous flow, much oil has been lost. The Pearsons have been at work in Potrero del Llano field for about two years, and have brought in two other wells there. The oil stratum is from 200 to 300 ft. in thickness. Pipe-line and storage plans are being rushed. The principal well of the Huasteca Petroleum Co., in the Juan Casiano field of Veracruz, is stated to be producing at the rate of about 18,000 bbl. daily. The pipe-line from that field to Tampico is being operated at capacity. Huasteca oil is going to the Mexican National Gas Co. in Mexico City, the Waters-Pierce refinery at Tampico, and the Mexican Petroleum plant at Ebano, where it is mixed with the Ebano product for delivery to the National Railways of Mexico.

E. A. Montgomery, of Los Angeles, has arranged a year's working bond on the Zapote copper property in Ameca district, Jalisco. The price specified is ₱100,000. The Zapote is owned by the Mutual Mining & Milling Co. of Mexico City. Work directed by S. J. Lewis resulted in opening a new body of high-grade milling ore on the 400-ft. level in the Amparo mine, near Etzatlan, Jalisco. The Ampara M. Co. has paid dividends of 3% quarterly on $2,000,000 during the past year, and has a surplus, which may be used for an extra dividend. The Navidad Mines & Reduction Co., controlled in Berkeley, Cal., has a new cyanide plant in operation in the San Sebastian district of Jalisco. Direct cyanidation is employed. The company is making plans for an 800-hp. hydro-electric plant on the Ameca river. As a result of arrangements for the piping of natural gas from the Reiser field in Texas across the international boundary to Nuevo Laredo, the establishment of a zinc smelter at that gateway is being considered. The United States returns show that zinc imports from Mexico in 1910 amounted to 80,309 tons, a decrease of 26,116 tons compared with the imports of 1909.

Ore stealing is so prevalent in the Mexican mines that ore dealers are to be placed under license and heavy bonds, and more stringent laws enacted against the crime. It is understood that the British syndicate which some months ago purchased the Torres & Prietas railroad is making plans to broaden the gauge of the road and extend it to a connection with the Yaqui River division of the Southern Pacific railroad, making a junction at Soyopa, Sonora.

There has been considerable activity in the vicinity of Velardeña during the past 60 days, several mining men having taken leases on properties in that district. Frank Carver has resumed operations at his mine in Velardeña and during the past month has shipped three carloads of ore to the Velardeña smelter. J. H. Williams has resumed work on the Libres mine for the American-Mexican Mining Co. and is shipping a good grade of ore. W. H. McCord has the mill at El Tajo about ready for operation. The Argentina de Anexas mines in Minas Nuevas are reported sold for $300,000.

JARBIDGE, NEVADA

Extensive Development and Good Prospects in the New District.—Outlook for Next Spring.

The adit on the Jarbidge Ely Mining & Development Co.'s property is now in 65 ft. and has entered slate which is supposed to be the wall-rock of a vein. It is expected to cut the first vein within the next 10 ft. This adit is on the Guess claim and is expected to cut the several veins east of the Pavlak, including the Pick, Success, Bluster, and Rock Creek, all of which have been opened a little to the south of the Jarbidge ground showing large veins and rich ore. These veins can all be traced onto the Jarbidge-Ely ground. This company has secured from W. R. Featherstone the lease and bond of the Guess group, comprising the Guess, Guess Again, Guess Fraction, Buster Brown, Sport, Short, and Search Me claims. This group is advantageously situated in the heart of the proved mineral district, and is on the strike of several of the best veins opened and is close to rich orebodies. Rich float is found and good pannings can be had from surface dirt in many places. A vein has been opened in quartzite on the Guess Fraction. Two openings have been made on the Buster Brown, and both veins show good pannings; these veins are west of and just below the quartzite. The company is composed of California, Illinois, and Idaho people who propose to thoroughly prospect the ground and have put up capital for this purpose. Mr. Featherstone has retained an interest in the company and is general manager, with Angus McDonald as superintendent. O. F. Rudd of Quincy, Ill., one of the officers of the company, has been inspecting the property and is well pleased.

The adit on the Rainbow has reached the Pavlak vein and is 5 ft. into the quartz. The quartz is similar to that found in the North Star and 4-M, which carries the best value. Usually it is a fine granular white quartz, but here it is heavily impregnated with pyrite. The vein is well mineralized throughout the 5 ft. A drift will be run on the vein to the south, as the surface indications point to rich ore a little to the south of the adit. Theodore Parks, the superintendent, is closing a deal on some Crater claims, but it is expected that he will soon begin new work on the vein. The adit cut the vein at a vertical depth of 125 ft. The adit on the St. Joe group is rapidly proving the southern extension of the Good Luck vein. It is in 60 ft. and wholly in the rhyolite vein-matter, with a constantly increasing amount of quartz, the face of the tunnel being almost entirely quartz which is heavily mineralized with pyrite, all of which shows some value. Very few assays have been made, but the returns from a picked sample gave $240 per ton. The ore is hard blue quartz, similar to that found on the Good Luck and the Pick and Shovel, and is filled with streaks of black iron and bunches of pyrite. The mountain side has a slope of 30 degrees, so that the adit gains one foot in depth for every two feet advanced.

The mill on the Pavlak is progressing slowly, owing to the stormy weather. On the 4-M lease the new adit has entered the last discovered vein at a depth of 40 ft. below the point of discovery. The vein is here 7 ft. wide, and all of it is good ore, while about 4 ft. is fine-grained white quartz that pans well. This is the best showing yet opened by the successful 4-M. On the Ham And lease, sinking is continued with favorable results; the orebody is widening and the pannings are improving. Al. McCloy is sacking the fine stuff which he considers too valuable to dump.

On the Curley lease, the owner is still driving in a good body of milling ore. In this district is what is locally known as the Crater country. The name is misleading, as they are not volcanic craters, but are deep basins with abrupt walls enclosing them on the west and part of the north and south sides, while to the east they connect with East Fork by steep gulches. These basins are along the top of the range, and their almost vertical sides are due to the breaking down of the upturned edges of the strata which form the Jarbidge range. As this ridge is the backbone of this section of country, the vein system of the district, the crater vein, seems to have its centre along this ridge. There is no evidence in this district of active volcanic activity at any period. In the Crater locality the vein has been opened in many places where there is rich ore; it has been prospected and traced for more than five miles; up over peaks that attain an altitude of nearly 11,000 ft., and down 1500 or 2000 ft. into the basins. A large part of the way the vein is covered with slide rock which in places is very deep, but by following the strike of the vein it is again found.

Several companies are working up there this winter, and some of them have taken the precaution to lay in a lot of sacks with their other supplies, and a few are filling these sacks with high-grade ore. The managers of these companies believe that they will be in shape by spring to require mills, and plans are already made to start work, as soon as the frost begins to leave the ground, on a wagon-road from Three Creek direct to the Robinson cabin, on the East Fork, and up the East Fork to Fall creek, thence following the ridge two and a half miles to the mines. The grade to Fall creek will be gradual, from there to the

mines it will be steep, but it can be made a fair freight road at small expense. When these companies get ready for their mills they will be able to have it delivered where they want it without delay.

The True Fissure Gold Co. is one of the most active of these Crater companies. They had 60 days last fall from the time they took a bond on the property until the snow closed the pack trail, and in that time they organized their company, paid for the property, and got tools and supplies delivered at their camp to last until spring. A log-cabin was built and work started on an adit that is now in 50 ft. in fine ore all the way. The vein is from 2 to 7 ft. wide, of granular, soft, white quartz, with very hard porphyry walls. The adit starts from near the bottom of the basin and gains depth rapidly, as the average slope of the sides is 45°. Besides the main vein, there are three other north-south veins known to exist on this property, besides at least one cross, or southwest, vein. The cross-veins appear to belong to an older vein system, as they are cut by the north and south veins. Several of these cross-veins have been traced down into Snowslide gulch, where they have been opened on several claims.

A new find has been made eight miles southwest of Jarbidge where some rich gray copper-silver ore was found, but as it is mostly silver and is found in the lime, there has been but a small stampede to the place.

TORONTO, CANADA

Affairs at Nipissing.—Prosperity of La Rose.— Railroad Construction to Porcupine.

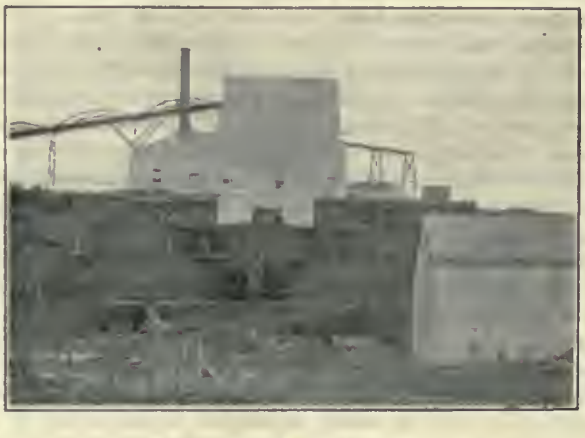
During December Nipissing mined 371,559 oz. silver of the net value of $201,022 and shipped ore to the value of $437,615 net. At No. 64, a vein from 10 to 12 in. wide of 1880-oz. ore, between the third and intermediate levels, has been blocked out for 55 by 40 ft. On the Meyer vein the winze being put down from the 175-ft. level is in good ore 1 to 2 in. wide. The La Rose shipped 417,000 oz. of silver in December, over 60% of which came from the Lawson property. The company is stated to have $900,000 in cash in hand and due from the smelters. A. P. Seymour, manager of the Cobalt Lake mine, has resigned, and will take a trip to Europe. He is succeeded by M. R. B. Gordon of the Little Nipissing. At the Bailey two new veins containing silver have been found at the 75-ft. level. The Silver Bar is to be sold, the company having made an assignment. An attempt at re-organization was made without success. The debts amount to about $36,000. The report of the City of Cobalt for the three months ended December 31 shows receipts for ore, $51,850, and a balance on hand of $28,525. At G. F. Webb's claim in the Gillies Limit, a vein 1½ in. wide carrying smaltite and native silver has been found on the surface and stripped for 150 ft. The total shipments from Cobalt during 1910 were 34,026 tons of ore, against 29,942 in 1909, which, considering that last year the camp had the advantage of cheap power and additional machinery, is hardly as encouraging as expected.

In the construction of the railway to Porcupine the working force has been increased to 500 men, and the steel is being laid. A real-estate boom is in progress, and considerable building is going on. The telephone line from Matheson to Porcupine is in working order. The Porcupine Exploration & Mines Co. has taken an option on three claims in Deloro, and will commence development. Two prominent South African companies, in addition to the Consolidated Gold Fields already there, are looking for properties in Porcupine. There are indications of renewed activity in the Elk Lake district, many of the properties in which had closed down. The Silver Alliance mill is to be put in operation again. Machinery is being installed at the Toledo preparatory to re-opening it in March. Preparations are being made to develop the United States mine. The Big Six has gone into liquidation. The Commissioners appointed by the Quebec Government to investigate the mineral resources of the Chibougamou district in the northern part of the province, including Alfred Barlow of McGill University, Montreal; J. C. Gwillim, of Queen's University, Kingston; and E. R. Faribault, of the Canadian Geological Survey, have presented their report, which is decidedly unfavorable. They state that they can not find that the mineral deposits so far discovered are of sufficient merit to justify the building of the projected railway from Lake St. John to that region. The orebodies contain gold, but not in a free-milling state in sufficient quantities to make stamp-milling feasible. The asbestos noticed in the working faces of the open-cuts, as well as on the dumps, was insignificant in amount and insufficient for their successful development as mines, and there is no probability of finding silver or cobalt. Eugene Haanel, Canadian Director of Mines, has returned to Ottawa from Vancouver, where a refinery has been established in connection with the Canadian mint. This will enable the placer miners of the Yukon to convert their gold into cash, without sending it to Seattle. J. M. Macoun, of the Canadian Geological Survey, who with his party of fourteen was wrecked last September off Wagner Inlet, Hudson Bay, and given up for lost, has arrived safely at Fort Churchill, having walked about 1000 miles.

JOHANNESBURG, TRANSVAAL

East Rand Debentures and Plans for Extension. — De Beers Diamond Output.—Giant Mines of Rhodesia.

An important debenture issue is announced by the East Rand Proprietary Mines, Ltd. The object of the scheme is to discharge the liabilities of the company to the National Bank of South Africa. The total issue is to be for £1,500,000. At the last annual meeting of the company Sir George Farrar, who presided, estimated that the indebtedness of the company at the end of the current year would be a little



Mill at Giant Mine, Rhodesia.

over £1,000,000, but, in fact, this amount has been exceeded by £232,310, and the total liability at present approximates £1,250,000. The loan from the National Bank was originally secured with the primary object of pushing the development of the company's huge property, and the excess expenditure is attributed to the further capital expenditure in increasing the capacity of the company's reduction plants from 2,100,000 tons per annum to 2,400,000 tons. There has also been a fall in the estimated profits, chiefly owing to delay in delivery of the machinery required for completion of the plant. The issue is guaranteed at 98% and is offered to shareholders at the same figure, thus allowing a yield of over 5%, and providing the company with £1,470,000. If the debentures are not converted into shares at £5½ and the company does not of compulsion redeem them, they will not be wiped out until 1929. After liquidation of the debt to the Bank it is proposed to devote the greater part of the balance remaining from the issue (about £236,000) toward underground development of the eastern parts of the property. The scheme is considered one of the most important that has ever taken place in the history of the Rand, and the issue will constitute the largest loan assumed by any gold mining company operating in South Africa. The an-

nual report of the De Beers Consolidated Mines, affording as it does the keynote of the diamond mining industry, makes interesting reading. During the 12 months ended June 30 last, De Beers sold diamonds realizing £5,414,895. Adding to this the sum of £176,272 brought forward from the previous year, and a quarter of a million pounds derived from sundry revenue, the grand total of receipts amounts to £5,843,265. The total ordinary expenditure amounts to £2,976,266, leaving a balance of £2,866,999. After payment of dividends, income tax, and blue ground stock account £728,325 is carried forward. It is interesting to observe that the stock of blue ground on the floors was reduced from 9,526,531 loads to 7,776,059 loads during the year under review. An examination of the company's statistics shows that on the whole a substantially better market for tne produce of the De Beers mines obtained during the year ended June last than in the 1908-1909 period. While there has been a falling off in the yield per load from the Wesselton and Bullfontein mines, there has been a marked improvement in the yield from the De Beers and Kimberly mines. The most hopeful features in the situation are, the improvement in the diamond market, and the great financial strength of the company. These two factors assure stockholders of a continuance of dividends, and should there be any truth in the rumor that the various diamond producing concerns in South Africa are co-operating with a view to maintaining the price of diamonds, the position will be much strengthened. The co-operation of the De Beers and Premier companies has so often been reported and denied that but little importance should be attached to the story until the De Beers company officially confirms the statement. A marked improvement has recently been exhibited in the affairs of the Giant Mines of Rhodesia, Ltd. The mine of this company is situated near Gadzema, in Mashonaland, and is the third largest producer in Southern Rhodesia, its output being exceeded only by that of Globe & Phoenix and Eldorado mines. The company has to date paid 60% in dividends on an issued capital of £250,000. The formation worked consists of a large body of schistose auriferous banded ironstone, and the reduction plant comprises 30 stamps and 3 tube-mills. For the first eleven months of the year 1910, the company has produced £122,000. The following figures relative to production for the past six months show an increasing improvement: June, £6578; July, £8434; August, £12,739; September, £14,362; October, £13,740; November, £19,069. The company's operations have been much hampered by a scarcity of native labor, and although the situation in this respect is better now than in the past, the efficiency of the labor leaves much to be desired. Owing to the development on the seventh level continuing to show broken formation, investigation by an expert has recently been made to determine the position of the orebody in the lower levels of the mine. The result of this investigation is said to be of a favorable nature.

MANHATTAN, NEVADA

New Mill for Manhattan.—Discovery in the Montgomery-Shoshone.—Tungsten in Nevada.

The so-called McNeill mill in the eastern suburbs of Manhattan, which has been running successfully for three weeks past, is of interest as showing what can be done in the way of extraction from a free-milling ore with a very moderate expenditure of money. The mill is situated adjoining one of the dumps of the Union No. 4 lode. The shaft from which the ore is being milled is now furnishing the water for the mill. From the dump the earthy and fine ore is trammed about 100 ft. to a crusher of the Dodge type, situated just outside the south wall of the mill building. Outlet from crusher delivers by spout to the boot of an inclined bucket-elevator which raises the crushed ore to the battery bin. Each battery of 5 stamps of the 10 employed is run by a separate 'bull-wheel,' connected by belt with a single counter-shaft, driven by an electric motor which furnishes the power for everything at the mill except the pump at the shaft, which is operated by a small separate motor. The batteries and plates present an antique appearance, as the former were built by the Miners Foundry, San Francisco, in 1865. The stamps weigh about 1000 lb. and drop 95 times per minute, and do good work. The output of the batteries, with fine screens and high discharge for Coast practice, is estimated at 25 tons per day. Stamp stems are kept in place and alignment by passing through built-up cross-beams of the battery frame instead of the usual modern forms of guide-blocks. The outflow of pulp through the screens falls into distributing boxes and thence through perforations to the plates, so the effects of splash and wave motion are mainly lost, and the flow over the plates is uniform and continuous. Inside amalgamation is practised, but there are no lip-plates. Apron-plates are a little less than usual size and divided transversely into three parts by two drops. They are also divided longitudinally by a wood strip in the middle, extending the entire length of the plates. Tailing from both plates flows through launders without intervention of amalgam and final tailing goes to waste. The mill is compact and simple in arrangement and was erected at low cost. Ore assays from $10 to $15 per ton and a high percentage of saving is made. The mill was erected and is managed by R. Wallace McNeill.

Clement Millward, R. Pritchard, Edward Bevis, and others have a lease on the entire Eclipse vein of the Tramp and propose to sink, drift, and cross-cut from the present lowest point in the mine. The finding of a new and large body of ore in the Montgomery-Shoshone Consolidated has stimulated leasing in the Bullfrog district as well as the usual re-location work of the New Year period.

At Johnnie the Nan, Runaway Girl, Howitzer, Primero, Blue Bell, Anna M., Golden Eagle, and Tripod claims adjoining the Johnnie Consolidated on the southwest have passed to the ownership of the Eureka-Johnnie Gold Mining Co., organized and controlled mainly by French capital. The property was formerly owned by the Nevada Johnnie Mining Co. A strong vein, believed to be the continuation of the Crown Point, is exposed for nearly 1000 ft. on the Blue Bell claim, and has been developed by a 125-ft. adit and two shafts each 50 ft. deep. The vein has yielded at times very rich ore. A well defined vein, supposed to occupy a cross-fissure from the main Johnnie to the Crown Point vein, is found on the Golden Eagle, and has been developed by two shafts 50 and 128 ft. deep respectively. The erection of a mill is contemplated during the present year. Charles Labbe and M. C. Labbe, of Los Angeles, are president and secretary, respectively, of the company, and Abe Campbell, formerly a foreman at the Copper Queen mine, at Bisbee, Arizona, is superintendent.

It is a fact of interest that after many years one of the many tungsten deposits in Nevada is being put in shape for production. It is near Mt. Wheeler in Snake range, 45 miles southeast of Ely. The large group of claims is owned by the United States Tungsten Co. The main vein crops on the side of a hill for a long distance and has been opened in many places by shafts and adits. Other veins on the company's ground have had considerable development. A concentrating mill of 100 tons capacity is well under way. It is equipped with crusher, coarse and fine rolls, Wilfley tables, Isbell vanners, and other machinery. Power for the mill, as well as water for concentration, is obtained from Williams creek through a ditch 6000 ft. long. Other water is obtained for concentration and other purposes from springs a short distance north of the mill. A steam plant is also installed at the portal of the main adit to operate compressor and furnish power in event of partial failure of the water supply. The ore, in the form of hübnerite and scheelite, contains from 1 to 50% of tungstic acid, worth about $8 per unit. A reduction in freight rates on concentrate has been obtained from Ely to New York City, to which place the first output of the mill will soon be shipped. F. L. Fletcher, of Ely, is general manager. The mill was erected under supervision of Thomas L. Mitchell.

NEW YORK

Wall Street and the Public.—Copper the Centre of Attention. —Again the Merger.

The situation in the East is peculiar. The inertia which prevails seems to be partly dispelled, from time to time, only to again overcome all the headway gained. New York is the financial centre of the country, and, as such, has centralized its power in this direction as much as possible, only to find that this very centralization has in a way circumvented Wall Street's own ends. The public was a long time learning that its contributions to Wall Street were largely looked upon as 'sucker money', but, having learned that its only rôle was that of victim, the public is staying away with a consistency that is breaking the heart and pocketbook of the brokerage houses and promoters. Perhaps these will wake up some day to the fact that the public is demanding a new deal, and that until that new deal is offered with an ample guarantee of honest treatment, the public will continue to be very much engaged with its own affairs. After a long, hard struggle, the organization of the Curb is in sight, and the traders are to go under a roof; financial responsibility is to be, to a reasonable degree, insured, and the undesirables eliminated, as far as possible. The leading element in mining in the East, at this time, is copper. The copper situation is receiving a great deal of attention. There never has been accorded to any line of industry a more enthusiastic general support than has been given to copper. The output of various properties and the figures of the Producers' Association are studied carefully. Just now the copper situation is not encouraging, and the leading issues have shown declines since the beginning of the year, while the price of the metal has recently been reduced to 12½c., and heavy sales made at this figure by the leading agencies. Mining progress seems to have little or no effect upon the general attitude of indifference. As an instance, the revolutionizing of Greene-Cananea, the rebuilding of almost the entire plant, and a substantial reduction of operating costs has not bettered market conditions appreciably. Greene-Cananea staggers under the weight of a gross overcapitalization, but it is selling for less than one-third of its face value, and is without public support. The stockholders of the Calumet & Arizona are to meet on February 15 to authorize the increase in the capital stock, which is necessary to provide for the absorption of the Superior & Pittsburg. The authorized capital of the Calumet & Arizona will be increased from $2,500,000 to $6,500,000, and, when the outstanding stock of the Superior & Pittsburg shall have been exchanged on the proposed basis of 3½ shares of Superior & Pittsburg for one share of the new company, the new company will have outstanding $6,285,710 of its total authorized capital of $6,500,000. The Shattuck Arizona bids fair to become one of the leaders of Boston copper-share market. The company announces that notwithstanding its intention to build a new smelter, its regular quarterly dividend of $1 per share will be continued. The Shattuck ores are sent to the Copper Queen smelter. The company reports officially that its ore reserves are estimated at 17,000 tons of 17% ore and 600,000 of 6% ore, with only a small fraction of its territory proved. The Ray Central situation has not been cleared up as yet. The report made by Weed & Probert is not to be made public until early in February, but preliminary estimates are said to give the property about 6,500,000 tons of 2.15% ore, which can be handled at a profit of $1 per ton. Development, as planned, includes further work on some of the ground only partly explored. These estimates do not show the property to be as good as the first estimates made by J. Parke Channing, at the time when the property was under option to the General Development Co. The Tennessee Copper Co. has made a contract with the International Agricultural Corporation, by which the latter takes all of the output of Tennessee's sulphuric-acid plant for the next 10 years. The Tennessee Copper Co. is making 150,000 tons of acid per annum, but this is to be increased to 225,000 tons. Copper merger rumors have been much overworked during the past six months or more. There have been so many preliminary steps taken, each of which has been heralded as the immediate forerunner of the expected world-wide combination, that the public has become used to the sensation. Following the Calumet & Hecla merger, comes an equally sensational story to the effect that all of the Guggenheim interests are to be amalgamated into a holding company modeled after the United States Steel Corporation. Such an organization would include the American Smelting & Refining Co., the American Smelters Securities Co., the Yukon Gold Co., the Utah Copper Co., the Guggenheim Exploration Co., the Federal Mining & Smelting Co., the Nevada Consolidated Copper Co., the Braden Copper Co., and in all likelihood the Ray Consolidated, though the latter is probably not so completely a Guggenheim property as the others mentioned. Stockholders of the Giroux are becoming restive under the treatment they are receiving. It has been the rule for all of the developing properties to publish frequent statements as to the amount of developed ore proved, and the Giroux shareholders are asking why they cannot have some equal knowledge in reference to their property. Figures are available showing the production of the Utah Copper Co. and the Nevada Consolidated for the past year. The Utah Copper Co. made 80,019,596 lb. of copper at a cost of 8.11c. per pound. The Nevada Consolidated produced 65,500,590 lb. at a cost of 7c. per pound. Nevada Consolidated encounters some occasional high-grade streaks of ore which materially increase the percentage of the whole output. Recently in removing overburden from the new pit on the Liberty claim, commercial ore was found and ten carloads were sent to the smelter. Some 6% ore has been found in the Copper Flat pit, and while these seams have been too irregular and uncertain to be taken into account in estimating ore reserves they have materially improved the general average of ore treated. The Mines Company of America has granted a 60-day extension of time for the exchange of stock of the Dolores and El Rayo companies. More than 91% of the stock of both of these companies has been turned in under the merger plan. The present Mines Company of America is now paying dividends on a basis of 9% annually; 2¼% quarterly. The bondholders of the Hinds Consolidated Co. are to foreclose upon the property, which is situated in Chihuahua, and after acquiring the property at judicial sale will organize a new company to operate the mines.

Cobalt's 1910 figures are interesting as being probably the banner year for that camp. Total production up to and including 1910 is figured at 92,407,168 oz., of a net value of $48,384,000; 1910 output is estimated at 29,000,000 oz., an increase over the year previous of 3,000,000 oz. These figures indicate that Cobalt produced in 1910 more than 13% of the world's entire output. Cobalt's claim to distinction rests not so much on the gross production of the camp as on the small initial expenditure which has been made and the tremendous relative proportion returned in dividends. Of the $48,384,960 produced, there has been paid in dividends to the public $22,127,318, while to this must be added at least $4,000,000 paid to the holders of properties which were for a time operated as close corporations.

It is thought in the East that certain interests in Goldfield Consolidated did not like so frank a statement as was embodied in the report by J. R. Finlay and for that reason forced his resignation. The question of ore reserves, future life, and general conditions underground has been the point of discussion in the big Goldfield property for some months. The public has wanted to know, and, not being informed, has gone out in large numbers. The recent action in changing managers has not to any extent restored confidence, though there is no question made of J. H. Mackenzie's position in any way. It is detailed frankness that is demanded, even more than a continuance of the present handsome rate of dividend return.

General Mining News

ALASKA

Following the run of the rock of Goyette & Jacobson, from Fairbanks creek, the plates have been cleaned and the amalgam retorted. The gold was valued at $225, which is at the rate of $74 per ton. No test of the tailing has been made to determine what percentage of value went over the plates and concentrator. According to a report received at Fairbanks, Shaughnessy & Butler have struck a rich streak of pay dirt on Winworth creek, in the Hot Springs district, in a hole 12 ft. deep, where they found three feet of dirt that will average 7c. per pan. Winworth creek is a tributary of Sullivan, coming into that stream about a mile above the mouth of Fish, which was the scene of a stampede last fall. The mouth of Fish creek is nine miles below Kelly & Anderson's road-house. At present there are only five men in the vicinity of the strike, but others will be attracted there by such a report.

ARIZONA

COCHISE COUNTY

The Tombstone Con. M. Co. has leased the dump of the Toughnut mine to J. H. MacPherson. The ore is to be sent to El Paso for treatment.

GILA COUNTY

A vein of rich ore, said to average 20% copper, is reported to have been struck by the Summit Copper Co. at 400-ft. level. This company has an option on the Gibson mine which produced high-grade ore some time ago. The company expects to start shipments to El Paso in a short time.

The Live Oak Development Co., near Globe, has done 4039 ft. of underground work, but since July 1, 1910, has been using a churn-drill for exploration. By this means 1795 ft. of drilling has been accomplished. The company has developed 6,000,000 tons of ore averaging 2.25% copper and partly developed 3,000,000 tons of ore averaging about the same.

The business portion of the town of Winkleman was destroyed by fire on the morning of January 25.

MOHAVE COUNTY

A. W. Howitt and assistants are sampling the Gold Road mine, it is said in the interest of the United States Smelting, Refining & Mining Company.

YAVAPAI COUNTY

It is reported that the Octave mine, near Wickenburg, will soon resume operations under the management of E. W. Carpenter. Erwin Gillis, of Kalamazoo, Mich., paid a visit to the mine this week.

E. Haney, who has been developing the Alta mine, three and one-half miles south of Iron Springs, has found silver ore. Assays from a 6-in. streak gave 407 oz. per ton. The silver is associated with antimony. The ore was found 100 ft. from the mouth of the tunnel.

A bar of gold bullion valued at over $1700 was received by the Prescott National bank from the Tiger Gold company at Harrington, the result of a few days' run of the mill. With this yield, R. H. Hetherington, ore buyer representing the El Paso smelters, reported that a carload of concentrate valued at $2000 had been delivered to him.

YUMA COUNTY

(Special Correspondence.)—Chalcopyrite has been found on the 300-ft. level of the Signal mine of the Clara Consolidated Gold & Copper Mining Co., at Swansea. Since the discovery the ore has been developed by a 40-ft. winze and a 55-ft. drift. The ore carries from 5 to 7% copper and 25 to 30% sulphur. No cross-cutting has been done so that the width of the ore is not known. Drill-hole No. 13 has entered sulphide ore at a depth of 350 ft. This discovery is of importance, not only for the Signal mine, but for contiguous territory in what is known as the Bill Williams country, where surface indications are good but with little development at depth. H. Leew, a French engineer, has been at the Signal mine for the past three weeks making an examination of the property. His report will be made largely in the interest of the French stockholders of the company.

Parker, January 20.

The Steece Copper Co. has done over 3000 ft. of development on its claims and is making preparations to ship some of the ore to smelters. Judd & Moore have 22 miners employed on their claim 8 miles south of Vicksburg and expect to ship soon. Nine miners are working at Alamo, 9 miles south of Vicksburg, where a rich body of gold ore is being developed. Frank Whisman and the Shannon brothers are sinking a shaft on an extension of the Alamo, a recent discovery, and have several tons of high-grade ore. It is reported that the McEntee brothers have sold their Shamrock mines near Vicksburg to D. G. Lorenzo of San Diego, California. The principal shaft is 150 ft. deep. The ore carries gold, some of it being of shipping grade.

CALIFORNIA

AMADOR COUNTY

On the 1950-ft. level the Bunker Hill mine has been opened for a length of 500 ft. and the vein found to be about 20 ft. wide. The mill has recently been enlarged by the addition of 20 stamps. The mine has been a steady dividend payer for five years or more. The Argonaut company will place a 500-hp. electric-hoist at its shaft. It is reported that the Amador Queen No. 1 mine, near Jackson, will be re-opened. The 1200-ft. shaft will be unwatered and east and west drifts extended. The property was recently bonded to C. D. Porter of San Francisco. The South Eureka shaft has been placed in good condition and operations have been resumed. During the period of repairing, the company has paid regular monthly dividens of 3 cents per share from the treasury reserve. The Kennedy continues its normal output. Good ore is being mined in the vicinity of the 3500-ft. level, and recent developments have proved satisfactory. The 100-stamp mill is operating steadily.

IMPERIAL COUNTY

J. A. Gallagher and J. P. Gaskell of Yuma have been investigating mines in the vicinity of Picacho basin, 30 miles north of Yuma, with the idea of forming a consolidation of a number of mines there and undertaking their development.

INYO COUNTY

(Special Correspondence.)—The Skidoo Mines Co., operating in the Panamint range, reports for the first half of January 1911 a clean-up amounting to $7500. From 10 to 12 of the 15 stamps were in operation in this period. Supplies have been ordered for the resumption of cyaniding next month. A 2½-ft. vein, averaging $25 per ton in gold, has been uncovered on the 200-ft. level.

Skidoo, January 26.

KERN COUNTY

(Special Correspondence.)—The Jade Oil Co., operating in section 15 of the Midway field, west of Taft, has sublet practically all of its territory to seven lessees, royalties ranging from one-eighth to one-quarter. The S. K. D. lease is down 2200 ft., and expects to get into oil sand within the next 100 ft. The Penn-Midway lease is down 2260 ft., 150 ft. of which is in oil-bearing formation showing heavy gas pressure. The well on the Kewanee lease has reached a depth of 1750 ft. On the Alvarado lease (Union Oil Co.) No. 1 and 2 wells are down 2500 and 1600 ft. respectively. There has not as yet been any production from the leases of the Jade company, but it is expected that several wells will come in at about the same time. Two additional lessees of 40-acre tracts will be drilling within 30 days.

Taft, January 28.

NEVADA COUNTY

(Special Correspondence.)—A careful estimate of the yield of Grass Valley mines for 1910, from data available

at this time, places the production at approximately $2,500,000. Of this amount, the North Star is credited with $1,250,000, the Empire with $1,000,000, and the Pennsylvania-W. Y. O. D., Union Hill, Idaho-Maryland, and one or two small properties with the remaining $250,000. It is possible that the Empire production is rated somewhat too high, but it is believed that it is approximately as given. Sinking is progressing from the 1400-ft. level of the Pennsylvania, and it is expected that new orebodies will be uncovered. On the 700-ft. level a winze is going down and is reported to have entered good ore. A new electric motor was recently installed. Seventy-five men are employed, and 15 stamps are operating steadily. Bennett Opie is superintendent. Sinking at the Cincinnati Hill mine is progressing day and night. It is rumored that good ore has been found. This work is being done by the North Star company. At the Sultana, recently acquired by new interests, vigorous work is under way. Richard Barry is in charge of operations. The ditches and flumes supplying the Empire and other mines with water have been repaired, and all the affected properties are again working full-handed. A 3-ft. vein of milling ore has been struck in the Alaska mine. George St. John is manager. Dan McGonigal, of the Coan mine, reports that the new 10-stamp mill will be ready

Champion Mill, Grass Valley, California.

about February 15. The hoisting and pumping plant has been completed, and the two-compartment shaft is being sunk to the 300-ft. point. The Norambagua mine is being examined. It is said that San Francisco people are interested. The Pittsburg Mining Co. has purchased the 10-stamp mill, Blake rock crusher, and other machinery at the Reynolds mine, near Brandon, El Dorado county. The plant will be installed at the Pittsburg mine immediately. This will give the property 20 stamps. Mark B. Kerr is manager. Operations will be resumed at the Eagle Bird as soon as spring sets in. This property is near Washington. It is planned to install a 20-stamp mill, hoist, and pumping plant. It is stated that the main vein at the Fruitvale is 12 ft. wide, with only one wall exposed. It is planned to build a 10-stamp mill at an early date.

Grass Valley, January 30.

(Special Correspondence.)—A six months' option on the Champion-Providence group of mines near Nevada City has been given to an Eastern capitalist. Work is to be continued uninterruptedly by the company pending a thorough investigation by the prospective purchaser. This is one of the largest and most important groups of mines in the Nevada City region.

Nevada City, January 28.

SIERRA COUNTY

It is reported that a 3-ft. vein has been found in the Alaska mine at Pike City. It is said to be the best yet discovered in the property by the present company. It was found within 5 ft. of where work had previously been abandoned. The Alaska company has expended over $200,000 on the property since taking hold of it six years ago. The Alaska has a modern equipment and a new vertical shaft has been sunk to a depth of 750 feet.

TUOLUMNE COUNTY

The Green Spring mine, on the Stanislaus river, near O'Bryne's ferry, has been bonded by the Meuli brothers of Mountain Pass. The property is equipped for development work and for testing the ores. A small force has been put to work.

(Special Correspondence.)—Operations are to be resumed at the Carlotta and Pennsylvania mines, north of Tuolumne, the properties having been bonded to John Oleson, of San Francisco. Within the next two years 600 ft. of sinking and 400 ft. of driving must be done. This will include work in both shafts until they have reached a depth of 500 ft., when they will be connected. A new head-frame will be erected. A company has taken a bond on the Butler group of mines, in the Buchanan district and owned by Benj. Darmert and D. J. Sutton. A substantial payment has been made by the purchasers, and the balance is to be paid within one year. The veins have been opened by adits and a large quantity of ore has been profitably worked in an arrastre. It is probable that modern machinery will be installed by the new operators. William Bingham a prospector, has discovered, in an old mine in the vicinity of Confidence, a vein of rich ore. According to reports, a streak in the vein a few inches wide will go hundreds of dollars per ton. It is understood that the management of the Tarantula mine, near Tuttletown, will add 20 stamps to its mill, making 40 in all, and that before the end of the year the plant will be increased to 100 stamps. A number of buildings are under construction. Ore is being milled. A promising claim, known as the Duke, is being developed near Parrott's ferry by Otto Kanig. The vein is 30 in. wide and assays show the ore to be of good and uniform grade. The Duffield-Sonora Mining Co., with a capitalization of $100,000, has filed articles of incorporation in this county. The directors are Paul and Stepheno Lavagnini and Joseph Sanguinetti. The properties held by the new corporation are the Sonora and Duffield mines, near Arastraville. Much development has been done during the last year, and a 10-stamp mill is about completed.

Tuolumne, January 28.

COLORADO

CLEAR CREEK COUNTY

(Special Correspondence).—Work was resumed this week upon the Flat Iron property, on Democrat mountain. The shaft will be sunk 75 ft. A contract will be awarded to drive the McKinley adit on Lincoln mountain. Driving will also be started. The crew at the Vidler tunnel in East Argentine is to be doubled. It will be necessary to drive 1700 ft. to furnish an outlet for the ore from the western side of Argentine pass. A contract will be awarded during the next week to drive an adit 100 ft. on the Ohio property in West Argentine. C. Howard is manager. Heavy shipments are coming from the Gold Dirt mine on Covode mountain. Most of the work is being performed by lessees. The Gold Fissure mine is one of the steady producers of the Empire district. The ore is being sent to the Golden smelter. Willis Bristol is manager. Maxwell & Davis, owners of the King and Queen claims on McClellan mountain, have started development. W. C. Hood, owner of the Eclipse adit on Saxon mountain, has started development. The Virginia City adit on Lincoln mountain is now within 80 ft. of tapping the 500-ft. level of the shaft workings. Work is being carried on under the contract system. John Owen, of Idaho Springs, has secured a sublease from the Gem Gold Vein M. Co. on the Belman vein. Driving has been started to the west. Development has begun on the Silver Horn mine on Ute creek. F. E. Wire is manager. Work has commenced at the Lee mine at Dumont after an idleness of eight years. R. N. Curtis of Brookiyn, N. Y., is owner. It is said that a streak of copper-lead ore 6 in. wide is exposed on the 150-ft. level that will mill from $60 to $70 per ton. A force of 25 men is employed on the Stanley mine, under management of J. J. May. An average of ten carloads of smelting and concentrating ore is being shipped monthly. Shipments have been started from the Little Giant mine on Red Elephant mountain. The ore

mills from 450 to 500 oz. silver per ton. J. A. Young is manager.

Georgetown, January 23.

GILPIN COUNTY

(Special Correspondence.)—A. Rollins & Co., of Idaho Springs, have taken a bond and lease on the First National Kansas mine, situated on Quartz hill. Work has already been commenced on the 600-ft. level. The Hayseed adit on Quartz hill is now in 625 ft. The last shipment of ore brought a settlement of 0.52 oz. gold, 12 oz. silver, and 44% lead per ton. F. Fry is owner. A streak of ore 8 in. wide has brought returns of $40 per ton in gold, silver, and lead. Driving has been started on the Ingleborg east from the 114-ft. level. The Victor is being developed by Gus Meyers. The adit is in 130 ft., with a streak of mineral exposed that is 2 ft. wide, the average value of which is $12 per ton. Smith & Sidown, operating a small concentrating plant on Gregory street, are handling a fair tonnage of ore. It has been decided to purchase another Wilfley table. Reese & Co., leasing on the 600-ft. level of the Saratoga mine, shipped 30 tons of ore last month that milled $18 per ton. The Washington adit on Fall river will intersect the Tomahawk vein within the next 30 days. The work is being performed under contract by G. Minier. Shipments have been started from the Columbia adit on Quartz hill. The first-class ore mills $80 per ton in silver and gold. A shipment of 14 tons of ore from the Victor mine returned $41 per ton. Schuh & Ham are operating under lease.

Central City, January 22.

LAKE COUNTY

The Colonel Seliers mine, one of the oldest properties on California gulch, Leadville, for several years has been in control of the Empire Zinc Co., a subsidiary of the New Jersey Zinc Co. When the demand for zinc became active a few years ago, this company shipped ore, that had accumulated on the Colonel Seliers dumps, which is said to have yielded a net return of $350,000. Much of this ore is sulphide. Within the last six months the work of the company has centred on sinking a new shaft, opening drifts, and cutting stations; levels from the new shaft have been connected with other workings, and the conditions and equipment are such that the production of ore soon can be brought up to 500 tons per day. Steel ore-bins have been built from which the ore is to pass through gates into cars; these are the first steel bins erected in the district. Mr. Bergler has charge of the property, while J. H. Troutman and E. W. Kieth are closely identified with the company. A plant for concentrating zinc ore and separating zinc from iron is operated at Canon City.

SAN JUAN COUNTY

Work has been resumed at the Ledge Consolidated mine near Silverton with a force of 35 men, and development work will be vigorously carried on until spring, when the company will start the mill. Louis Sleade and John Schrader have taken a lease on the Esmeralda and are breaking ore in the upper levels. The wagon-road will be cleared and a shipment made. The Iowa-Tiger continues to make an excellent showing and concentrate is running better than 1 oz. gold and 10 oz. silver. A small slide struck one of the upper buildings last week but no damage was done and no one was injured. The railroad was opened to the Ledge last week and several cars of coal and supplies taken up.

SUMMIT COUNTY

The Vidler tunnel is being driven at the rate of 175 ft. per month. A new ore roaster will be installed at the Lowell mill at Idaho Springs. The company has erected a 20-ton mill at West Denver. In addition to these two mills, the company has given contracts for the building of two more mills.

TELLER COUNTY

The Cripple Creek Drainage & Tunnel Co. is contemplating a third deep drainage adit to still further lengthen the life of mines in that camp. The stockholders of the company, composed in most part of the owners of all the big properties in the district, held a meeting last week and instructed T. R. Countryman, supervising engineer for the company, to make a report on the new project, and it is expected that he will furnish facts and figures at the next meeting of the directors of the tunnel company to be held in February. Already the matter has been given careful thought, and the investigations thus far have supplied valuable data bearing on the future of the gold camp.

IDAHO

SHOSHONE COUNTY

(Special Correspondence.)—The recent find at the Jack Waite mine is one of the most important made in the Coeur d'Alene in many years. Where the cross-cut was made there is 5 ft. of ore, 2 ft. 7 in. of which is clean shipping galena which will go from 75 to 80% lead. The adit will have to be driven 80 ft. to get under the surface showing. Patrick Burke, manager of the mine, reports that the face of the main drift, now in 1000 ft., shows 18 in. of solid galena in a big body of concentrating ore, at a depth of 400 ft. from the surface. The face of the drift now lacks only about 40 ft. of being vertically under the beginning of the great ore outcrop, which is 500 ft. long and from 2½ to 6 ft. wide. The Carbonate Hill Mining Co. has made what seems likely to develop into an important find. In a cross-cut to the south from the main tunnel, at a depth of 700 ft. from the surface, a 20-ft. vein has been cut which shows a streak of good galena on both walls. One of these streaks is 15 in. wide and the other 20. They assay from 14 to 27% lead and 6 oz. silver per ton. The Terrible Edith mine, near Murray, has been bonded by T. D. Farrow of Butte, Mont., for $250,000. Ray Shannon, who is in charge, reports a drift of 40 ft. in the ore and a raise of 25 ft. The orebody in both the drift and raise is 4 ft. wide, one-half being shipping ore and the other concentrating ore that will average more than 20% lead. This mine differs from almost every other silver-lead mine of the north side, as it carries gold and silver as well as lead. Twenty inches of galena shows in the face of the drift on the Dalamatia Mining Co.'s vein near Kellogg. The adit has been following ore for months, but a few days ago the vein suddenly widened. It assays 65% lead and 80 oz. silver per ton.

Wardner, January 25.

MICHIGAN

HOUGHTON COUNTY

South Lake has stopped No. 8 diamond-drill hole at a depth of 740 ft., and No. 9 hole has been started 200 ft. north. It will be perhaps 500 ft. and the last one sunk below the vein. After that the preliminary sandpiping for the actual shaft will be undertaken. There will be no assessment. The policy will be to dispose of a part of its treasury stock, when market conditions warrant.

A committee consisting of H. L. Higginson, H. H. Gay, and S. B. Pearmain has been appointed by the Boston Stock Exchange to examine the proposed Calumet & Hecla copper merger plan. Boston papers state that it is the desire to ascertain whether or not the minority stockholder interests are being fairly treated in the deal. One thing should not be overlooked in this connection. When one company corrals six or a dozen other propositions, many of which are active traders on exchange, such action removes them from all possible future market activity.

MISSOURI

JASPER COUNTY

Good ore continues to be mined at the 80 and 90-ft. levels at the mine recently re-opened near the Missouri Pacific depot in Carthage. The three hand-jigs recently installed have piled up a carload of cleaned ore. The development of this mine is watched with great interest and several people are thinking of starting development in the vicinity in the near future. Drilling in that locality at several points has shown good ore.

NEVADA

ELKO COUNTY

Lack of water is said to be all that prevents the Gold Circle district from becoming a big placer camp, for pannings of gold are to be had almost anywhere within the camp. Some inventive geniuses of Gold Circle have nearly finished a dam intended to provide enough water for placer operations, and while the mine owners are awaiting easier financial times, they can try the old-fashioned method of digging gold from the soil. The Hardscrabble lessees are reported to be taking out some very rich ore from a new streak.

ESMERALDA COUNTY

The annual meeting of stockholders of the Florence-Goldfield Mining Co. will be held at the office of the company in Goldfield on Wednesday, March 1, at 10 a. m., for the election of directors for the ensuing year and for the transaction of such other business as may come before the meeting. Books for the transfer of stock will be closed 20 days prior to the date of the annual meeting, and remain closed until final adjournment. The annual report by Willis Lawrence, manager, shows that 55,000 tons of ore has been mined having an approximate value of $600,000. The mine had been systematically gouged by lessees, as far as development had gone, which necessitated much new work. The shaft was retimbered from the 350-ft. level to the surface, and a raise driven from the 500-ft. to the 350, thus completing the shaft to the 500-ft. level. Additional sinking has carried the shaft to nearly 700 ft. in depth. New development on the 600-ft. level is showing some very good ore, and indications are that the Florence will yet make a large and valuable mine. The mill is handling an average of about 130 tons per day, but has been somewhat handicapped by a shortage of water. While new ore reserves are being opened on the new levels, the mill will continue to be run on ore mined from the levels that have been supplying the tonnage for months past.

LINCOLN COUNTY

The Ploche merger was consummated in New York on January 27. The Amalgamated Ploche Smelters Corporation, the holding company, is to be incorporated in Maine, with a capital of 1,000,000 shares, par $10. Under the terms of the merger title to all the properties owned by the Prince Consolidated, Consolidated Ploche, and the Ohio Kentucky will be transferred to the Amalgamated Ploche. The latter corporation, in the acquisition of these properties, will be called on to issue not more than 700,000 shares of its authorized capital, and of this amount issued a majority will be held in the treasury of the Nevada-Utah Mines & Smelters Corporation, so that besides retaining ownership in the major portion of its own properties in the Ploche and other districts, the Nevada-Utah acquires a majority interest in the very rich and potential properties owned by the Prince Consolidated, Ohio Kentucky, and Consolidated Ploche companies. This is made possible by the fact that in connection with the merger the interests now dominant in Nevada-Utah, headed by the president, Ernest R. Woolley, have provided $500,000 cash which is now on deposit in a New York bank, but which is to extend the Ploche Pacific railroad to the Prince Consolidated mine and erect a mill at Ploche of 500 tons daily capacity.

LYON COUNTY

As an example of the difficulty of determining the position of some of the orebodies of the Mason valley mines, it is stated that often the workings have passed within a few feet of important shoots without the slightest indication of ore being near. One of these experiences happened at the West End orebody, where a drift passed within 7 ft. of the shoot and it was not discovered until six or eight months later. The finding of the orebody on the intermediate, below the fourth level, and of the shoot more recently opened in the southeast portion of the property on the third level, are among other instances of this kind. In the former case driving had passed by the shoot and it was not until a complete turn was made to the eastward that the orebody was picked up. While in the latter, notwithstanding that development had been carried on in the vicinity, the main haulage level passing within a short distance of the shoot, it was only when cross-cutting was done to the eastward that this important orebody was discovered.

NYE COUNTY

Production of the Tonopah mines showed a slight falling off the last week of January but it is estimated at $190,000, which is close to the recent general average. The Tonopah Mining Co. produced 3200 tons, the Belmont 2057, Montana-Tonopah 1057, Tonopah Extension 980, West End 375, and Midway 50, making a total tonnage of 7719. The new surface plant of the Belmont is in operation at the new Belmont shaft, the Desert Queen shaft being practically abandoned. The new shaft is centrally situated for present operations, and shorter distances in tramming will reduce mining costs. All of the mill ore is being shipped from the new bins and the smelter ore will also be sent from these bins as soon as the ore-washing plant can be removed to the new site. Underground operations continue along the usual lines. Some of the new cross-cutting is opening promising bodies of ore. At the Tonopah mine new development has been satisfactory, as several new bodies of ore have been found. The largest of these was found in the Red Plume ground and is being developed through that shaft, which is the most westerly now in operation on the Tonopah Mining Co.'s ground. Meantime stoping continues in the older workings on the Mizpah and Valley View veins, which are furnishing the bulk of ore at present, and they will continue to do so for some time to come, leaving the newer orebodies as a reserve. The customary development in the Montana mine is being continued, and a number of parallel veins are being opened and new orebodies found. The most interesting prospecting work at present is the winze from the north cross-cut on the 765 level, about 1000 ft. north of the shaft, for the purpose of prospecting the body of earlier andesite that was cut some time ago by the diamond-drill. The general condition of the mine continues satisfactory, with a large tonnage of ore exposed in the older workings, while the new work is continually adding to the reserves. Little change is noted in the Tonopah Extension. The bulk of the new work is being confined to the westerly workings on the 500-ft. level and pushing the long cross-cut out on the 600 to get under the workings on the 500-ft. level. Two or three promising veins have already been cut, but no driving has been done. Stoping is in progress on the south vein in various levels, the general average being about 4 ft., and in some places widening to 6 ft. Development is being carried on in the Midway, principally in the northern part of the ground, where a favorable formation has been entered. There is also some work being done in the southern end of the property. A small production is being made from various places in the mine, the output for the past week being 50 tons. A station is being cut at the 800-ft. level in the Rescue-Eula shaft, and cross-cutting to the northeast will be started as soon as the station is completed. A new compressor has been installed and machine-drills will replace hand work. Good headway is being made with the cross-cut on the 600-ft. level of the Jim Butler, which is now over 300 ft. from the shaft. It is being driven to reach the ground east of the Stone Cabin fault.

The Belmont Extension has nearly completed its surface plant, the Rescue has its shaft sunk nearly to 800-ft. depth, the North Star is still idle, as is also the Halifax, the last named being at the east end-line of the Belmont and in the vicinity of the recent developments in the latter. In the Tonopah Extension the drift on the 500-ft. level, at 900 ft. west of the shaft, has reached the vein found in a similar drift on the 400-ft. level. The vein on the 500-ft. level is much stronger, but the ore is variable in value. A drift on the 600-ft. level is being advanced to intersect the same vein, this being the farthest west of any milling

ore found in the camp. The vein recently found in the west workings on the 400-ft. level of the West End mine contains good milling ore. The Montana's search for ore in the most northerly workings of the camp resulted in finding ore in a winze sunk from the 765-ft. level, at a point over 1000 ft. north of the shaft. Further development is in progress to prove its economic worth.

Tonopah, January 20.

STOREY COUNTY

The annual meeting of the Silver Hill Mining Co. will take place the last Monday in May, and it is understood that a movement is under way to consolidate this mine and the Overland, near Silver City, to work them jointly and at greater depth.

WHITE PINE COUNTY

A depth of 520 ft. has been reached in the Zack shaft of the Ely Consolidated and a still larger body of ore has been discovered that was not previously known to exist there. The last 10 ft. of the shaft is in the solid body of ore that carries a good percentage in copper.

NEW MEXICO

GRANT COUNTY

During the month of December approximately 835,000 tons was added to Chino's ore reserves, of a grade approximately equal to that of the whole tonnage of December 1, 1910, based on the new estimates of the steam-shovel engineers, namely, 2.32%. For many months past, two separate calculations of ore reserves have been made at the Chino property. The first estimate, and the one which has been made public each month, takes as the lower limit of the ore on outside boundaries 1.5% copper, while the steam-shovel method of calculation includes some below this figure. The steam-shovel estimate is also based on the total tonnage of both shovel and underground ore on the property, and allows for the ores which will probably be worked out in actual practice by shovels; that is, the boundaries between waste and ore in the latter method have not been so clearly defined as in the first estimate, but the tonnage includes in many places tongues of overburden which extend into the ore, and which, in practice, will be found to give better results to mine with the ore than to attempt to separate; consequently, the tonnage has been increased and the grade decreased.

SOCORRO COUNTY

(Special Correspondence.)—In excess of 38,000 oz. of gold and silver bullion was smelted in December from 2800 tons milled at the Socorro mines. Although the tonnage was unusually low, the grade of ore was good and the recovery excellent, being 93% of the gross value of the ore. Eight large bars of bullion were shipped during the first half of January. The Ernestine Mining Co. milled 655 tons of ore during the week from which were produced 54 sacks of concentrate and the usual quantity of precipitate which is being smelted. An examination of this property has been completed, a corps of engineers having been engaged the past 6 or 7 weeks in sampling the large ore reserves. Production has been started at the Deadwood mines. The specially constructed tank-wagons are on the road delivering crude oil for use in the De La Vergne engine. At the Mogollon Gold & Copper company's Little Charlie, the east drift continues in excellent ore; the vein is becoming harder and less oxidized. The Bloomer Girl adit was advanced 93 ft. in ore under the recent contract and it is planned to let another for a like distance. Raising from the main adit is the principal work in progress on the Cooney mine. The drift is being advanced on the Malachite in the ore recently discovered. The management is having the various workings sampled and tested in the new laboratory. The Oaks company's engineers have completed a survey and investigation of the Stevens power project. The Gold Dust Mines Co.'s east and west drifts are reported to have been advanced over 250 ft. in ore. At the Admiral Dewey-Apache, work continues in the north drift from the cross-cut adit.

Mogollon, January 27.

UTAH

BOX ELDER COUNTY

The Lakeside Copper Co. has filed articles of incorporation with the county clerk. The company is capitalized for $75,000, with shares of the par value of 10c. The officers for the ensuing year are H. E. Baker, president; J. M. Russell, vice-president; D. C. Lawson, secretary and treasurer. These, with Fred W. Chambers, A. Fernlund, Anna White, C. A. Zimmerman, P. G. Paulsen, and Thomas R. Tisdale, form the board of directors. At present the company owns and operates 20 mining claims in the Promontory mining district in Box Elder county.

JUAB COUNTY

The water problem has been solved at the Centennial-Eureka mine by the installation of large pumps. Three shifts are working. It is thought the long continued heavy pumping at this mine has resulted in lowering the water-level in some of the neighboring mines. F. J. Hanson and R. Campbell are tearing down the old Eureka Hill concentrator. It is thought the tailing dump, below the concentrator, may be re-worked at good profit. The flue-dust from the Knight smelter, at Silver City, is being shipped to Midvale. Several Eureka men have leased the tailing dump of the May Day company.

PARK COUNTY

Good reports continue from Park City in regard to the new work on the American Flag property. A fine grade of shipping ore is being taken from the fourth, sixth, seventh, and eighth levels, there being three or four fine looking faces on the seventh. Shipments are being made without interruption. One interesting bit of work just completed is the connection between the old tunnel level and the new workings, this providing excellent air as well as affording another exit from the mine in case of need. The American Flag is looking better than it has for several years.

MEXICO

Stockholders of the Dolores and El Rayo companies have been informed by the secretaries that the time for exchanging their shares for that of the Mines Company of America stock has been extended to March 11, 1911, and that all the remaining shares are expected to be turned in shortly. This merger is very close to consummation, for not long ago the Mines Company of America had secured 91% of the Dolores and 93% of the El Rayo issued capitalization.

SONORA

(Special Correspondence.)—A 75-ton lead smelter is being erected at the Mina Mexico, forty miles northeast of Tonichi, the present terminus of the railroad on the Yaqui river. It is expected to blow in some time in February. The cyanide plant of the Barranca Mines, Ltd., has been running since the first of last July, treating 50 tons per day from its own mines. This is a silver-gold property, the ore running in the ratio of 100 oz. silver to 1 oz. gold, but recent development on a cross-vein has shown a body of ore averaging 2 oz. gold and 15 oz. silver per ton. With the addition of a pumping plant, now being installed, the capacity of the plant will be increased to 75 tons per day, and contracts are being made with adjoining mine owners for the treatment of their ore. This will be welcomed by many, as it will enable them to resume development on properties that have been idle since the closing down of the Toledo smelter. The Sunset Development Co., a subsidiary of the Southern Pacific, that has been developing the coal-fields at La Barranca, is contemplating the installation of an aerial tramway to convey the smelting ores from San Javier to the railroad, a distance of about 12 miles. It will put in a producer-gas plant, utilizing local coal, and besides running the tramway, will supply power to the surrounding mines. During the past four years the Buena Vista mine, at San Javier, has developed 25,000 tons of iron fluxing ore carrying 25 oz. silver per ton, and the owners are now awaiting cheap transportation.

San Javier, January 25.

Personal

Professional men are invited to send news of their engagements and travels. Such news is interesting to friends.

J. E. Spurr is in Chihuahua.

Gelasio Caetani is in London.

R. T. White was in San Francisco.

J. C. Clancy is at Colorado Springs.

Frank Dennis has gone to Nicaragua.

Howard D. Smith is in San Francisco.

R. H. Chapman is at Washington, D. C.

G. H. Garrey has been at Goldfield, Nevada.

Thomas T. Read has arrived in San Francisco.

F. M. Harris, of Reno, Nevada, was in San Francisco.

Charles Janin has gone to Madera county, California.

W. H. Knowles has returned to Sacramento from New York.

H. Foster Bain was at Blair and Goldfield, Nevada, last week.

J. R. Finlay will be at Miramar, California, for a few weeks.

Algernon Moreino is on his way to New York from London.

J. V. N. Dorr returned to New York, January 20, from London.

C. E. Jamison has been appointed State Geologist of Wyoming.

Henry Francis Lefevre has returned from Managua, Nicaragua.

C. D. Kaeding was in San Francisco, but has returned to Nicaragua.

Edwin E. Chase, of Denver, has gone to Arizona on professional work.

C. W. Purington is at Amazar, Siberia. He will return to London in March.

Ferdinand McCann is manager for El Tajo M. Co., San Sebastian, Jalisco, Mexico.

Jesse J. MacDonald is examining the Mortimer mine at Owenyo, Inyo county, California.

Robert Gordon, mine superintendent of the Montezuma mines of Costa Rica, is in New York City.

R. M. Haskell has succeeded Clarke Sullivan, who recently resigned as metallurgist for the Progreso Mining Co., Triunfo, Baja California.

A. L. Simon, chief metallurgist for Head, Wrightson & Co., London, sailed for England recently. He has been examining a mine in Manhattan.

W. H. Blatchley has resigned as assistant superintendent for the Progreso Mining Co. at Triunfo, Baja California, and after visiting San Francisco and Kansas points, will go to North Carolina.

M. E. Appelbaum has resigned as president, treasurer, and director of the New York Metal Selling Co., and will hereafter conduct an independent metal selling business on commission basis at 55 Liberty street, New York.

Frank H. Probert, of the firm of Weed & Probert, has been in New York recently in connection with the report on the Ray Central and has gone to Boston. From Boston Mr. Probert is to go to Butte, where the firm is engaged in the Anaconda v. Butte-Ballaklava litigation.

C. B. Conlin, formerly with the United States Steel Corporation in Minnesota, late superintendent at the Commodore gravel mine in Sierra county, has taken active charge for the San Luis Consolidated Mining Co., whose properties adjoin the Keystone mine at Sierra City. Mr. Conlin will make his headquarters in Los Angeles.

The San Francisco Section of the Mining and Metallurgical Society will hold a meeting following informal dinner at the Palace Hotel, February 6.

Market Reports

LOCAL METAL PRICES.

San Francisco, February 2.

Antimony	12—12¾c	Quicksilver (flask)	44½
Electrolytic Copper	14½—15¼c	Tin	45—46½c
Pig Lead	4.75—5.70c	Spelter	7—7¾c

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

METAL PRICES.

By wire from New York.

Average daily prices in cents per pound.

Date.	Electrolytic Copper.	Lead.	Spelter.	Silver, per oz.
Jan. 26	12.23	4.48	5.39	53
" 27	12.10	4.48	5.39	52⅞
" 28	12.13	4.48	5.39	52⅞
" 29	Sunday.		No market.	
" 30	12.13	4.48	5.39	52¾
" 31	12.18	4.48	5.39	52¾
Feb. 1	12.28	4.48	5.39	52¼

ANGLO-AMERICAN SHARES.

Cabled from London.

	Jan. 26. £ s. d.	Feb. 1. £ s. d.
Camp Bird	1 17 1½	1 16 6
El Oro	1 6 10½	1 6 9
Esperanza	1 13 9	1 10 6
Dolores	1 5 0	1 5 0
Oroville Dredging	0 7 0	0 7 0
Mexico Mines	7 16 3	7 13 9
Tomboy	0 15 0	0 15 6

(By courtesy of W. P. Bonbright & Co., 24 Broad St., N. Y.)

COPPER SHARES—BOSTON.

	Closing prices, Feb. 2.		Closing prices. Feb. 2.
Adventure	$ 6	Mohawk	$ 45
Allouez	36	North Butte	29½
Atlantic	5⅛	Old Dominion	41¼
Calumet & Arizona	54	Osceola	108
Calumet & Hecla	520	Parrot	12⅝
Centennial	12⅝	Santa Fe	1¼
Copper Range	69¼	Shannon	12
Daly West	3	Superior & Pittsburg	15
Franklin	7⅛	Tamarack	45
Granby	35	Trinity	4¼
Greene Cananea, ctf.	6¾	Utah Con	12½
Isle-Royale	14¼	Victoria	1⅞
La Salle	4¼	Winona	8⅝
Mass Copper	7¾	Wolverine	118

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

MINING STOCK QUOTATIONS—NEW YORK.

(By wire from Catlin & Powell Co., New York.)

	Closing prices, Feb. 2.		Closing prices, Feb. 2.
Amalgamated Copper	$ 66	Miami Copper	$ 19⅝
Arizona-Cananea	3¼	Mines Co. of America	5⅜
A. S. & R. Co.	80⅝	Montgomery-Shoshone	⅛
Braden Copper	4	Nevada Con	18¾
B. C. Copper Co.	6½	Nevada Utah	1⅛
Butte Coalition	19⅛	Nipissing	10⅞
Chino	21⅜	Ohio Copper	1⅞
Davis Daly	1¼	Ray Central	1¾
Dolores	5½	Ray Con	17⅜
First National	1⅞	South Utah	⅞
Giroux	7¼	Superior & Pittsburg	14⅛
Greene-Cananea	6⅞	Tenn. Copper	36
Guanajuato Con	⅛	Trinity	4½
Inspiration	8¾	Tuolumne Copper	4¾
Kerr Lake	7¼	United Copper	4½
La Rose	4⅞	Utah Copper	46¾
Mason Valley	9¾	Yukon Gold	4⅛

SOUTHERN NEVADA STOCKS.

San Francisco, February 2.

Atlanta	$ 12	MacNamara	$ 18
Belmont	5.97	Mayflower	6
Booth	5	Midway	16
Columbia Mtn	2	Montana Tonopah	92
Combination Fraction	12	Pittsburg Silver Peak	80
Fairview Eagle	35	Rawhide Coalition	2
Florence	1.55	Round Mountain	42
Goldfield Con	6.67	Silver Pick	5
Gold Kewenas	6	St. Ives	16
Great Bend	1	Tonopah Extension	1.00
Jim Butler	28	Tonopah of Nevada	8.12
Jumbo Extension	21	West End	56

(By courtesy of San Francisco Stock Exchange.)

COMSTOCKS

San Francisco, February 2.

Alpha	$ 6	Hale & Norcross	$ 19
Alta	10	Julia	19
Andes	10	Justice	5
Belcher	67	Kentuck	10
Brunswick Chollar	21	Mexican	1.35
Brunswick Potosi	21	Occidental	41
Billion	10	Ophir	1.25
Caledonia	28	Overman	25
Cassidy	10	Potosi	27
Challenge Con	11	Savage	15
Chollar	15	Scorpion	11
Confidence	45	Seg. Belcher	8
Con. Imperial	4	Sierra Nevada	25
Con. Virginia	85	Silver Hill	4
Crown Point	70	Union	50
Exchequer	14	Utah	7
Gould & Curry	18	Yellow Jacket	35

(By courtesy of San Francisco Stock Exchange.)

OIL SHARES

San Francisco, February 2.

Alma	$ 1.00	Occidental	$ 20
Apollo	—	Palmer	1.50
Associated Oil	45.25	Paraffine	80
Bay City (New Stock)	50	Pinal	4.10
Brooksbire	1.15	Premier	71
Caribou (New Stock)	1.35	Record	—
Claremont	1.15	Republic	43
De Luxe	1.10	Sauer Dough	—
Empire	2.00	Silver Tip	1.20
Enos	65	S. W & B.	30
Fulton	—	Sterling	2.00
Illinois Crude	20	Turner	1.10
Jade	—	Wolverine	40
Monte Cristo	2.30	W. K. Oil	2.60
Nevada Midway	16	Yellowstone	25

(By courtesy of San Francisco Stock Exchange.)

CURRENT PRICES FOR CHEMICALS

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

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

	Min.	Max.
Acid, sulphuric, com'l, 66°, drums, 100 lb	$0.90	$1.25
Acid, sulphuric, com'l, 66°, carboy, 100 lb	1.00	1.50
Acid, sulphuric, C.P., 9-lb. bottle, bbl., lb	0.13	0.18
Acid, sulphuric, C.P., bulk, carboy, lb	0.09½	0.12
Acid, muriatic, com'l, carboy, 100 lb	1.60	2.00
Acid, muriatic, C.P., 6-lb. bottle, bbl., lb	0.15	0.20
Acid, muriatic, C.P., bulk, carboy, lb	0.10½	0.15
Acid, nitric, com'l, carboy, 100 lb	5.25	6.50
Acid, nitric, C.P., 7-lb. bottle, bbl., lb	0.16	0.22
Acid, nitric, C.P., bulk, carboy, lb	0.12½	0.15
Argols, ground, bbl., lb	0.20	0.25
Borax, cryst. and conc., bags, 100 lb	2.75	3.85
Borax, powdered, bbl., 100 lb	3.00	4.00
Borax glass, gd., 30 mesh, cases, 100 lb., tin lined	10.00	13.00
Bone ash, 60 to 80 mesh, bbl., 100 lb	4.50	5.50
Bromine, 1-lb. bottle, lb	0.55	0.65
Candles, adamantine, 12 oz., 40 sets to case	3.50	4.15
Candles, adamantine, 14 oz., 40 sets to case	4.00	4.55
Candles, Stearic, 12 oz., 40 sets to case	4.95	5.50
Candles, Stearic, 14 oz., 40 sets to case	4.65	5.20
Clay, domestic fire, sack, 100 lb	1.50	2.00
Cyanide, 98 to 100%, 100-lb. case, lb	0.20¾	0.24¾
Cyanide, 98 to 100%, 200-lb. case, lb	0.20	0.24
Cyanide, 127-129%, 100 lb. case, lb	0.27½	0.28½
Cyanide, 127-129%, 200-lb. case, lb	0.26¾	0.27½
Lead acetate, brown, broken casks, 100 lb	8.75	9.00
Lead acetate, white, broken casks, 100 lb	10.00	10.25
Lead acetate, white, crystals, 100 lb	11.75	12.25
Lead, C.P., test., gran., 100 lb	13.00	15.00
Lead, C.P., sheet, 100 lb	15.00	18.00
Litharge, C.P., silver free, 100 lb	10.50	13.00
Litharge, com'l, 100 lb	7.50	9.00
Manganese ox., blk., dom. in bags, ton	20.00	25.00
Manganese ox., blk., Caucasian, in casks, ton. (85% MNO_2—¾% Fe)	45.00	50.00
Nitre, double ref'd, small cryst., bbl., 100 lb	7.00	8.00
Nitre, double ref'd, granular, bbl., 100 lb	6.50	7.50
Nitre, double ref'd, powdered, bbl., 100 lb	7.25	18.00
Potassium bicarbonate, cryst., 100 lb	12.00	15.00
Potassium carbonate, calcined, 100 lb	15.00	18.00
Potassium permanganate, drum, lb	0.11	0.12½
Silica, powdered, bags, lb	0.03	0.05
Soda, carbonate (ash), bbl., 100 lb	1.50	1.75
Soda, bicarbonate, bbl., 100 lb	2.00	2.50
Soda, caustic, ground, 98%, bbl., 100 lb	3.15	3.50
Soda, caustic, solid, 98%, bbl., 100 lb	2.65	2.85
Zinc shavings, 800 fine, bbl., 100 lb	10.50	11.50
Zinc sheet, No. 9—18 by 84, drum, 100 lb	9.50	10.50

CURRENT PRICES FOR ORES AND MINERALS

(Corrected monthly by Atkins, Kroll & Co.)

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

	Min.	Max.
Antimony ore, 50%, per ton	*$20.00	$25.00
Arsenic, white, refined, per lb	0.02½	0.03
Arsenic, red, refined, per lb	0.07	0.08
Asbestos, according to length and quality of fibre, per ton	100.00	350.00
Asbestos, lower grades, per ton	10.00	100.00
Asphaltum, refined, per ton	15.00	20.00
Barium carbonate, precipitated, per ton	42.50	45.00
Barium chloride, commercial, per ton	42.50	47.50
Barium sulphate (barytes), prepared, ton	20.00	30.00
Bismuth ore, 10% upward, per ton	*75.00	upward
Chrome ore, according to quality, per ton	10.00	15.00
China clay, per ton	15.00	20.00
Cobalt metal, refined, f.o.b. London, per lb	2.50	
Coke, foundry, per 2240 lb	15.00	17.50
Diamonds:		
Borts, according to size and quality, per carat	2.00	15.00
Carbons, according to size and quality, per carat	75.00	100.00
Feldspar, per ton	5.00	25.00
Firebrick:		
Bauxite, per M	175.00	200.00
Magnesite, per M	195.00	250.00
Silica, per M	47.50	
Flint pebbles for tube-mills, per 2240 lb	15.00	25.00
Fluorspar, per ton	10.00	15.00
Fullers earth, according to quality, per ton	20.00	30.00
Gilsonite, per ton	35.00	45.00
Graphite:		
Amorphous, per lb	0.01	0.02½
Crystalline, per lb	0.04	0.13
Gypsum, per ton	7.50	10.00
Infusorial earth, per ton	10.00	15.00
Magnesite, crude, per ton	7.50	10.00
Magnesite, dead calcined, per ton	22.50	27.50
Magnesite, brick (see firebrick).		
Manganese ore, oxide, crude, per ton	10.00	25.00
Manganese, prepared, according to quality, per ton	40.00	120.00
Mica, according to size and quality, per lb	0.05	0.30
Molybdenite, 95% MoS_2, per ton	500.00	600.00
Monazite sand (5% thoria), per ton	150.00	200.00
Nickel metal, refined, per lb	0.45	0.60
Ochre, extra strength, levigated, per lb	0.02½	0.03½
Platinum, native, crude, per oz	25.00	30.00
Scheelite (see tungsten ore).		
Sulphur, crude, per ton	15.00	25.00
Talc, prepared, according to quality, per ton	20.00	50.00
Tin ore, 60%, per ton	450.00	475.00
Tungsten ore, 65%, per ton	520.00	550.00
Vanadium ore, 15%, per ton	200.00	250.00
Wolframite (see tungsten ore).		
Zinc ore, 50% up, per ton	*15.00	20.00

The Prospector

This department makes a charge of 25 cents to subscribers not in arrears and $3 to non-subscribers for each determination. To ensure promptness in publication of the determinations, payment must be forwarded with specimens.

G. R. E., Baker City, Oregon: Quartz containing tetrahedrite.

H. M., Golden, Utah: No. 1, friable sandstone: No. 2, schistose silicious rock.

J. A. H., Clifton, Arizona: Massive sphalerite. It appears to have cadmium sulphide with it.

C. J. L., Georgetown, California: No. 1, sericite schist; No. 2, pyritized quartzite; No. 3, chlorite-mica schist; No. 4, amphibolite.

On Saturday, February 4, 1911, the Bunker Hill & Sullivan M. & C. Co. paid dividend No. 161 of $81,750. This makes the total amount of dividends paid $12,456,600.

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EDITORIAL

RUMOR has it that Mr. R. A. Ballinger is to resign "of his own free will," March 4, and that Mr. T. H. Carter will succeed him as Secretary of the Interior. Why?

FOREIGN visible supply of copper decreased 94,080 pounds in the two weeks ended February 1. The world's surplus stock January 1 amounted to 309,735,475 pounds, of which 187,705,280 was held in France and England and 122,030,195 in the United States.

MINING ENGINEERS do not often figure in fiction, excepting the variety found in fake promotion reports. It is refreshing, then, to hear, at a well known New York theatre, one of the characters of the play remark to the hero, a young mining engineer, "I've known some square men in my time, but you are bred in the deep purple." It is a pleasure to be able to reflect that mining engineers, as a class, are bred in the deep purple, and that the exceeding yellowness of certain members of the profession is accentuated by the contrast.

LEADVILLE has been celebrating the recent discoveries of zinc ore in its mines. One feature of the occasion was a luncheon served 1200 feet underground in a room, the walls, floor, and roof of which were zinc carbonate. It is easy to overlook the carbonate minerals, and Leadville's experience in zinc was but a repetition of what happened earlier in Wisconsin, Missouri, and New Mexico. If every rock that might contain zinc were analyzed the chemists would be busy and the job would be long and expensive. In districts, however, where zinc sulphide, which is easily recognized, is present, active search should always be made for the carbonate and silicate.

CYANIDATION without preceding concentration of the slime is being carried on at the mill of the Tonopah Extension Company, the tube-mill product going direct to the cyanide settling tanks. The manager, Mr. John G. Kirchen, finds that so far there is no difference in total extraction, and apparently no great difference in cyanide consumption. It is not long since it was generally considered impracticable to cyanide ores containing sulphides. The first step was to separate the sulphides by concentration and ship them to the smelter. Later various plans of cyaniding the sulphides separately were worked out. Then at the North Star mine the sulphides, after being concentrated and re-ground, were remixed with the slime for treatment, and now Mr.

Kirchen, temporarily at least, discards concentration altogether. His further results will be watched with much interest.

Lost Motion

Slipping belts, gears that do not mesh, loose eccentrics, leaky valves, spilling launders, all these indicate wasted energy. Whether it be measured in the indicated horse-power of a reciprocating engine, the brake horse-power of the turbine, the gross power of the water wheel, the kilowatts delivered by the generator, or the days work of the employee, energy is the most important element entering into costs. Misdirected or wasted energy must be paid for at the same rate as that which accomplishes a useful purpose, and in every cost sheet there is a large charge for 'lost motion,' though we do not remember ever to have seen it frankly stated as such. The greatest benefit to be derived from the new 'science' of efficiency is that the cost of inefficiency is stated and its source determined. Railway men were frankly skeptical when Mr. Louis Brandeis, a lawyer, asserted that a million dollars per day might be saved by more efficient operation and that it was entirely practicable to make the saving. As closer comparisons are made between results now achieved on different roads, the feeling of skepticism is distinctly moderating. It is trite that conditions differ and that costs must follow, but comparisons, fairly made, give standards, and repeated measurements are great incentives to progress. The most valuable standards are those most immediately applicable. Rand costs are mainly of academic interest on the Lake Superior iron ranges, but steam-shovel costs mean something at every property where steam-shovels are in use, or where their introduction is physically possible. The ideal plan is a standard for each mine, and for each piece of work in the mine. Usually these standards are largely carried in the head of the foreman or other staff officer. The system now being advocated by Mr. Harrington Emerson, Mr. F. W. Taylor, and other proponents of 'efficiency engineering,' involves translating this usually nebulous and largely subconscious set of standards into a concrete set of figures and continually measuring performance against them. Net results are to be set down month by month alongside of predetermined estimates and the difference between plants and achievement is to be charged to a special suspense account. It is clear that the value of any such system lies in the accuracy with which a correct standard is determined. This calls for highly trained men and special knowledge. It also calls for painstaking investigation of past performance, and we believe there is danger in the growing notion that a specialist may be called in to inaugurate a system that will automatically increase efficiency. Without doubt his outside point of view will be of value, but an inside point of view is also essential. Granted, however, that an accurate set of standard costs be available, there can be no question as to the resulting gain from regular comparison of unit cost and standard cost. We know one mine where figures showing working cost per ton of ore in each stope are available to the shift-boss every day, and the total cost, including overhead charge, is pro-rated once a week. It is perhaps significant that operating costs at this mine have steadily decreased and are now lower than at any other property in the district. Psychology is important in mining as elsewhere.

Chinese Labor

We publish this week the concluding installment of an interesting description of actual working conditions in Eastern Siberia. Mr. C. W. Purington's article is suggestive in many ways. It is customary to think of China as the land of cheap and efficient labor, so much so that, except where it is physically impossible to concentrate a sufficient number of coolies at one point, the introduction of modern machinery is not to be attempted. In the last analysis, however, correct procedure is determined by the cost per horse-power-year; the cost of rice per coolie, with no charges for maintenance and depreciation, versus the cost of coal or oil for steam, plus repair, depreciation, and interest charges. Contrasting steam-shovel work in the open-cuts at Ely, Nevada, with handling ore by coolies in the open-cuts at Tayeh, Hu-nan, we find the costs slightly less at Tayeh. It seems clear, then, that Mr. Purington, as he suggests, did not obtain the best class of Chinese labor at Kolchan. The reason for this is not far to seek. The Chinese have a rather well-founded belief that northern Manchuria and Siberia are lawless countries, infested with brigands. As a result, they do not plan to make their homes there, but yearly the more adventurous spirits go north to seek their fortunes, returning with the beginning of winter. The most venturesome will be found farthest north, and the most venturesome do not make the best miners. The efficiency of a Chinese workman largely depends upon the efficiency of the man who has taught him how to work; more specifically, upon the power to thread the intricacies of the Chinese mind and teach in the right way. Well trained Chinese workmen are undoubtedly among the best in the world, but they must be well trained from the beginning; to repair the deficiencies of early training is a hopeless task. The more docile characters are the more easily trained, and this is why the lamb-like Korean makes such a good miner.

Not less important is the matter of transportation. If transportation from South China were easy and convenient the labor problem would be solved, for then the overcrowded population of that area, one that furnishes excellent workmen, like the Californian Chinese, would be available. Freight charges that mount and mount through transhipment after transhipment must be reckoned with as well, while perhaps the most important of all is the question of time. The problem of needing machinery tomorrow when the nearest point at which it can be obtained is three months away is almost enough to discourage the most optimistic engineer. Fortunately the men who go out to find the riches of the earth in her waste places have stout hearts and resourceful minds.

Mining in the San Juan—IV

By William H. Storms

Eight miles southwest of Ouray, and high up amid the rugged cliffs, on the south side of Sneffels creek, which is the west branch of Canyon creek, is the group of mines owned by the Atlas Mining & Milling Co. Just over the nearly vertical ridge of volcanic rock, to the southwest, lies the group of the Revenue Tunnel, including the famous Virginius. This latter is credited with a production of $44,000,000. A short distance farther southwest, in Savage and Marshall basins, are the Tomboy, with a record of $18,000,000, and the Smuggler-Union, which has produced $35,000,000.

Fig. 1. Rock-Stream in Silver Basin, at Atlas Mine.

Near the Tomboy is the Japan-Flora group, a comparatively new property, rapidly developing into a great mine, and between them, following closely the crest of the ridge, lies the Camp Bird, which has produced $17,000,000. The great adit of the Virginius group, known as the Revenue Tunnel, enters the mountain near its base, on the south side of Sneffels creek, and runs for more than 7000 ft. in a southwesterly direction, cutting several veins in its course, including those of the Atlas company. Through this adit the Virginius-Revenue group has been worked for many years. The mill, now an antiquated affair, and much in need of repair, still pounds away, on ore from the company's mines, though the scale of operations is much less extensive than in former years. A good deal of development work is in progress, however.

The Atlas group comprises over 20 claims and covers a somewhat intricate system of veins, the most important of which are the Hidden Treasure, Atlas, and Nacoochee. The last two are nearly parallel and but few feet apart for a long distance, uniting (probably crossing) in the Atlas claim, and then diverging to the southeastward. The various mines have been acquired by purchase and location, and the group now forms one of the largest properties in the San Juan region. Extensive development has been in progress for several years, and still continues, for these great mines of the San Juan mountains cannot be made in a day, nor in a single year. At the time of my visit development was being urged in both the east and west ends of the property; in the former through the San Pedro adit, and in the latter by means of the Atlas adit, the object being to connect these workings, thus improving ventilation, and making it possible to send the ore mined in the San Pedro westward through the Atlas adit to the mill, situated several hundred feet below its portal, and with which the mine is connected by aerial tramway of the 'jig-back' type. These workings are at an altitude of over 11,400 ft., just below timber-line, and an idea of climatic conditions may be surmised when it is stated that in one of the levels I saw a mass of ice 30 in. high, about the same width, and over 60 ft. long, that had remained there throughout the summer. The work on the Atlas vein has exposed a vein varying from a few inches to 4 ft., the value ranging from $5 to $50 per ton, mostly silver, though occasionally gold predominates, running up to $15 or $30 per ton. Sometimes very rich ore, chiefly tetrahedrite, is found running hundreds of dollars per ton. When

the eross-eut adit reaehed the Atlas vein a drift was started each way on the ore, but driving easterly toward the San Pedro was carried on uninterruptedly. When 400 ft. had been driven on a vein a slight disturbance oeeurred in the fissure, whieh was found split into several seams, and the work was eontinued on what seemed to be the most important of these. The vein soon formed again, defleeting somewhat to the northward, with regular walls, and was followed for 1900 ft. Although the vein was found to eontain a great deal of ore, it was assuming a different eharaeter, and was generally of lower grade. Finally it turned so far to the north that it was eoneluded that the main Atlas vein had been left at some point in the drift. Aeeordingly a diagonal eross-eut was started in the direetion of the San Pedro workings, and driven several hundred feet, eventually eutting the main vein. In the meantime, a slight eave oeeurred at the plaee where the first deflection in the vein was notieed, whieh exposed some high-grade ore. A drift was started here, and in a few feet the Atlas vein was found, re-formed, solid, and of exeellent grade. On another vein, known as the Crown Point, a winze was sunk 50 ft., where the vein was 3 to 8 ft. wide, with 1 to 6 ft. of quartz averaging $50 gold; some of the ore was high grade. A great deal of other development work and some stoping by lessees has been done on the various elaims of this property, and the aggregate produetion reaehes many thousand dollars. The middle portion of the mine workings lies direetly beneath Silver Creek basin, shown in the aeeompanying illustration from the interesting paper on 'Landslides of the San Juan,' by Ernest Howe, of the U. S. Geologieal Survey. The main workings are beneath the high ridges, which rise from 1500 to 2000 ft. above the basin at either end. Where the veins pass through the erests of the ridges, deeomposition and erosion have eaused gaps or notehes to be eut in the roeks, whieh are elearly diseernible against the sky-line viewed from the basin. In this basin is seen what may be considered the perfect type of the remarkable roek-streams whieh oeeur in the San Juan mountains and whieh were deseribed in a previous paper. This Silver basin rock-stream bears on its surfaee the eurious eoneentrie ridges eharaeteristie of these streams, and whieh eontribute so much to their resemblance to glaeiers. That these rock-streams owe their existenee to glaeiers there is, in my mind, no doubt. The study of the roek-streams, landslides, talus slopes, and moraines, is among the most interesting of the many to be found in these wonderful mountains.

What the Atlas mine needs most is increased milling faeilities, these being at present restrieted to a 10-stamp mill with eoneentrator and eanvas tables. This little mill, however, under the direetion of Andrew Shipman, has suffieed to work out the metallurgieal problem, so that when a larger mill is provided for, there will be no uneertainty in the method of ore treatment that shall be adopted. The scheme of treatment worked out by Mr. Shipman was not arrived at by ehanee, nor by the adoption of the methods of others, but was worked out with eare after many diseouraging trials. The accompanying flow-sheet will prove interesting.

The ore is highly silieious, carrying galena, blende, pyrite, chalcopyrite, tetrahedrite, and some less common minerals, and the problem of eoneentration is

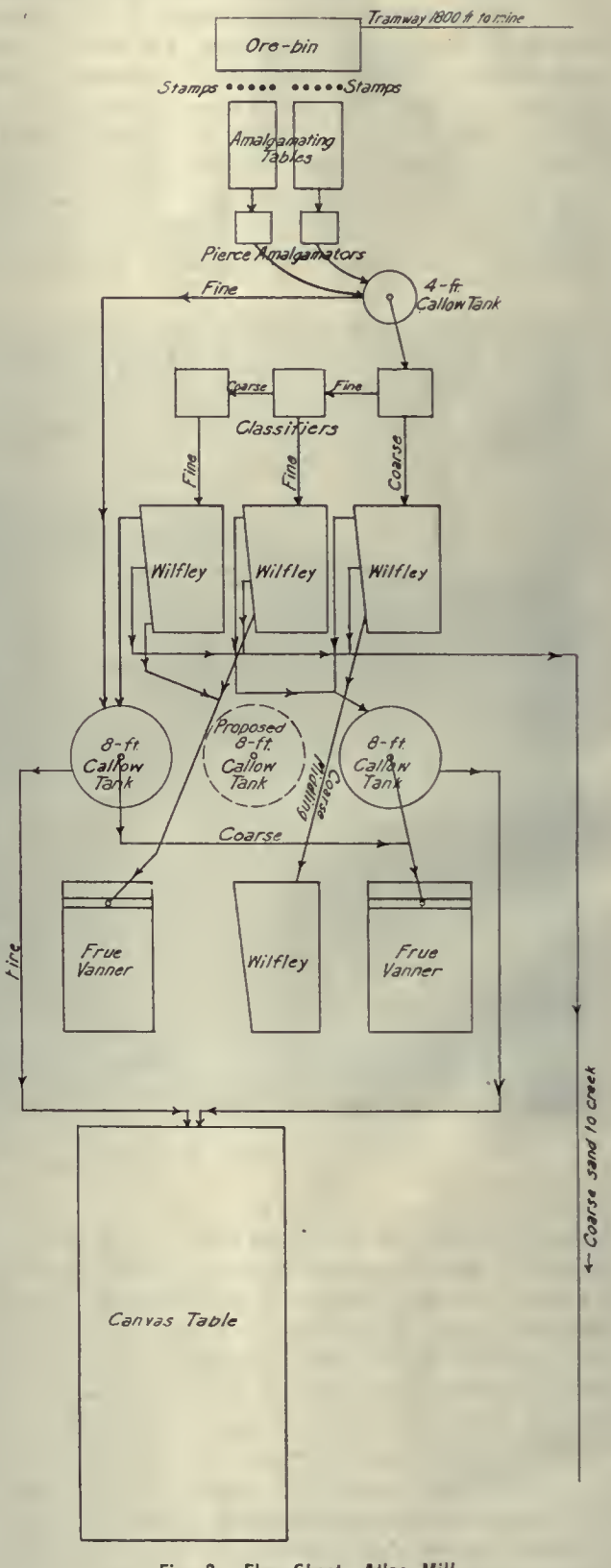


Fig. 2. Flow-Sheet, Atlas Mill.

not an easy one. Moreover, the ores from the various veins are distinetly different in character, and often vary radieally from plaee to plaee in the same vein, so the mill superintendent must keep eonstantly alert to see that he is not losing in the eoneentrating department. The eoneentrate from the Wilfleys

and vanners is sent down to a loading platform near the base of the mountain by means of a chute, saving much trouble and some expense in transportation. That from the canvas tables is sent to the same platform, where the sacking is done and the wagons loaded for the railroad which takes it to the smelters. The Atlas mine is one of the great properties of the San Juan, but as yet it has comparatively only superficial development. The vertical range of the veins, from the base of the volcanic series up to the varying profile at the surface is from 2000 to over 3000 ft., with nearly 7000 ft. horizontally along the Atlas and other veins, a territory which it will require years to develop and exploit. Besides this, the company owns another large area in the vicinity traversed by other veins, on which little development has been done. An interesting geological feature of this district is what

Fig. 3. Mount Sneffles, as Seen From the Atlas Mine.

is known as the Wheel of Fortune vein. This fissure cuts the country for miles, striking in a northeasterly direction, dipping southeast. It is one of the latest fissures in the region, cutting and slightly throwing the numerous veins in its course which strike west of north. It can be traced from the south side of the crest of the range in San Miguel county to beyond Ouray. Although it is explored at many places by cuts, short adits, and shafts, pay-ore has not yet been found in quantity at any place in its entire length of eight or more miles. It is a most remarkable vein and a perfect type of the fault-fissure. Between the Camp Bird mill and the Revenue Tunnel the Bagdad-Chase Mining Co. undertook the development of some property a year or two ago, but abandoned the enterprise, not having found anything considered to justify further expense. Several other small properties in the vicinity have superficial development, but none of them as yet has proved profitable. In fact, the San Juan is not a 'poor man's country,' generally speaking. The ores are of good grade, but complex in character, requiring a high order of metallurgical skill to properly treat them. Large capital is required to provide for transportation if the property be far from the established roads, and usually a great deal of money and time are neeessary to develop the veins, build mills, and establish a camp, with the essential machine-shops and comfortable aeeommodations for the workmen. The metallurgical problem is always uncertain, and must be worked out in each case, the neighboring mills affording only suggestions as to the best course to pursue; for, as previously stated, no two mills in the San Juan are built alike, and the processes of treatment vary in a most remarkable degree.

In working out the seheme of treatment in the Atlas mill, Mr. Shipman has introduced the canvas plant, as indicated in the flow-sheets. The slime saved on these tables is high grade and the results obtained testify to the value of this method of treatment of the tailing from the previous operations. The Atlas mill is not the only one in the San Juan where this method of slime concentration is employed, for in the Smuggler-Union mills, at Pandora, in the southern outskirts of Telluride, is an elaborate canvas plant, whieh will be referred to later.

The seventh annual report of the Goldfields Water Seheme at Kalgoorlie, Western Australia, exhibits a reservoir capacity of 4,680,000,000 gal., a total inflow from April to August of 10,121,000,000; length of main and reticulation, 463 miles; number of services, 13,252; water consumed by mines, 482,664,000 gal.; by railways, 85,066,000 gal.; by general services, 434,009,000 gal., a total of 1,001,739,000 gal. The gross income for the year was $1,105,000; operating expenses, $360,000; interest on supplementary capital, $58,000; sinking fund, $47,000; interest on main capital, $456,000; sinking fund, $398,000, a total of $1,319,000; deficit, $214,000. The total capital expenditure to date amounts to $16,165,000. The report shows an increase of 32,143,000 gal. used, an increase in revenue of $400,000, and a deficit of $185,000 less than that of the previous year. Charges vary from 36c. to $4 per 1000 gal. In view of the installation of apparatus to add five grains of CaO per gallon to prevent corrosion, it is interesting to note that during the year 177 holes were eaten through the main conduit. The cost of pumping 353 miles was 11c. per 1000 gal. The seheme has been the means of expanding the mining industry, and making life more tolerable for those engaged therein.

In veins of a variable dip, or in large deposits where the walls change their dip, bonanzas are often found in the flatter portions of such veins or walls. This is of surprising freqnency, and when sinking in a vein the dip commences to flatten, better ore may usually be anticipated. There are exceptions to this, but in the greater number of cases it will be found that the ore shows improvement on the floors, or places of low dip. However, rules in mining geology are often unsafe and may lead away from the truth.

Sluicing at the Kolchan Mines, East Siberia—II

By Chester W. Purington

(*Continued From Page 196.*)

Summary of Costs. Cost of handling gravel on the Kolchan property by various methods may be summarized as below:

(*a*) By hand-shoveling from shallow bank to cars, tramming same to foot of derrick, hoisting same, dumping to fixed sluice and washing in open sluice (No. 1) (capacity 233 cu. yd. per 24 hours): working cost, 1.34 Rs.; fixed charges, 1.80; total, 3.14.

(*b*) By hand-shoveling from loose tailing stacked so as to afford dump-room, wheeling to sluice (No. 2), and washing in open sluice (capacity 100 cu. yd. per 24 hours): working cost, 0.59 Rs.; fixed charges, 0.69; total, 1.28.

(*c*) By digging, transporting, and delivering to fixed sluice (No. 2) by mechanical drag-line excavator, and washing with water raised with centrifugal pumps (capacity 593 cu. yd. per 24 hours): working cost, 0.31 Rs.; fixed charges, 0.69; total, 1.00.

(*d*) By hand-shoveling from fresh bank, wheeling, and dumping to fixed sluice (No. 3) (capacity 30 yd. per 24 hours): working cost, 2.86 Rs.; fixed charges, negligible.

Comment on the above may be offered as follows: (*a*) Hand-shoveling and hoisting by derrick, costing 3.14 Rs., is not an economical type of plant for Asiatic conditions. The total cost is not excessive, comparing it with similar plants in Alaska, but the low capacity and disproportionate amount of foreign supervision necessary are sufficient reasons to condemn any further attempts to install similar plants in East Siberia. (*b*) The cost of hand-shoveling and wheeling of loose tailing is less than half that of dealing with fresh ground. Under special conditions this type of operation is advisable in Siberia. Where the amount recoverable is less than 2 Rs. per cu. yd. it is to be avoided. (*c*) The cost of 1 Rs. per cu. yd. determined for the excavator plant is a valuable factor in our present knowledge of Siberian gravel mining. Together with the comparatively high capacity attained (nearly 600 cu. yd. per 24 hours), the low cost of this operation, and the low capital expenditure involved, commend this type of plant where physical conditions are suitable. As a general rule, with recoverable gold of 1.50 Rs. per cubic yard or over, and where ten seasons work is in sight, the plant is to be recommended. (*d*) The isolated Pokrovsky plant operated at practically the same cost as the 1908 shoveling operation on the Kolchan, namely a little under 3 Rs. per cubic yard. The capacity in 1908 was larger, as the conditions were easier. As a rule it may be said that a gang of Russian laborers will handle two and a half times the capacity at two-thirds the cost per cubic yard in shoveling to a string of American sluice-boxes, as against the same number of men working with the ordinary Siberian long-tom, variously called *Butara* or *Amerikanka*. The use of the string of boxes also lessens the chance for theft. Shallow creek gravels carrying over 5 Rs. per cubic yard are not infrequent in East Siberia, and can be profitably worked by this method of shoveling in, the only capital expenditure necessary being for tools, sawed lumber, and provisions.

Sluice No. 1.—My foreman was not able to commence preparations until the first week in April 1909, when the annual break-up of the frost rendered work difficult. Five log buildings, including a machine shop and blacksmith's shop were moved to a new site, a quarter of a mile away, and re-erected. Four thousand feet of two-foot flume was constructed, and an old retaining dam was repaired as well as possible. Pumping plants and a good sluicing plant were erected. Two old steam-shovel excavators were dismantled, and a hoist and derrick plant was constructed from the parts. These preparations were finished early in July. The plant, supplied with water from the Kolchan creek by pumping, and having its gravel furnished by Chinese shoveling into cars, which were lifted by derricks to the sluice, ran from July 8 to October 5 inclusive, handled 21,000 cu. yd. of gravel, and recovered approximately £8,300 (81,533 Rs.) from about one acre of ground worked. Together with the work of the year before, which began the cut finished by the derrick plant, the total gross recovery from this one place has been very nearly £10,000 (96,033 Rs.). The work was a continuation of the work on the small rich bench which was carried on in 1908.

In 1908, 39 days work done by simple shoveling in, handled 2000 cu. yd. of gravel, with a gross recovery of 14,500 Rs. In 1909, the sluice, fed by derrick, operated for 90 days from July 8 to October 5 inclusive, actually operating 1500 hours out of a possible 2160, or about 70% of the time, handling 21,000 cu. yd., recovering 5989 oz. of amalgam worth 13.61 Rs. per ounce, or 81,533.10 Rs., being at the rate of 3.88 Rs. per cubic yard. The total yardage handled by sluice No. 1 in 1908 and 1909 was 23,000, which, with 96,033.10 Rs. recovery, gives an average of 4.17 Rs. per cubic yard. It is estimated that 80 kopecks has been lost in the tailing owing to washing in open sluice. This will be recovered by the dredge, as the tailing will all be re-handled. The sampling of this bench showed 30,000 cu. yd. having a recoverable tenor of 2.40 Rs. or a total of 72,000 Rs. The actual recovery has therefore already given over 24,000 Rs. more than the sampling showed, and 9000 cu. yd. remain to be worked. With what will still be recovered from tailing and what can be reached of the untouched portion by dredging, it is safe to say the bench will afford another 20,000 roubles.

The plant consisted of two centrifugal pumps, 8 and 9 in., operated by two portable engines, 15 and 25-hp. respectively, set up at the bank of Kolchan creek. They lifted together 250 miner's inches of water, to a height of 40 ft. This water was carried around by 350 ft. of flume on trestle to the dump-box of the sluice. The sluice consisted of two dump or mud boxes in succession, the first on 12 in.,

DRSK GOLDFIELDS LIMITED

GOLD PRODUCTION DURING 1909 SEASON

DATE	No. of settlement	CONSIGNMENT OF ARGENTIFEROUS GOLD — PRODUCED — At claim	CONSIGNMENT OF ARGENTIFEROUS GOLD — WEIGHT — By poods	pounds	zolotniks	dolias	LIGATURE GOLD — No of Bar	LIGATURE GOLD — WEIGHT — poods	pounds	zolotniks	dolias	ASSAY VALUE (fineness) — Gold	Silver	Ligature	PURE GOLD — WEIGHT — poods	pounds	zolotnik	dolias	PURE GOLD — VALUE at 5.50 330/345 per zol. — Rs.	c.	PURE SILVER — WEIGHT — poods	pounds	zolotniks	dolias	PURE SILVER — VALUE at 14.06 c. per zol. — Rs.	c.	TOTAL VALUE — Rs.	c.	LESS DEDUCTIONS:— 1% Government Dues — Rs.	c.	Revenue stamps — Rs.	c.	In refund of excess paid in 1908 (Mint correct) — Rs.	c.	Total deductions — Rs.	c.	Due in final settlement — Rs.	c.
1909.																																						
July 26	371	Sretensky	–	29	41	–	428	–	29	34	90	.705	.287	.008	–	20	67	33	10,949	35	–	5	41	3	113	74	11,063	29	110	64	16	65			127	29	10,936	–
Aug. 5	412	— " —	–	38	73	–	481	–	23	6	60	.720	.273	.007	–	18	4	73	14,344	58	–	6	81	–	156	83	14,481	41	144	82	21	75	10	34	176	91	14,304	50
							482	–	13	53	60	.669	.243	.088	–	9	6	75			–	3	28	28														
" 26	506	— " —	–	35	39	48	591	–	30	77	60	.718	.269	.013	–	22	11	34	15,391	18	–	5	27	57	152	90	15,544	08	155	45	23	40			178	85	15,365	23
" "	"	Pokrovsky	–	5	65	–	593	–	4	49	12	.720	.267	.015	–	3	25	81			–	1	19	62														
			smelted				592	–	5	60	90	.662	.326	.012	–	3	70	9			–	1	80	33														
" 31	532	Sretensky	2	4	38	–	627	–	29	75	–	.688	.252	.060	–	20	48	95	30,075	18	–	7	48	44	288	94	30,364	12	303	65	45	60			349	25	30,014	87
							628	–	28	69	–	.672	.283	.065	–	17	91	55			–	7	2	56														
							629	–	28	33	30	.699	.261	.040	–	18	39	94			–	6	84	14														
Oct. 8	732	— " —	–	26	35	–	859	–	28	21	30	.698	.277	.027	–	18	24	04	20,024	16	–	7	25	28	191	16	20,215	32	202	17	30	45			232	62	19,982	70
" "	"	— " —	–	28	83	–	860	–	28	68	–	.683	.250	.067	–	19	58	33			–	7	17	–														
Sep. 30	708	— " —	2	8	24	36	850	–	29	44	36	.701	.241	.038	–	20	62	68	34,387	62	–	7	9	61	325	33	34,712	95	347	13	52	20			399	33	34,312	62
							851	–	29	39	–	.698	.254	.048	–	20	50	44			–	7	45	3														
" "	"	Pokrovsky	–	7	24	–	852	–	27	67	60	.689	.262	.049	–	19	8	46			–	7	24	78														
							853	–	7	19	54	.659	.316	.025	–	4	71	70			–	2	26	51														
TOTALS			8	24	38	84		8	20	48	6				5	36	62	74			2	9	81	38	1,208	90	126,381	17	1,263	86	190	05	10	34	1,464	25	124,915	92
																			PLUS Gold dust taken by Mr. Purington to the value of								60									
																			GROSS VALUE OF SEASONS OUTPUT	Rs.							126,441	17								

The rouble is equivalent to $0.515; the kopeck is one hundredth part of one rouble.

The profit and loss statement for the season was as follows, stated in roubles:

GROSS REVENUE

Sluice No. 1	81,553.10	
Sluice No. 2	40,348.53	
Sluice No. 3	4,539.54	
		126,441.17
Trading profit on stores	2,508.62	
Interest	227.15	
	2,735.77	129,176.94

OPERATING COSTS

Sluice No. 1	65,937.38	
Sluice No. 2	40,389.21	
Sluice No. 3	4,295.93	
	110,622.52	
Gross working profit		18,554.42
Less		
Depreciation	8,185.52	
Royalty to Russo-Chinese Bank	8,850.35	
		17,035.87
Net profit 1909 season		1,518.55

the following on 16-in. grade, around which platforms were built, one side being inclined, in hopper form. These boxes, each 16 ft. long and 4 ft. wide, set 18 ft. above the surface, were narrowed at the lower end to discharge into the main sluice of 30 in. boxes, on 8-in. grade. This sluice was originally 200 ft. long, and lengthened as the dump filled, and spread with Y's until the total sluice length was 500 ft. Riffles were wooden poles of larch 12 ft. long and 3 by 4 in. in cross-section, set ¾ in. apart. These were found more satisfactory than wooden Hungarian iron-shod riffles, which wore badly. Two derricks, one on either side of the sluice, operated by separate hoists, served to lift the gravel in wooden skips from the trucks to the sluice. The trucks were parts of old Koppel side-dump ore-cars,

which were inherited from the Oehotsk company. The wooden derriek-skips, fashioned to be set on these trueks, were made by Franz Mrkos on the premises, the irons being forged in the shop. Gravel was barred or pieked from the bank and shoveled into the skips by hand labor, mostly Chinese. After being filled, the skips were trammed to the derriek-foot and hoisted. The plant, whieh was in all respeets similar to those used on the Alaska and Klondike ereeks was weak from the element of poor hand labor. Chinese eontractors, or rather Harbin gamblers posing as eontraetors, robbed and half-starved their men, who in eonsequenee were feeble and ineffieient. Serious delays were eaused in the midst of the season by the neeessity of ehanging from the eontraet system to day-pay. This ehange, and the substitution of Amerieau foremen, resulted in great improvement. Unfortunately the season was spent except 21 days, and the best part of the bench was already worked. In the first 69 days, 14,000 eu. yd. or only 203 eu. yd. per day was handled, at a eost for pit labor and foremen of 98 kopeeks per yard. In the last 21 days, 7000 eu. yd., or 333 eu. yd. per day was handled at labor eost of 72 kopeeks per eubie yard. The eost per eubie yard of hoist and pump labor in the last 21 days also showed improvement, in spite of the faet that the wages of all engineers and firemen were raised. Taking the season as a whole, the duty of shovelers was less than 2 eu. yd. per shift per man, or about two-fifths of what it should have been.

The eapital expenditure for this plant is praetieally written off, as it was mainly expended in labor for moving buildings, sawing lumber, building flume, trestles, and sluiee-boxes, and moving and eonneeting old maehinery inherited from the Russian eompany. One new hoist and set of derriek irons were in use a portion of the time, but as these are uninjured and necessary in the dredge eonstruetion, very little amortization is ealled for. The plant was well equipped for its work, and earned a small profit. The work proved, however, that plants of this eharaeter are not eeonomieal in Siberia on aeeount of the ineffieieney of the loeal labor. Besides this defeet, the insuffieieney of water supply owing to exeeptionally dry season redueed the eapaeity of sluiee No. 1, although not as seriously as in the ease of sluiee No. 2. Both in this work and in that of sluiee No. 2 thanks are due to the members of the staff for earnest and eonseientious work under diffieult eonditions. J. P. Hutehins assisted materially in making the sluieing plants a sueeess.

Sluice No. 2.—Altogether this plant handled 39,000 eu. yd. of tailing stacked up by the old company: 4000 eu. yd. was hand-shoveled, and 35,000 eu. yd. was dug by a Page-Crawford drag-line exeavator, dumping directly into 24-in. open-sluiee, with whieh its traek ran parallel. The total reeovery was 3095 oz. of amalgam, worth 13.02 Rs. per oz., or 40,348.53 Rs. The gross valne was thus 1.03 Rs. per eubie yard. The amount going into the tailing from this operation was small; I shonld judge not mueh over what it will eost to move it when the area over whieh it is spread is dredged.

During the month of March 1909, 4000 ft. of 2-ft. flume, mainly on low trestle, on grade $^3/_{16}$-in. to 12-ft. was eonstrueted from old lumber, and a small proportion of new lumber prepared by whip-sawing. This flume led the water of Abramovsky ereek on grade to the rieh staeked tailing sampled in 1907. The eost of this flume, for labor and material was one ronble per foot, whieh is very low. It is in good shape for several years serviee. Normally it affords 200 miner's inches of water, but in the dry time of last year the supply sunk to less than 50. This flume supplied sluiee No. 2 with a portion of its water during 81 days run from July 22 to October 11. The sluice was also supplied with water from a 10-in. eentrifugal pump, operated by a 35-hp. portable engine, lifting 35 ft. from Kolehan ereek. A further addition to the supply was obtained by leading the excess water from sluiee No. 1 by 300 ft. of 9-in. pipe arranged as inverted siphon from No. 1 flume to the head-box of sluiee No. 2. The sluiee was run longitudinally through the ellipse-shaped flat-topped tailing-pile. Some four thousand eubie yards of the top seven feet of gravel was shoveled into the sluiee by Russians on eontraet, at a working eost of 59 Kop. per eubie yard, while the exeavator was building. Fixed eharges added 69 Kop. per eubie yard to this eost.

The sluiee-boxes of sluiee No. 2 were built mueh heavier and stronger than those of sluice No. 1. Although of 30 in. width at first this was found too wide to earry the large stones, and lining boards were put in to narrow it to 24. The first length of 200 ft. was gradually extended in straight sluiee and Ys to spread the dump, until over 600 ft. length of riffle-surfaee was finally afforded. Wooden poles were used as riffles at the upper end, but the greater length was paved with 16-lb. steel rails, eut in 12-ft. lengths. The grade was 8 in. to 12 ft., whieh was found very satisfaetory.

The exeavator used at this plant is an entire experiment in plaeer mining, and had never been tried previously so far as I know. In April I ordered in Chieago a Page-Crawford scraper-exeavator with 1½-eu. yd. bueket. This maehine, weighing with extra parts 50 tons, was ordered from the Lidgerwood Manufaeturing Co., April 6: was delivered from Chieago, April 16, was shipped on steamer *Mongolia*, together with other maehinery and supplies, from San Franeisco, May 5, 1909. The shipment went by way of Nagasaki, Japan, Vladivostok, Nikolaievsk, and Lake Chla, and arrived on the property July 15. The excavator was erected in three weeks on top of the 150,000 eu. yd. of tailing which previous sampling had shown workable. It eommenced work on August 12, and was shut down on October 11, 1909. Water was supplied to this sluice by a flume, and by eentrifugal pumps. The required amount was 600 eu. ft. per minute, but owing to the extremely dry season it was seldom possible to furnish more than half the requisite quantity. Thus it was impossible to run the exeavator at anything like full eapaeity, that is, 24 hr. per day. The average run was 10 hr. per

day. At this rate, in 59 days, up to October 12, there was excavated and washed 35,000 cu. yd. of tailing, at an actual operating cost of under 20 kopecks per cubic yard. The cost of 30 kopecks hereinunder given includes allowance for expensive transport of imported machine-runners. As in the case of Sluice No. 1, fixed charges added greatly to this cost.

The entire plant burned about 6 cords of wood per 24 hr. and utilized the services of only 7 men on a shift in its operations, namely, a machine-runner, fireman, wood-packer, pumpman, and 2 sluice tenders. The same amount of gravel handled per day by any method requiring the labor of men locally available would have necessitated the employment of 300 men. Moreover, the amount handled, 600 cu. yd. per day, is less than one-third of what the excavator can handle if working to its full capacity. The excavator was erected and operated during 1909 by a first-class erector, who was

Excavator on Tailing Pile.

brought from Chicago to take charge of it. But during the summer two new men were taught to operate the machine, one a young American student, and one a Riga Russian, both of whom are less expensive to employ than a special erector. It is planned to teach other German-Russians to operate this machine, and thus eventually to depend on native labor.

The excavator is of the rail-circle type, the lower carrying-frame being itself mounted on trucks, which run on 90-lb. rails. These were laid parallel with the sluice, at a distance of 60 ft., the length of the structural-steel boom which leads the hoist-line over a head-sheave to the 1½-cu. yd. scraper-bucket. One man handles both hoisting and swinging engines, and controls the entire operation. A fireman is the only other man necessary or allowed about the machine. The bucket is dropped into the gravel, and dragged toward the machine. It can dig at any point in a radius of 60 ft. away from the centre, and from 0 to 30 ft. below the track of the machine. After filling, it is hoisted, held horizontally, or slightly inclined backward, so as not to spill water or gravel. The machine is then swung through an arc until the bucket is suspended over the sluice, when it is dumped by letting up on the drag-line, through an ingenious arrangement of a short compensating cable connecting the two main lines. The machine works backward, and when ready for moving, two track-layers are called on to remove the track-ties. The machine lifts the track section from in front and deposits it in position at the rear. When the track is connected the operator digs the teeth of the bucket into the ground behind, and pulls the excavator 10 ft. back. It is then ready for a new cut. It must be remembered that the bucket can be successfully dumped only in a position vertically below the head-sheave.

The 1909 cuts were 120 ft. wide and from 27 to 30 ft. deep. After digging 24,000 cu. yd. on the east cut, all the water connections to the sluice were removed, and the machine was moved in two days a distance of 400 ft. to the north end of the proposed west cut. The pipe and flume connections were then restored and 11,000 cu. yd. was dug on this cut before shutting down at the close of the season. This cut is about one-third finished. The

Bucket Digging in Bank.

following report was furnished by the foreman in charge of the excavator:

August 12 to 26, inclusive, 215 hours work, capacity about one-third. August 27 to 31, inclusive, 79 hours work, capacity about one-half. September 1 to October 10, inclusive, 303 hours work, capacity practically full. The entire work done was equal to the full capacity of the machine working 16⅔ days of 24 hr. each at full capacity of 2170 cu. yd. per day. The actual work done for the period of 59 days over which the excavator worked was 593 cu. yd. per day.

From experience last summer, I am entirely justified in saying that had the machine not been shut down fully half the time for lack of sluicing water to wash the gravel dug, an average time of 20 hr. per day would have been maintained, with a yardage of 1750 per day. This capacity is larger than that of European gold-dredges in general.

The washing requirements for Sluice No. 2 necessitated a constant flow of 400 miner's inches of water to wash the gravel and carry away the tailing. This amount was only obtainable during the last 12 of the 59 days during which the excavator worked. During the driest month, September, there were only about 250 miner's inches available for both sluice No. 1 and No. 2, and the Abramovsky

creek, which in normal years supplies nearly this amount by itself, ran almost dry. A reservoir from which the 10, 9, and 8-in. centrifugal pumps all got their supply, was only fully completed on October 2 by making a hydraulic-filled dam of tailing from sluice No. 2 across the Kolchan. It was then possible to run the water from sluice No. 2 back into this reservoir, and keep the same practically full. All the ingenious contrivances resorted to by the hydraulic miner, such as gates and turn-outs in the sluice, the use of shear-boards to cut down the dump, the intelligent use of sluice-forks in breaking jams, etc., were instituted and supervised by J. P. Hutchins, without whose painstaking work the capacity of the plant would have been very much less.

Notwithstanding the inevitable use of incompetent local labor (mechanics, carpenters, and sluicemen), besides great difficulties attendant on late starting and inadequate preparations, Sluice No. 2 demonstrated the principle that entirely new methods of handling gravel, embodying the latest types of machinery, and cutting down hand and horse labor, can be successfully installed and operated by foreigners in Siberia with comparatively small capital expenditure. Heaps of tailing having the approximate shape and size of that worked, exist in the Zea, Selenja, and Lena regions, and contain from 2 to 4 roubles per cubic yard. Where gravity sluicing water is available, these piles can be worked profitably by an excavator and fixed sluice, like the No. 2 plant. The capital expenditure for the entire plant erected would likely be under 60,000 Rs. in the more remote Siberian districts. Advantageous 'Staratel' or temporary leasing arrangements can be made with Siberian mine-owners, thus obviating government interference.

COST OF EXCAVATOR OPERATIONS AT SLUICE NO. 2

	Rs.	Rs.
Labor—Day shift (average 10 hr.).		
1 foreman at 20 Rs. per day (operating the excavator)	20.00	
1 fireman at 2.50 Rs.	2.50	
1 wood packer at 1.60 Rs.	1.60	
2 sluice tenders and track layers at 1.6 Rs.	3.20	
1 pump engineer at 2.50 Rs.	2.50	
1 fireman at 1.60 Rs.	1.60	
		31.40
Night shift.		
1 foreman at 6 Rs. per day	6.00	
Others (as above)	11.40	
		17.40
Or for 2 shifts per day		48.80
To this the labor of carpenters, machinists, blacksmiths and general outside men added per day		14.85
		63.65

Thus the total working cost chargeable to the actual operation of Sluice No. 2 with excavator plant was 10,850 Rs. for handling 35,000 cu. yd. in 59 days of the 1910 season. In my estimation, this was the most important figure arrived at as a result of the season's work. To it naturally must be added the cost resulting from fixed charges as below shown. But it would be the greatest injustice to consider these charges as in any degree representative, for this character of work.

As Sluice No. 2 will not be used again, owing to the transfer of the excavator to Pokrovsky in 1910, it is necessary to include in the 1909 fixed charges all the construction charges for sluice No. 2, as well as the proportional part of the items listed under sluice No. 1; as general manager's salary and expenses, foreign staff expenses, taxes, police, hospital, legal, bank, bullion, and camp and road maintenance.

	Rs.	Rs.
These amount to		40,148
Less working expenses excavator plant	10,850	
Less working expenses hand-shoveling	2,360	
		13,210
For entire 39,000 cubic yards		26,938
Per cubic yard		0.69

Of this amount the total fixed charges against the excavator plant are 35,000 × 0.69 Rs. = 24,150 Rs.

The total cost per cubic yard of handling and washing gravel with the excavator plant was:

	Rs.
Working cost	0.31
Fixed charges	0.69
	1.00

The net results of the excavator plant were: Fixed charges, 24,150 Rs.; working cost, 10,850 Rs.; total cost, 35,000 Rs.; recovery in gold, 36,050 Rs.; net profit, 1050 Rs.

COST PER CUBIC YARD.

	Rs.	Rs.
Total labor for the 59 days		0.11
An additional item which must be charged to labor account was the proportional share of traveling expenses, and pay en route of the two American foremen, 3760 Rs.		0.10
Repairs, a total of 1289.15 Rs.		0.04
Supplies consumed.	Rs.	
Wood (about 6 cords per day)	791.90	
Tools	25.65	
Excavator parts	99.49	
Steel cable	241.82	
Oil	61.46	
Coal oil	11.50	
Carbide	15.90	
Nails	60.55	
Quicksilver (gain instead of loss)	00.00	
Lumber, for new boxes and trestles as the work progressed (lumber used in first construction not charged), about	300.00	
Sundries, lighting, stables, melting, and store charges	514.65	
Total supplies	2,122.92	
Total for supplies and sundries		0.06
Total working cost per cubic yard		0.31

The cost of the construction of Abramovsky flume and sluice No. 2 has been entirely written off under the head of fixed charges. This is a very conservative basis to reckon on, as the flume will be useful for at least two years more, and the sluice-boxes are in good condition and useful in other portions of the property. The cost of the excavator, erected and ready to run, was 22,023.16 Rs. Of this, 10% has been arbitrarily written off, although the machine is in perfect condition and good for several years service.

Pokrovsky Claim.—The Pokrovsky area, comprising a part of the Kolchan property, was practically discovered during the season of 1909. It had been worked in a desultory way by the old company, but no records of product were available, and the area was not included in the assets of the property indicated in my report of 1907. Early in 1909 it was reported to me that a gang of Chinese was stealing gold at night from the Pokrovsky ground, four miles south of the main Kolchan camp. In order to more

effectually guard this isolated spot, I sent a few shovelers under a trusted man to camp there, and installed a string of sluice-boxes. During about 50 days 1500 cu. yd. was washed, constituting a respectable sample, from which nearly 5000 roubles was recovered. The gravel washed was taken from various parts of an area of about an acre and a half. Pan samples of the same material gave results from two to three times as high as the saving in the sluice-boxes. This was because the amount of clay in the gravel and the small amount of water available, only 40 cu. ft. per minute, caused more than half of the gold to escape. The cost of working was 2.86 Rs. per cubic yard, of which 2.52 Rs. was for labor, the remaining 34 kopecks being for supplies and sundries. Little supervision was required after the sluicing was once started, and the cost is fairly representative of what plain shoveling and wheeling from bank to sluice will cost in Siberia, under conditions of little water and where gravel is difficult to wash.

Labor.—An important fact determined beyond question during the 1909 season relates to labor. While it is certain that hand-labor operations in Siberia are to be in general condemned, it is also certain that mechanical excavators of large capacity, and in all probability dredges, can be eventually operated by a certain class of Russian subjects, namely, Germans from the Baltic provinces. This means that instead of paying expert men to come from abroad, managers may look to developing a class of native machine-runners, the annual expense of whose wages and expenses will be from one-quarter to one-half that of similar men brought from abroad. This fact has a double advantage. It reduces expenses, and inclines the local population and government more favorably toward a foreign enterprise. On the other hand, as regards the efficiency of labor employed in hand-work of any kind, that labor which is locally available gives disappointing results. The common Russian labor, when comparing the duty of such a man shoveling from bank to car, picking his own ground, with Swede labor in Alaska, is generally higher, as long as the Russian works steadily. But his servile, whining disposition, protected as he is by excessive government paternalism, combined with deep-rooted adherence to the customs of a priest-ridden country, make him a dangerous member of a mining community. Chinese coolie labor was also a failure the past season, in shoveling. As I have never worked Chinese except on this mine, I hesitate to say that the Che-Fu coolies I had on sluice No. 1 are a fair sample of the race. They do not appear to compare with Californian Chinese in efficiency. My own opinion is that the late start rendered it necessary to take local Chinese instead of importing picked men from the treaty ports. Consequently only the riff-raff of the Amgoon tributers was available. At any rate, the duty of the Chinese shoveler averaged but 2 cu. yd. of gravel per 10-hr. shift, as compared with 5, which is the average in Alaska. The experience in the small amount of work done in 1908 was practically the same. Therefore, I am justified in saying that any sluicing methods used in future on the Kolchan property must eliminate hand labor as much as possible. In other words, the hand labor, apparently cheap, is not in practice cheap, but more expensive than well-paid labor in America.

As regards carpenters, both Russians and Chinese require expensive surveillance, constantly. The Chinese are superior, as they work faster and are more adept. On flume work, where exact joints are not required, a gang of six Russian carpenters is the equivalent of two Californians. On sluice-box work, I had one gang of Chinese, three in number, who worked very well after long training. It seems impossible for Russians to learn this work well.

As regards fuel, when winter cutting can be taken advantage of, it is safe to say that the price will not exceed 3 Rs. per cord, delivered. The whipsawing of lumber in 1909, of which about 50,000 board-feet were used, cost 50 roubles per thousand feet.

Freight Charges.—The experience in handling heavy pieces of freight, in the season of 1909, was as follows:

American shipment of 78 tons, about one-quarter of which was heavy pieces. Prices are in roubles per ton: Rate from Chicago to Nagasaki, 71; Nagasaki to Nikolaievsk, 32; Nikolaievsk to 'Residenz', including unloading at Nikolaievsk, barge transfer to Residenz, and unloading from barge. 26; Residenz or lake-landing to mine, 90; total, 219. These are figures for the 1909 cost for heavy pieces.

English shipment of 10 tons: Hull to Nikolaievsk, 82; Nikolaievsk to the mine was less than the American shipment, as the pieces were all small (on heavy pieces the freight would have been the same), 116; total from Hull, England, to Kolchan, 198.

From the above experience, one would be justified in assuming an estimate of £20,000, or 200,000 Rs., for a dredge shipment of 1000 tons, from either New York, Hull, or Hamburg, to the Kolchan property.

The Kolchan property, although directly on the seaboard surrounded by navigable waters, is in a region where general business and commerce are undeveloped. Very few direct steamers to European and American ports make Nikolaievsk a port of call, consequently many transhipments are necessary for machinery destined for the Amur goldfields.

Taxes.—The list of taxes given below is fairly representative of the nominal Government dues:

TAXES PAID DURING 1909

	Rs.	Rs.
Dessiatin tax.		
1909 tax	2,683.75	
Fine on same	129.00	2,812.75
Personal licenses, 1909 tax		48.00
Mine Owners' Association, 1909 levy on proportion of gold produced by each mine in the district		165.65
Judge tax, annual levy for 1909		109.00
Police expenses, paid to police as salaries from April to December 1909 inclusive (police charges are at the rate of 0.232 Rs. per month)		2,286.60
Police tax, annual levy for 1909		205.00
Church, subscription to same for 1909		100.00
Boiler tax, 1909		216.59
Fundamental industrial tax, 1909		2,147.00
		8,090.59

California Gold and Silver Output in 1909

Final figures showing the mine production of gold, silver, and platinum in California in 1909, compiled by Charles G. Yale, of the U. S. Geological Survey, have just been made available for publication. The delay in appearance is due to the co-operation of the Geological Survey with the Bureau of the Census in collecting the statistics of mineral production in 1909. The final figures for the output in California in 1909 are as follows: Gold, $20,237,870; silver, 2,098,253 fine ounces, valued at $1,091,092; platinum, 416 refined ounces, valued at $10,400. The corresponding values for 1908 were: Gold, $18,761,559; silver, $873,057; platinum, $13,414; the quantities of silver and platinum in 1908 were respectively 1,647,278 and 706 ounces. Material gains in the output of gold and silver and a decrease in that of platinum are therefore shown for 1909. The production of gold and silver in California in 1909 by counties is shown in the following table:

County.	Gold (value).	Silver. Quantity (fine oz.).	Silver. Value.
Amador	$ 2,298,785	32,118	$ 16,701
Butte	2,987,079	13,856	7,205
Calaveras	1,440,511	137,342	71,418
Del Norte	1,610	100	52
Eldorado	238,284	2,498	1,299
Fresno	17,539	16,352	8,503
Humboldt	25,690	181	94
Imperial	59,705	1,007	524
Inyo	457,846	90,609	47,117
Kern	654,799	195,448	101,633
Lassen, Modoc, and Colusa	116,327	2,813	1,463
Los Angeles	864	4	2
Madera	14,716	775	403
Mariposa	396,465	5,247	2,729
Merced and Stanislaus	228,492	1,100	572
Mono	354,909	72,677	37,792
Monterey	333	10	5
Nevada	2,660,235	47,935	24,926
Placer	281,372	2,869	1,492
Plumas	157,491	1,130	587
Riverside	186	46	24
Sacramento	1,669,814	5,492	2,856
San Bernardino	40,071	24,173	12,570
San Diego	12,812	3,310	1,721
Shasta	1,600,489	1,414,346	735,460
Sierra	189,672	1,841	957
Siskiyou	416,160	4,125	2,145
Trinity	520,046	4,427	2,302
Tuolumne	925,703	8,430	4,384
Yuba	2,469,865	7,992	4,156
Totals	$20,237,870	2,098,253	$1,091,092

Comparison of the above table with the county figures for 1908 shows that 17 counties increased their gold output in 1909, those showing the largest increases being Sacramento, with an increase of over $500,000; Shasta, and Yuba, each of which increased its gold output over $400,000; and Nevada, with an increase of over $350,000. Sixteen counties in California showed decreased production of gold in 1909, chief among which were Sierra county, with a decrease of over $200,000, and Kern, Butte, San Bernardino, and Eldorado, in the order named, each with decreases of over $100,000.

Platinum is produced in California mainly from the dredging fields along Feather, Yuba, and American rivers, though small quantities come from Humboldt, Siskiyou, and Trinity counties, in the northern part of the State.

Electric Pumping Problem

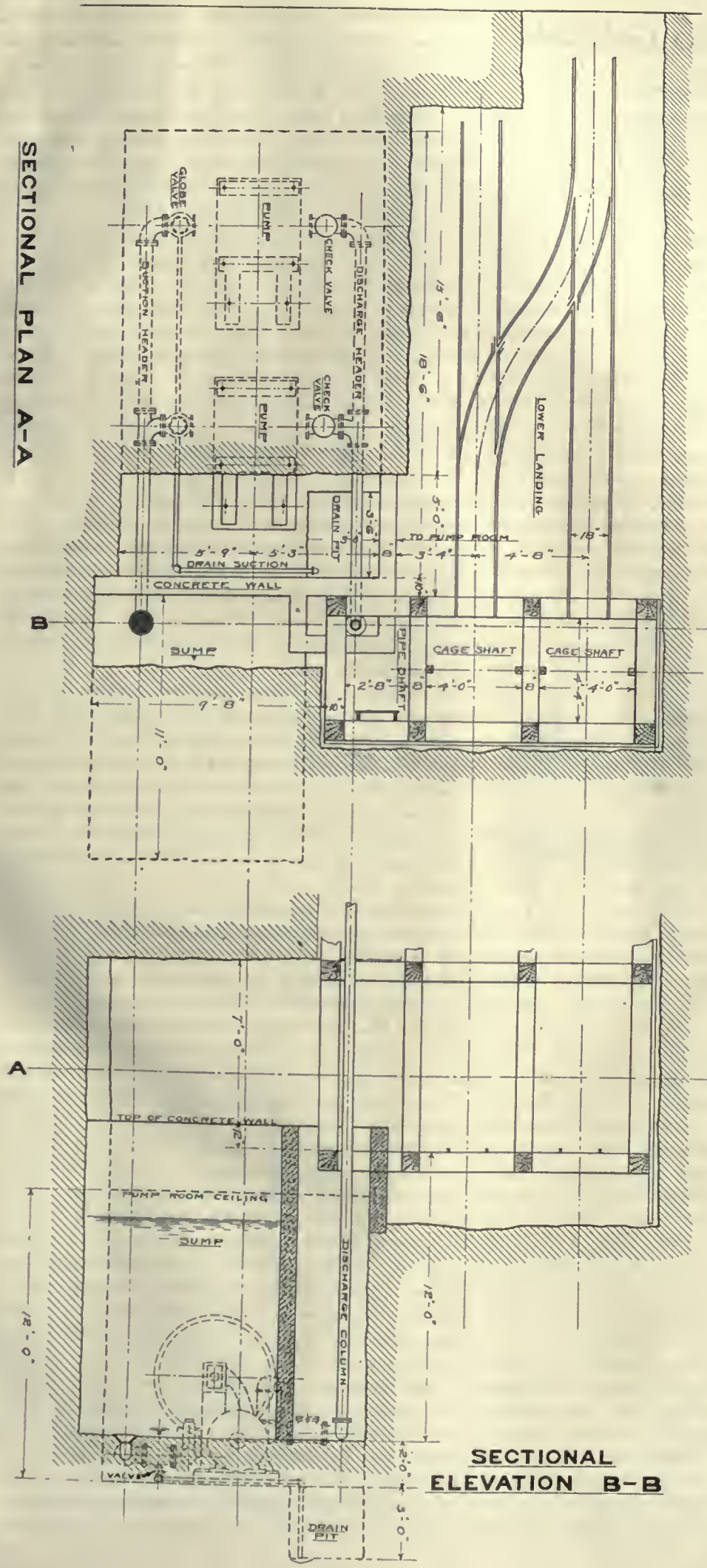
By Max J. Welch

An electric pump operates at a constant speed. The supply of water is never constant, in the case of draining a mine. The problem is, how to operate a constant-speed pump at less than its rated capacity, and do so economically.

Suppose that the heaviest flow of water into a mine is 100 gal. per minute. A portion of the year the flow is probably only 40 to 60 gal. per minute. In order to provide for emergency, a safe installation is two 100-gal. pumps, of the same manufacture. By this arrangement only one set of duplicate parts subject to wear and breakage need be carried in stock.

Three systems have been used to solve the problem of under-rated water supply: (1) with a by-pass valve; (2) a speed-shifting device; (3) periodic pumping. The first system requires little attention, but is not economical. It consists in the introduction of a water-valve between the discharge line and the supply sump. When the water-supply is low, a float automatically opens this valve and allows an amount of water to churn through the pump, without being discharged from the mine. It is readily seen that the pump is consuming as much power as if it were actually discharging 100 gal. per minute. The second system, of changeable gears, is more economical in power consumption, but requires the time and careful attention of the pumpman. The first cost of installation is greater, owing to a duplex system of gears. The third system, of periodic pumping, is extremely practical if the pumpman's time is of little value. Automatic starting rheostats are in use, but they are hardly reliable enough for mine pumping. The rheostat, as generally installed, is in the delicate position of constantly opening and closing. Practical methods in isolated regions require as little delicate mechanism as possible.

A few years ago I put in a triplex electric pump, using the by-pass system. The supply was hot water, and consequently the sump tank was placed above the valves in the pump. The breaking of this valve led to the theory that the by-pass is entirely unnecessary. As long as the water flows into the valves, the machine is a pump. When there is no water supply, the pump is an air-compressor. When the water supply is half the rating of the pump, it becomes an air-lift device; in other words, the air which passes into the discharge water column, reduces the weight of the column and takes the working load off the pump. The by-pass was closed and



the pump worked successfully. A recording watt-meter was used to measure the power consumed. It was found that the amount of electric current used by the motor was almost in direct proportion to the volume of water pumped.

The first question of doubt which arises is this, will there be any hammer in the pump, due to admitting air? Certainly not. Hammer, in a pump, is caused by insufficient water-supply, accompanied by a vacuum. If there is a vacuum in the pump cylinder at the end of a stroke, then the valve will not open on the return stroke until the water has formed a solid mass against the piston. This is the point in the return stroke where water-hammer occurs. But, if air is admitted along with an insufficient water supply, the air cushions the pump piston against the water, destroying the hammer. The drawing herewith shows the method of installing pumps below the sump. It also shows the duplicate system of pumps, one extra being held in reserve for emergency, in case of heavy repairs.

Picric acid, the high explosive material, was first manufactured in 1771, and for about 100 years was employed as a dye, its explosive character never being recognized. This substance is also known as carbazotic acid.

The Klerksdorp Goldfield

By Rowland Gascoyne

The Klerksdorp district of Transvaal from a gold-mining standpoint has been under a cloud for a good many years but recently the satisfactory manner in which the Africander mine has been opening has again attracted attention to it. However a much more important issue than that of the success of an individual mine has been raised by a discovery close to Buffelsdoorn, almost due west of Potchefstroom, and about fifteen miles northeast of Klerksdorp. Buffelsdoorn is well known as the scene of a mining fiasco almost equaling in extent that of the old Coronation Syndicate deal in the Heidelburg district, and one would naturally expect that the mere mention of the word Buffelsdoorn would have been sufficient to scare even prospectors, not to mention speculators or investors. However, such has proved not to have been the case, for despite all discouragements and difficulties two old Rand prospectors named Du Plessis and Murray have persisted in prospecting for the Main Reef series west of Buffelsdoorn, eventually succeeding in forming not only a Main Reef syndicate, but, under geological guidance, in finding a reef having many of the characteristics of the Main Reef series. In the event of the leaders recently struck proving to belong to the Main Reef series, the importance and value of the discovery of the Klerksdorp district and the Rand generally can scarcely be overestimated, as it will at once raise the first named district to the same high mining status as the Rand.

It may perhaps seem strange that in such an old gold-mining district as that of Klerksdorp the possibilities of finding the true Main Reef series should have been so long ignored. Molengraaf, state geologist to the old South African Republic, however, considered the subject, and after him, David Draper and a host of others of varying capabilities, experience, and training, with nearly as many ideas as there are individuals. It is impossible to say whether Hatch or Corstorphine have ever visited Buffelsdoorn and inspected the farms lying to its immediate west, but the latest map by Hatch shows the area to be occupied by beds older than the Main Reef series. Probably the author has depended on information supplied by others less capable of drawing deductions as to the probable deposits of soil and alluvium. If the reef now found belongs to the Main Reef series the principal cause of the difficulty would seem to have been in the inability of the local geologists to correctly identify the Red Reef while they have been disputing among themselves the true age of the Buffelsdoorn series.

Numerous views have been expressed as to the true age of the Buffelsdoorn Reefs, some identifying them as belonging to the Main Reef, and others to the Government series, but the majority regarded them as of Elsburg age. Should the beds recently found prove to be Main Reef series, the majority would appear to have correctly diagnosed the Buffelsdoorn Reefs as being contemporaneous with the Elsburg series. The question may then be asked, why in the event of having correctly correlated the Buffelsdoorn as being of Elsburg age, some well guided attempt should have not been made to find the Main Reef series. The reply to such a question is found in the fact that all the leading geologists consider the Elsburg series to be non-conformable to the Main Reef series, and therefore untrustworthy as a guide to the discovery of the latter.

Undoubtedly the most reliable guide to the Main Reef series on the Rand is the presence of either the Kimberley or Bird Reef series, and as both are claimed to be present and exposed where the Main Reef series has been found on the Klerksdorp district, it is on this point, perhaps, that some explanation is due from local geologists. Lying to the west of the Buffelsdoorn series is a reef known to local geologists as the Red Reef, and this is now claimed to be the Kimberley series instead of belonging to the Government series as hitherto supposed. It would seem therefore that the inability of the prospectors and geologists to recognize the true age of the Red Reef has led to the difficulty of establishing the exact existence of the Main Reef series, and the coloring on Hatch's map showing the country as belonging to the Lower Witwatersand formation below the horizon of the Main Reef series, has seemed to confirm that view.

An equally interesting point to remember is that not only do the discoverers of the Main Reef series claim that they have identified and proved that the Red Reef belongs to the Kimberley series, but they likewise claim to have found and opened the Bird Reef series in its proper position below the Kimberley, or so-called Red Reef, as likewise the Livingstone series; so that the existence of all the different reefs or markers above the Main Reef series is claimed to have been proved and established. It is clear that the prospectors, while being confident that the Main Reef series existed in the neighborhood, were not sufficiently well versed in geology to hit upon the right spot to look for it, because, despite the fact that the country rock was covered by 90 ft. of overburden, the well-known red bar was observable, but they were prospecting on the wrong side of it. On a geologist being called in, he not only traced all the underlying beds from the granite to the Buffelsdoorn Reef, which he identified as being in their proper geological sequence, but he measured from the supposed Bird Reef series, fixed on the position of a bore-hole to strike the Main Reef series at a depth of 600 ft, and struck a rich leader at the base of a reef, going 39 dwt. over 12 inches at a depth of 546 ft. from the surface. The discovery in itself is of course of considerable value, but should its correlation be established with the Main Reef series, it will roughly double the productive length of the Rand, the possibilities of which will now be extended from Randfontein to Klerksdorp, a distance of nearly ninety miles. About one-half of this distance at the Randfontein end is, however, covered by newer formations which will add to the difficulty of prospecting and mining. Discarding the covered area, there will still remain a distance of about fifty

miles to be proved, through which the only drawback would seem to be that in some places the ground is broken and will need careful handling. Twenty miles of well settled country can, however, be relied upon; should the present bore-hole yield of nearly 2 oz. per ton over a width of 12 inches be established even over that length, it seems almost impossible to estimate at present what it may add to the resources of the Rand. The leader first struck has a low dip to the east of about 30°, and being in a country provided with railroad facilities and easily accessible, the working costs ought not to exceed the average of the Rand. The whole matter emphasizes anew the importance of thorough prospecting of outlying districts and augurs well for the future of gold mining in South Africa.

Empire Mines Cyanide Plant

By Frank C. Landguth

The Empire mines at Grass Valley, California, G. W. Starr, general manager, put in operation on December 1 a new cyanide plant, one of the most modern in the West. It was designed by Henry Hanson of San Francisco, assisted by myself. Mr. Hanson also built the plant, being assisted by J. T. Hooper. The plant has a capacity of 150 tons per 24 hours. The building is of wood covered with corrugated iron, the framework on the inside is painted white, and all the tanks and piping are painted dark green. Electricity is used throughout for light and power, the current being delivered to motors six in number, ranging from 3 to 25 hp., at an energy of 440 volts. The site is an ideal one, as it permits the handling of all material by gravity.

The tailing from the stamp-mill flows through 425 ft. of 15-in. terra-cotta tile at 3% grade, supported on T-rail trestle, to the cyanide plant, where it is received direct by the Merrill classification equipment consisting of two settling-cones 8 ft. 4 in. diam., with sides sloping 50°, and five sizing-cones 4 ft. 8 in. diam., sides sloping 70°. To the apex of settling-cones is bolted a multiple casting tapped for 1½-in. pipe. Five of these pipes are in use, one feeding each sizing-cone. Each sizing-cone is fitted with Merrill hydraulic sizer. The pulp is here divided into two products, sand and slime. The slime overflow from settlers and sizers flows through an 8 by 12-in. galvanized-iron V-launder to a 3 by 4-ft. galvanized-iron sump filled with adjusting gates to give an equal distribution of slime to clarifiers, four in number, 24 ft. in diameter by 22 ft. deep, filled with false conical bottoms sloping 45° toward centre, and annular inside launders for clear-water overflow. This overflow is conveyed in galvanized-iron V-launder to a 20 by 16-ft. water-wash tank, from which it is drawn for various purposes.

The thickened slime, sp. gr. 1.4 to 1.8, is drawn from centre of the bottom of the clarifiers continuously through a 1½-in. pipe which discharges 9 ft. above the bottom of the tank through a special cock, fitted with chilled-iron bushing, to a 6 by 10-in. galvanized-iron V-launder which in turn conveys sludge to four agitating-tanks 10-ft. diam. by 18 ft. deep, fitted with central cylinder special nozzles for compressed air at 10 lb. pressure, conical false-bottoms sloping 50° toward centre of tank and piped throughout for continuous system of slime treatment. After agitation the slime flows to the filter department, where it is treated by two Oliver continuous filters of 70-ton capacity.

Among the new features of the plant is the vacuum pump used in connection with Oliver filters, which at 90 r.p.m. makes a 24-in. vacuum and elevates the filter effluent 41 ft. to a 16 by 20-ft. storage tank. This pump is doing excellent work and was designed by Edwin Letts Oliver. An Ingersoll-Rand 10 by 10-in. compressor, making 150 r.p.m., furnishes compressed air for blowing slime-cake off the filters, agitating sludge, and aerating the sand-charges.

The underflow of classified sand from sizing-cones is conveyed through a 10 by 10-in. wooden launder to the leaching department, where an automatic distributer charges the leaching-tanks, four in number, 24 by 10 ft., fitted with an annular inside overflow launder to carry overflow during filling, and a wooden filter-bottom of new design. These bottoms slope ¼ in. per foot toward the centre of the tank and are covered with the usual filter medium. The object in sloping these bottoms is to facilitate discharging through a 12-in. centre gate, Merrill type, with automatic sluicing machines. The sand residue is sluiced to waste through an 18-in. terra-cotta tile. The effluents from sand-vats are conveyed to sump-tanks in two 4-in. pipe-lines. These pipes are fitted with adjustable nipples so that effluent may be turned to any one of the four 20 by 10-ft. sumps. Adjacent to these sump-tanks are two automatic zinc-belts which feed dry zinc-dust to a mixing-cone where a zinc emulsion is formed by adding a small amount of barren solution. This emulsion is conveyed to the pump suctions of two 5 by 5-in. Aldrich triplex pumps, specially designed for handling cyanide solutions, which elevate the solution to two Merrill precipitating-presses of 250 tons capacity. Precipitated solution from presses flows to a 20 by 16-ft. storage tank. So far results show that the plant will be very efficient. I hope at an early date to be able to give a detailed description of the metallurgy.

Cyanidation Plant, Empire Mines.

Discussion

Readers of the MINING AND SCIENTIFIC PRESS are invited to use this department for the discussion of technical and other matters pertaining to mining and metallurgy. The Editor welcomes the expression of views contrary to his own, believing that careful criticism is more valuable than casual compliment. Insertion of any contribution is determined by its probable interest to the readers of this journal.

Sinking the Lightner Shaft, Angels, California

The Editor:

Sir—I have read with interest and surprise an article on 'Sinking the Lightner Shaft, Angels, California,' in your issue of February 4, and the costs as therein given have prompted several questions that I should greatly like to have answered by your correspondent.

It is stated that four baby drills were employed, and yet only four miners on a shift. From this it is inevitable that they chucked their own machines. But from my own experience in shaft-sinking a baby drill has not enough power to throw the mud properly for rapid drilling, particularly on flat cut holes, and is hence less satisfactory, and often more trouble to chuck, than a large machine that always requires the attendance of two men. But presuming that your correspondent was not misinformed, and four men ran four drills, how deep did they drill their holes, and how many holes to a round? Only one labor item is given, namely, $15.70 per foot of sinking. Does this include the engineers on the winze hoist, and the timbermen who placed the sets?

SUPERINTENDENT.

Jackson, California, February 6.

Nichrome Wire

The Editor:

Sir—While working with an alloy of nickel and chromium in the form of a resistance wire, its resistance to the common laboratory fumes and to oxidation at the temperature which it is possible to obtain with the ordinary blast lamp, made it occur to me that this wire might be used to advantage to replace the ordinary platinum triangle.

Several triangles were made by twisting together the ends of three pieces of No. 13 nichrome wire (a larger size could be used with advantage), each about four inches long. The triangles made in this manner were used to support platinum crucibles, which were ignited side by side with others supported on platinum and on common pipe-stem triangles. The crucibles showed about the same loss in weight when ignited by the same means on any of the triangles mentioned. This was true whether they were ignited over a Bunsen burner, blast lamp using city gas (containing a large amount of sulphur), or a gasoline blast lamp. The nichrome triangles when used with city gas, either over the Bunsen or the blast, lost at most one milligram per hour, and at times showed a slight gain or no loss at all When the gasoline blast was used (this did not contain any sulphur) the loss of either the crucibles or the triangles was not more than 0.2 or 0.3 milligram per hour. One of these triangles will outlast a number of pipe-stem triangles and at the same time allow a higher temperature to be obtained in the crucibles. In fact they make a good substitute for the platinum triangle and cost much less. This article has been put on the market by C. H. Stoelting & Co. of Chicago.

R. C. BENNER.

Tucson, Arizona, February 8.

Phosphate Discoveries

The Editor:

Sir—Your editorial remarks on page 128 of the issue of January 21, 1911, apropos of a recent discovery of phosphate rock in Montana by Hoyt S. Gale of the U. S. Geological Survey, seem to me to call for some statement more in keeping with the known facts.

In May 1903 I made the first technical examination ever made in the inter-mountain region of an isolated deposit of phosphate rock, in Rich county, Utah. This was the inception of the discovery of the phosphate field of Utah, Idaho, and Wyoming, and as the result of "careful scientific examination" I personally located at least 80% of the present economically available deposits in that field, during 1903, 1904, and 1905. My letter files during this period show the extensive and accurate information supplied by me to the U. S. Geological Survey, and in the *Engineering & Mining Journal* of May 18, 1907, you will find the first description ever given of 'Phosphate Rock in Utah, Idaho, and Wyoming,' by myself. This paper was an extract from one prepared at the request of the Survey, to appear in 'Contributions to Economic Geology' for 1906. The Survey saw fit to publish another article in that volume, in which I was completely ignored. In Bulletin 430-H, 'Phosphates, 1910,' my early work in the field is grudgingly acknowledged in a few lines that are not even faint praise. I sometimes wonder if this is the usual treatment accorded the independent engineer by the Survey. In regard to Mr. Gale's recent "discovery" in Montana; Bulletin 430-H was written by him, based on work throughout the Idaho, Utah, Wyoming field in 1909, and the Montana section is but an extension of the general field, and Mr. Gale certainly had all the results of others' and his own extended observations to guide him. It is a fact that previous to 1903 openings in the "black stuff" in this field had been shown to members of the U. S. Geological Survey without the nature of the deposits being recognized or suspected. In conclusion, I beg to quote you a few sentences from the paper submitted the Survey January 23, 1907, which paper, as I have remarked, was returned as unavailable.

"An examination of the geologic folios of Carboniferous areas in the inter-mountain section shows a constant reference to chert and black or dark beds at the horizon in question, and I feel convinced that future search with the key afforded by the investigations already made will greatly enlarge the field. Much of the country is at present commercially inaccessible. A wise Providence seems to have made the Carboniferous coal-bearing in the Appalachian and phosphate-bearing in the Rocky Mountain

region: the difference arising in the one being a swamp with a collection and laying up of vegetable material, and the other a shallow sea with the deposit by animal, vegetable, and chemical means of the vast amount of phosphoric acid borne by it from the degradation of the land areas. It behooves the Government of the United States to preserve for future generations this great storehouse of phosphoric acid so essential to the well-being of any nation, and not to allow it to be distributed to every other nation for the temporary benefit of a few dollars. This can be accomplished now when the private holdings are comparatively small and the bulk of it is still to be discovered on the public domain. It would seem to be a legitimate function of the U. S. Geological Survey to have control of the matter."

In contrast to this, in 'Phosphate Deposits in the Western United States,' Bull. U. S. Geol. Survey No. 315, 1907, in the Introduction, the report reads:

"The discovery of these beds has opened up a new industry in the West, the future of which is largely dependent on the granting of such rates by the railroads as will enable the manufactured product or raw material to be sold at a profit in Australia, Honolulu, Japan, and the Middle States, the home market on the Pacific Coast being at present a somewhat limited one."

C. Colcock Jones.

Los Angeles, California, January 24.

[Our reference was of course based on the published record and the contrast we had in mind was not between official and private work, but between well directed scientific surveys such as Mr. Jones undertook, and chance prospecting. It would have been more accurate had we said that previous discoveries had been *mainly* by accident. In giving credit in this case to the geologist, we gladly include Mr. Jones. There can be no greater mistake than the assumption that there are no geologists except those officially designated as such.—Editor.]

Montana-Tonopah Mill

The Editor:

Sir—My attention has been directed to some remarks in a review of your book, 'More Recent Cyanide Practice,' which appeared in the issue of November 12 last, in which several statements are made which do an injustice to the design of the Montana-Tonopah mill, Tonopah, Nevada. Your critic, who writes under the initials of 'C. C.', remarks: "As a sample, Rotherham's article on the Montana-Tonopah mill may be cited. That article was a striking one when published, and Rotherham's clear, concise style of writing pictured the mill admirably to readers of the article. * * * The practice of today at the Montana-Tonopah is now different from that described in the book." Further on he remarks: "All these were admirable at the time of publication, and are yet valuable as a matter of cyanide history, but *in the sense of reliable data concerning modern practice*, are misleading." In fairness to the Montana-Tonopah mill, and to F. L. Bosqui, the distinguished metallurgist who designed it, I wish to point out the inaccuracy of the foregoing statements. The metallurgical practice at the Montana-Tonopah at the present time is practically unchanged from the date when the mill originally started crushing, some twelve months before Mr. Rotherham's article was written. Slight changes in minor details, such as the addition of a melting-room with furnaces for the reduction of cyanide precipitate to bullion, have been added, but these were contemplated when the mill was built, and in any case they do not affect the milling practice. Moreover, as a matter of fact, no important advance in metallurgical practice in the milling and cyaniding of silver ores has been made in the Western United States since the Montana-Tonopah mill was built. The use of tube-mills, vacuum-filters, and zinc-dust precipitation was all incorporated in the original mill. Furthermore, several of the most modern mills recently erected, or now in course of erection, in the United States and Mexico, for the treatment of similar ores, follow closely the practice as originally in use at the Montana-Tonopah. Therefore, I claim that the description of the Montana-Tonopah mill referred to, not only describes present practice at the mill, but that the data furnished should be considered as relating to the most modern milling practice.

Edgar A. Collins.

Tonopah, Nevada, January 26.

An experimental coal mine is to be opened by the U. S. Bureau of Mines in order to demonstrate to miners and other persons that the valuable results obtained in the explosives chamber at Pittsburg are not merely laboratory experiments. J. A. Holmes, the director, has arranged to carry out the same experiments in a coal mine and by an arrangement with the Pittsburg Coal Co. a certain coal property in Brucetown, Pa., has been obtained for these purposes. A new mine will be started under Bureau supervision, in which all sorts of experiments will be possible. Blown-out shots will be reproduced with permissible powders in the presence of gas and coal dust. Black powder will also be used, the shot being fired by electricity from the outside. Short circuits of electric wires in rooms filled with coal dust or with gas will also be attempted. The various remedies for rendering coal dust harmless will be tried, and many important tests in mine ventilation are promised. It is said that miners who have witnessed the destructiveness of coal-dust explosions in the explosives gallery have said that such things do not occur in coal mines. The experts of the Bureau are satisfied that such do occur, but are willing to demonstrate beyond the possibility of any doubt.

The diamond-drill is more serviceable in searching for large orebodies than for those that are small. Great orebodies can be blocked out satisfactorily, but small veins are likely to convey misleading information when intersected by the diamond-drill. Much depends upon the systematic distribution of the holes. Reliable results can only be secured by proceeding methodically.

Concentrates

Most of these are in reply to questions received by mail. Our readers are invited to ask questions and give information dealing with the practice of mining, milling, and smelting.

Quicksilver in large amount has been obtained from the Terlingua mines of Brewster county, Texas.

Antimony and quicksilver do not readily form an amalgam. There are few mineral substances more objectionable in the metallurgy of gold and silver, than antimony in any form.

The damper of the boiler fire-box should never be closed entirely when there is fire on the grates, as gas may collect and result in an explosion as destructive of property as a boiler explosion.

The carbides are the result of the union of carbon with a metal, calcium carbide being the combination of the metal calcium with carbon. The carbides are all artificial and are the product of the electric furnace.

The pneumatic-hammer drill is an excellent device for taking samples in hard veins, as by its use channels of even width and depth may be readily cut. These machines have been used for this purpose to great advantage.

When cyanide solution containing gold passes rapidly through the zinc-boxes only a portion of the gold is precipitated. It is necessary, for good precipitation, to have the current flow slowly, particularly with weak solutions.

Black diamonds, to be used in the diamond-drill, that do not throw off small fragments when struck a blow with a hammer, are useless for drilling, so say some experts. The person attempting this test of carbons should only do so under the careful instruction of an experienced man. A mistake is expensive, as carbons are costly.

In California it is not probable that the entire extent of the profitable oilfields has been determined. There remains much territory to be proved, and there is likelihood of finding profitable oil in untried fields. It is also probable, however, that wells in such districts will have to be deep. Some of the wells have failed and others show signs of weakness. Undoubtedly either a decreasing of oil, or a demand for crude oil in excess of the supply must result in a general revival of interest in the oil business in California.

Pulverizing devices are numerous. It would be difficult to name the various machines that have been introduced for pulverizing ores within the past 30 years. A large number of them were useful and found favor with mining men, but by far the greater number were of no use whatever, other than to show how pulverizers should not be built. They comprised ball-mills, rolls, grinding-pans, hammers, centrifugal and pneumatic devices, each of several varieties. In the designing of a crushing or pulverizing mill the chief things to be considered are: low first cost, as related to capacity; inexpensive operation; few and inexpensive repairs; a perfectly pulverized product, a simple machine, with parts easily replaced. In addition to these there is always a certain amount of prejudice to overcome. A good machine will make steadfast friends, but often the inventor finds it a slow and discouraging process. Merit, however, usually wins.

Separating oxygen from the air, says James Swinburne, is not the same as making liquid air. To separate oxygen from nitrogen involves doing mechanical work, which is converted into heat. A rectifying plant may be considered as an apparatus, which takes in heat substantially at the boiling-point of the liquid with highest boiling-point, and gives it out at a lower temperature near the boiling-point of the most volatile liquid. An air separator thus takes in heat at 90° A, gives out heat at about 82° A, and at the temperature of the works, say, 273° A. The Linde process may be regarded as a rectifying plant of this sort, and a thermodynamic engine, in which a gas is compressed so as to liquefy at 90° A under pressure, and to evaporate at 82°, thus supplying the heat at the boiling-point of the oxygen, and absorbing it at the boiling-point of the air. Such a process is generally considered irreversible, but is in fact nearly reversible and therefore economical. Assuming an efficiency of 40%, the cost of oxygen comes out approximately one shilling per ton on a large scale. This ought to lead to its use in blast-furnaces and other cases where an extra high temperature may be important.

The largest mass of gold ever found free from quartz, of which there is any record, was that taken out of the Byer & Haltman mine, Hill End, N. S. W., May 10, 1872. It was imbedded in blue slate 250 ft. from the surface. It weighed 640 lb. and was 57 in. long, 38 in. wide, and averaged 4 in. thick. It was valued at $148,800. The Welcome Stranger nugget was found on Mt. Moliagel, Australia, Feb. 9, 1869. It weighed 190 lb. and was valued at $45,000. The Welcome nugget was found at Bakery Hill, Australia, June 9, 1859. It weighed 184 lb. 9 oz. and was valued at $44,356. The nugget found August 18, 1869, in the Monumental quartz mine, 12 miles north of Downieville, Sierra county, California, was the largest piece of gold ever found in the State up to that date. It weighed 1142.25 oz. or 95½ lb., cleaned, and was worth $21,156.52. It was found in decomposed quartz 25 ft. from the surface. A pocket was discovered in the Bonanza mine, at Sonora, Tuolumne county, California, in the early days of that mine, about 350 ft. from the surface. This pocket produced $360,000, and the central mass of solid gold was worth $40,000. It is claimed that nearly $3,000,000 was taken from a hole on the Morgan mine, 20 by 20 by 30 ft., on the summit of Carson hill, Calaveras county, California, in 1851. This latter has probably been exaggerated somewhat, though there is no doubt a large amount of gold was taken from that place.

Special Correspondence

LONDON

Zinc Production at Broken Hill. — Milling Methods. — The Sulphide Corporation and Minerals Separation Co. — Amalgamated Zinc. —Broken Hill Block 10.—Elmore Process.

The news relating to the zinc production at Broken Hill is published more quickly and completely in London than in Australia, so I owe no apology to your readers for treating them this week to a disquisition on this subject. I will begin with the Sulphide Corporation, which was formed originally in 1895 by Gibbs Bright & Co., of Melbourne, and the Exploration Company of London, to acquire the Central Mine at Broken Hill and the Ashcroft wet electrolytic process. Subsequently, this method of treating the ore was abandoned, and at about the same time the Exploration Company withdrew. The ore is now treated for lead by jigs and tables, and the zinc tailing by the Minerals Separation process. For a long time the ordinary shares received no dividends, but payment was resumed for the year July 1908-9, when 10% was distributed. The preference shares have received 10% per annum to date. During the year ended June 30, 1910, the company has been highly prosperous and the preference shares (£550,000) and the ordinary shares (£412,500) both received dividends of 15%. Production at the mine has continued uninterruptedly and 231,748 tons was raised. The lower levels have additional reserves which now stand at 2,702,000 tons. The ore raised yielded 51,342 tons of lead concentrate assaying 61.8% lead, 9.4% zinc, and 28.4 oz. silver. The tailing and slime, together with 47,129 tons of dump tailing, were treated in the zinc plant and yielded 88,767 tons of zinc concentrate, assaying 43.5% zinc, 11.2% lead, and 14 oz. silver. Plant is now being erected for the purpose of re-treating this concentrate in order to remove some lead and increase the zinc content. The lead concentrate is smelted at the company's works at Cockle Creek, where a new smelter is in course of erection. Most of the zinc concentrate goes to Germany and some to the Central Zinc Co.'s works at Seaton Carew in the North of England. It is notable that by the present arrangement of the concentration plant, the whole of the ore is beneficiated, the slime going to the flotation plant along with the zinc tailing.

While writing of the Sulphide Corporation it will be of advantage to say something of the Minerals Separation company which is treating the zinc tailing. The company owns the Sulman-Picard-Ballot-Hoover flotation patents for the concentration of sulphide ores. The plants are situated at the Sulphide Corporation mine, Broken Hill; one plant owned by the corporation treats current zinc tailing at a royalty, and the other, belonging to the Minerals Separation company, has been treating old zinc tailing dumps of the corporation. The dump plant treated during 1909, 193,842 tons and produced 68,532 tons of concentrate assaying 46.8% zinc, 8.9% lead, and 14 oz. silver, at a treatment cost of 7s. 9d. per ton. During the 9 months, January to September 1910, the amount treated was 179,218 tons, yielding 62,775 tons of concentrate assaying 46.9% zinc, 9.4% lead, and 14.2 oz. silver at a cost of 7s. 6d. per ton. During the last part of the period the cost had been reduced to 6s. 8d. per ton. The Sulphide Corporation dump was then exhausted. The whole dump had contained 481,859 tons for which Minerals Separation had paid £177,686 in cash. The plant cost £25,903 and the treatment cost £142,722. The concentrate produced sold for £492,955, and after paying brokers' commissions, etc., the net profit was £120,788. Since October 1 the plant has been working on lower-grade tailing, paying no purchase price to the Sulphide Corporation, but sharing the profit equally. The company is erecting plant at the Great Fitzroy copper mine in Queensland; also at a copper mine in New South Wales, and at a zinc-lead mine in Finland. Arrangements have been made to work the process actively in North America by means of a subsidiary syndicate, for whom E. H. Nutter and James Hyde will act as technical advisers. An interesting improvement in the process not before recorded is that whereby the first flotation produces a zinc concentrate high in lead and the second a zinc concentrate low in lead. The advantage of this is that in the subsequent dressing out of lead on Wilfleys much less material has to be sent over the tables than when one uniform product is made. Unfortunately the company is still in the midst of lawsuits. Two have been commenced; one against the Zinc Corporation for breach of contract, and one against the Amalgamated Zinc (De Bavay's) for infringement of patents. Actions in which the company's process is implicated have been taken against the Sulphide Corporation by the Elmores and by the Potter company. Under the circumstances the company is not distributing any dividends, but conserving the large cash profit it has made. The most unfortunate lawsuit of all is one against Theodore J. Hoover, who has been engineer to the company in London for the last three years and during that time has improved the mechanical process in many important ways. His engagement terminated on December 31 last, and the company has since

Map Showing Position of Broken Hill.

applied to the Court of Chancery to prevent his retaining certain records.

Another company engaged in concentrating zinc tailing at Broken Hill is the Amalgamated Zinc (De Bavay's). This company was formed in Melbourne in September 1909 for the purpose of expanding the operations of the De Bavay Treatment Co., which owned the De Bavay flotation process for producing zinc concentrate from Broken Hill tailing. During the half-year ended September 30 last, 160,957 tons of tailing was treated, producing 47,448 tons of zinc concentrate assaying 48% zinc, 7.12% lead, and 7.28 oz. silver, and 767½ tons of lead concentrate assaying 54% lead, 11.8% zinc, and 23 oz. silver. The second unit of the new plant commenced work in August, the old mill being at the same time abandoned; and the third new unit began operating at the end of October. During the first part of the half-year therefore the output came from the first new unit and the old mill, and during the latter part from the two new units; the third and final new unit did not come into operation until after the expiration of the period under review. When the company was formed £150,000 was

estimated as the expenditure required for erecting the new plant. Owing partly to the difficulty of obtaining efficient labor this estimate has been exceeded, and the figure eventually will be about £190,000. Some of the extra expenditure is due to improved methods introduced since the company was started, the increased capacity thereby gained having an important influence on profits. During the half-year the income from sale of concentrate was £135,057 and the profit was £43,390. Out of this £10,000 has been allowed for depreciation and £25,000 has been placed to reserve. The half-year commenced with a balance of £28,816, and the balance on September 30 was £37,206. Since the close of the year a dividend of 1s. per share has been distributed and the intention is to declare dividends quarterly. During the half-year the options on the remaining 122,500 shares have been exercised, so the whole of the £500,000 capital has now been issued. The company still has dump material to treat and has long contracts for the current output of the Broken Hill South, North Broken Hill, and Block 10 mine. The report mentions that the company is defendant of a suit brought by the Minerals Separation Co. for infringement of patents.

The work at Broken Hill Block 14 mine is restricted to winning carbonate ore left behind in the upper levels. During the half-year ended September 13 last, 12,420 tons was raised averaging 31% lead and 14¾ oz. silver, as compared with 12,876 tons averaging 32% lead and 16.4 oz. silver during the previous six months. As regards further supplies, F. Voss Smith, the manager, finds it impossible to give any estimate; though few solid bodies of ore are left, prospecting and reopening of old stopes is bringing to light small bodies of ore. It is probable that the mine will continue to yield for sometime. Little has been done in mining the sulphides, the reserve of which amounts to 220,000 tons averaging 12% lead, 9% zinc, and 8½ oz. silver. About 500 tons has been raised for the benefit of the Murex company which has erected a plant on its own account for the purpose of testing the process. It has proved successful in obtaining a mixed sulphide concentrate from the crude ore, but the necessary plant for the second part of the process, that is, separating the mixed sulphides, is not yet in working order. During the half-year the carbonate ore was sold to the Proprietary company for £24,891, and the net profit was £5278.

In a review of the zinc position published in your issue of January 7, it was mentioned that work at Broken Hill Block 10 mine had been suspended for three months at the beginning of 1910 owing to the coal strike. Work was resumed on April 18 and has continued since. During the half-year ended September 30, 53,558 tons of sulphide ore was mined and 53,025 tons sent to the lead plant. This ore assayed 12.4% lead, 13.9% zinc, and 12½ oz. silver. The lead concentrate produced amounted to 7608 tons assaying 59.25% lead, 7.6% zinc, and 34 oz. silver. It was also stated that arrangements had been made to treat the zinc tailing by the Elmore process instead of selling it to the Zinc Corporation and the Amalgamated Zinc (De Bavay's) Co., and that four units capable of treating 800 tons per week commenced operations at the end of June. The results obtained were not satisfactory and the plant was closed at the end of September. During the time it was running 3548 tons of zinc tailing was treated, assaying 17.58% zinc, 3.77% lead, and 7.84 oz. silver, and the yield of concentrate was 964½ tons assaying 43.63% zinc, 9.6% lead, and 20.91 oz. silver. The recovery was 67% of the zinc, 69% of the lead, and 72% of the silver. The performance of the plant varied, and the slime was not amenable to the treatment. It seemed probable that the plant would have to be greatly enlarged in order to make a profit. The acting manager, J. N. F. Armstrong, was of the opinion that the recovery could be improved with practice, but the board decided to revert to the old custom and sell the tailing to the De Bavay company. One reason for encouraging them to do this was that they had no satisfactory contract for the disposal of the zinc concentrate, whereas the De Bavay company had. Probably the fact that W. L. Baillieu has a large say in the direction of both companies had some influence on this decision. During the year the lead concentrate was sold for £46,509, and the credit for zinc concentrate sold but not paid for and for other small items of income brought the total revenue to £56,490. On the other side of the accounts the working expenditure came to £60,481, making a loss of £3991. Out of the tailing reserve account of £22,991 carried forward from the previous half-year, it was possible for the company to distribute £15,000 as dividend, being at the rate of 3s. per £10 share. As regards the developments in the mine the main shaft is now down 1715 ft. and a new level is being opened at this depth.

FAIRBANKS, ALASKA

Drilling Company Organized. — Discoveries of Rich Ore. — Progress Made by Lessees.—Bank Suspension Ties up Money.

A party of business-men, in December, incorporated the Fairbanks Core Drill & Mining Company, with a capital stock of $25,000, and no move will be made to sell any until spring, or soon enough to get at least two drills in by the first boats. The object of the company is not only to drill holes at so much per foot, but also to acquire interests in quartz or placer properties for prospecting same. The directors are R. L. Palmer, Roy Hall, R. C. Wood, E. H. Mack, L. M. Drury, George Hunter, and E. A. Suter. E. H. Mack is manager. The Fairbanks Quartz Development Co. has also been incorporated, and its primary purpose is to determine the future of at least one of the quartz mines in the district and to stimulate the industry in a legitimate way. One of the most important discoveries in the camp was made on the Friedrich property at the head of Vault creek. This was in the shaft of the Peterson lease at the 75-ft. level. The shaft was sunk through the edge of a rich orebody, from which picked samples could be taken that would pan from $5 to $10 per pound. Three samples taken across the 2-ft. ore-shoot showed, respectively, $1057, $1257, and $2224 per ton. A shipment of 3½ tons of ore from the Cook Bros.' property on Fairbanks creek gave returns in the local test-mill of $73 per ton. There is in the bottom of the 50-ft. shaft a foot of ore, samples of which assayed $290 per ton. It is thought another good shoot of ore has been encountered. Just below these claims Goyette and Jacobson have a promising property. A shipment of 3 tons gave returns of 13.1 oz. assaying $74 per ton. More ore is to be taken out and hauled to the mill in town. Close to Cook Bros.' mine, August Hess is working on a vein that may make a mine. Rich ore has been found carrying coarse gold. A piece of quartz from the Rhodes-Hall mine on Bedrock creek weighs over 300 lb. and contains considerable free gold. The property on Bedrock creek is looking better, and at the end of the 700-ft. adit the vein was again found and has been followed a distance of 80 ft. The ore is shipping grade. Another adit has also been driven this winter at a level about 150 ft. higher.

The Calvin lease, on the Pioneer quartz claim, has a vein of rich gold quartz. This property is on Chatham creek and is one of the first claims located for quartz. When Mr. Furstenau gets back, Mr. Calvin will probably sink 300 ft. on the lease held on the Jupiter-Mars property. The lease taken by Sherrard and Golden on the Heshberger-Buell-Phipps property bids fair to be a profitable one. At the bottom of a 40-ft. shaft the ore-shoot was found by driving to the east. Some of the ore assayed $208 per ton. A shipment of 30 tons will soon be made to the Chena custom mill. A mill-run on 7 tons from the Buell lease on Willow creek gave returns of $25 per ton. More ore is being taken out that is thought to be of higher grade. Work on the Spaulding-Clough property at the head of Dome creek has been suspended until a boiler and hoist can be installed. Some driving was done on the 100-ft. level. Besides good ore in the shaft, there are known to be veins on both sides that may be opened. Except for the distress caused by the suspension of the Washington-Alaska Bank, the outlook for development of the quartz properties never looked so favorable as now.

SALT LAKE, UTAH

Metal Production for 1910.—Coal Output.—The Ohio Copper. — The Tooele Smelter.—Park City Mines.—Tintic District.

Advance reports of the local office of the United States Geological Survey show that the gross value of the mineral production of Utah during the year 1910 was in excess of $33,000,000, an increase over 1909 of about $1,600,000. Dividends exceeding $8,000,000 were paid by 18 different companies. Ore mined amounted to 6,163,089 tons, an increase of 1,000,000 tons over 1909. Seventy per cent of the total came from the porphyry deposits at Bingham; 11% of the total was shipped direct to the smelters and the rest was milled, all but a small portion being concentrated. Copper production was 126,000,000 lb., an increase of 14,000,000 lb. Production of zinc was materially increased and this increase in copper and zinc tended to an increase in the production of gold and silver, notwithstanding the fact that there was a decrease in the production of lead. The Government Assay Office at Salt Lake purchased gold and silver bullion to the amount of $916,305. Total production for the year was as follows: gold, 239,499 oz.; silver, 11,782,990 oz.; lead, 112,209,256 lb.; copper, 126,000,000 lb.; zinc, 15,337,367 pounds.

The production of coal for the year (State Coal Mine Inspector's report) was 2,526,093 short tons, an increase of 204,000 tons; and of coke, 146,064 tons, a decrease of 35,000 tons.

The output of the Utah Copper Co. for December 1910 was 7,137,585 lb., a decrease of 331,415 lb. from November. More rumors are extant concerning the Ohio Copper Co., the latest one being that the Heinze interests including the Mascotte tunnel will be taken over by an Eastern syndicate which will take up the remainder of the authorized bond issue, pay outstanding indebtedness, and complete the mill. The Tooele smelter is now showing a small surplus as the result of its operations. International stock is now paying 8%, the profits coming from the refinery at Raritan, New Jersey. The tunnel heading of the Utah Metal Co. has passed through the lime belt, and is now being driven through a porphyry dike. The side-line of the Bingham Metal Mining Co. has been passed, and driving is now in the Sunset group. Mrs. F. Kent Smith, of Butte, Montana, has been awarded a Carnegie hero medal and monthly allowance of $80. Her husband, F. Kent Smith, while assistant superintendent of the Utah Copper Co., lost his life in attempting to rescue an Italian miner lost in a winze in which gas had been tapped.

One of the most important ore discoveries in the history of the Park City district has been made in the Andes claim, owned jointly by the Silver King Consolidation and Silver King Coalition. The find was made by the Consolidated and the extent has not been determined. It was made in a fissure vein, the ore being found in the vein proper, and in bedded deposits on the sides. An assay, made without sorting wall-rock from ore, showed 50% lead, 40 oz. silver, and $3 to $4 gold. At the Daly-Judge the water on the 1600-ft. level has been reduced to 500 to 600 gallons per minute; the old water course has been avoided in the new work, and for the first time the drifts in this mine have been extended into quartzite. A considerable tonnage of milling ore is available on the lower level, which will be developed when the shaft is sunk to a level which will connect with the Ontario drain tunnel. In the old California mine, in Thane's Canyon, which is in the hands of lessees, a 6-ft. vein has been opened containing zinc and lead. The ore is being shipped to the Huff electrostatic mill at Midvale.

The new pumps in the Centennial Eureka, Tintic district, have brought the water to the point where it was considered safe to shoot out the concrete bulkhead put across the drift on the 2250-ft. level. As soon as the extra flow brought on from this drift is thoroughly under control the workings on this level will be extended. The Grand Central has shipped 12 to 14 cars of ore from stopes between the 2000 and 2100-ft. levels. The ore consists of copper, accompanied by gold and silver. The Grand Central has become involved in another suit with the Mammoth. This time the latter is complainant, the suit being to determine the ownership of a triangular piece that is overlapped by claims of each company. The Scranton mine has a new railroad spur by which ore shipments may be increased to 1000 tons per month. The 1900-ft. level of the Eagle and Bluebell, through which the King William is being operated, has been extended 200 ft. into the ground of the latter in which are stringers of manganese, iron, and calcite. The cross-fissure, which is the objective point, is about 75 ft. ahead. The Eagle and Bluebell people recently opened a body of ore which assays 40% lead and 100 oz. silver. Manager's report on the Sioux Con. shows that the cash balance was increased $75,000 during the last year, $165,000 net profit was made, and dividends amounting to $90,000 were paid.

DENVER, COLORADO

Labor Trouble. — Report of Legislative Committee. — Cripple Creek News.—Celebration at Leadville.

The strike in the northern coalfields seems farther from a settlement now than ever. Conditions became acute late in December, when, through the laxity and sympathetic attitude of the town marshal at Lafayette, the striking miners were emboldened to such an extent that they disregarded the injunction protecting the employees and property of the Northern Coal & Coke Co. As a result 16 of the offenders are now serving a one-year jail sentence for contempt of court. Friends of the miners have brought the matter to the State Supreme Court by asking for a writ of supersedeas. The argument advanced is that the lower court exceeded its jurisdiction and has seized and imprisoned men without due process of law. The court has taken the case under advisement. Unless the decision favors the labor organization there will be radical measures regulating the issuance of injunctions introduced into the present legislature. The legislature now in session has appointed a committee to investigate conditions in the affected district.

The report of the committee appointed by Governor Shafroth to study the conditions in the several coal mining districts of the State and to recommend changes in the present laws has been presented to the legislature. The committee finds that the present system is inadequate and ineffective, because of the limited number of inspectors. Seven resident inspectors, subject to the chief coal mine inspector, are recommended, and, in addition, a commission of three experts with discretionary power to close mines that are not safe is to be created; the expense of this supervision is to be met by a tax of 1c. on each ton of coal mined. The remainder of the report is also sensible and reflects credit on the committee. It is to be hoped that if these suggestions are adopted the selection of inspectors and members of the commission will be made on a strictly civil service basis.

The Roosevelt tunnel has been completed without encountering any underground lakes or dangerous water-courses, as some of the newspapers predicted. Cripple Creek operators are enthusiastic over this method of drainage, and the Tunnel Association has called for estimates on a lower tunnel. A lateral is now being driven from near the bottom of the El Paso drill-hole to cut the C. K. & N. vein which was the cause of flooding the El Paso mine. The wrecking of the upper Granite mine plant by an explosion of dynamite and the burning of the Abe Lincoln shaft-house are two rather sinister events to chronicle so early in the year. Incendiarism is suspected in both cases. The milling of the low-grade ores of the district is the live topic of the camp. With the new Portland mill in successful operation, and the promise of a new unit to be added to the Independence mill, and construction work already begun on the Ajax mill, the operators of the mills at Colorado City are becoming worried. The Clancy electrochemical process is being tried out on the Ajax ore and if successful will be the first installation of that process in the camp. There is a persistent rumor that the Golden

Cycle mine and mill have been sold to the Consolidated Gold Fields of South Africa. The coal lands of Colorado Springs are not included in the deal.

It may be difficult to figure out just what connection Robert Burns ever had with mining, but a stranger in Leadville on January 25 would have guessed him to have been a patron saint of the industry. The Scottish society was celebrating his birthday and the whole city joined in the festivities in recognition of the returning prosperity of the camp. A feature of the occasion was the luncheon served in a zinc carbonate stope on the eleventh level of the Wolftone mine. A new $5,000,000 corporation, known as the Moose Smelting & Refining Co., is reported as about to erect a smelter at Alma. As there is already one smelter in this small camp there promises to be competition keen enough

Portal of Roosevelt Tunnel.

to satisfy the most ardent opponent of the smelter trust. The local papers have been full recently of reports of a rich ore discovery at Kremmling. Rich pockets of ore are said to have been found and a few people have staked claims on the snow in anticipation of a rush to the district in the early spring. The latest rumor is that a railroad is to be built in to Kremmling.

BUTTE, MONTANA

Record of January Operations. — Electric Power and Compressed Air to Supplant Steam. — Anaconda Company v. Butte & Ballaklava.

The January production of copper by Butte mines was 22,062,930 lb., against 22,879,116 in December. On account of a fire in one of the principal mines of the Anaconda company several properties were closed for a week, but the production of other mines of the company was increased so that there was little falling off on account of the fire, except in the North Butte mines, which are connected with the property in which the fire occurred, and they were closed for three days. The Boston & Montana properties were all down for four days during January on account of extreme cold weather which interrupted smelter operations at Great Falls.

The daily ore tonnage for the month of January, average yield of copper per ton and the average gross yield daily are as follows:

Companies.	Daily ore tonnage.	Yield per ton, lb.	Daily output, lb.
Anaconda	3,850	60	231,000
Butte & Boston	450	61	27,450
Parrot	320	60	19,200
Washoe	330	60	19,800
Trenton	380	58	22,040
Original	620	62	38,440
North Butte	900	61	54,900
Butte Coalition	1,100	68	74,800
Tuolumne	300	90	27,000
Boston & Montana	3,000	65	195,000
East Butte	380	95	36,100
Totals	11,630		745,730

Now that the fire has been subdued in the High Ore mine, all the properties in operation previous to the fire are in running order, and the work of dismantling the Mountain View is making rapid progress; it is expected that another month will witness the hoisting of ore under the new compressed-air system. After the Mountain View has been got into successful operation the work of preparing two other mines will be commenced, and by May 1 it is expected three mines will be operated under the compressed-air system. In making the changes it is being arranged that no two mines shall be closed down at the same time, so as not to interfere with the usual monthly output. Just as soon as it has been fully demonstrated that the compressed-air system is cheaper and better than that of steam, the work of extending it to all the mines will be undertaken. The coal used at the mines of the Anaconda company costs over $2,000,000 per year, and this expenditure will, of course, be done away with altogether when the compressed-air system is put into general use. The electric power for driving the air-compressors will be supplied by the Great Falls Power Co. and will bring the cost down to one-third of what it is costing the company through the employment of steam-power.

The annual meeting of the Butte-Alex Scott company is to be held at Pittsburg on February 14, when it is expected important business will come up for consideration. Since the last meeting the company has made considerable progress and the mine has become a producer. One month ago the company began shipping ore to the East Butte smelter, and the net results of the first month will not only pay all expenses, but leave a neat sum for the treasury. A suit has been filed against the Davis-Daly company for $45,000 by a man who claims that he suffered injuries of a permanent character through the fall of a cage. F. Augustus Heinze is the head of this company.

The granting of an injunction and sudden termination of the suit of the Anaconda company against the Butte & Ballaklava company came as a surprise to those who had been watching the case. The question came up on application for a permanent injunction, and the Anaconda company occupied two days in putting in evidence to show that the Butte & Ballaklava company was working on apexes in the Mountain Chief and Right Bower ground belonging to the Anaconda company. A model prepared by the plaintiff was brought into use to demonstrate the claims of the company. The engineers of the plaintiff gave evidence as to their examination of the ground in dispute, and were followed by H. V. Winchell, of Minneapolis, and John W. Finch, of Denver. Both experts stated that they had examined the ground in controversy and were familiar with the same. They declared that the vein being worked by the Ballaklava people had its apex in the Monntain Chief ground. Following Mr. Finch, the president of the Ballaklava company was called to testify by the attorney for the plaintiff. He was asked if it were not a fact that Mr. Atwater had made an examination of the working and made a report on the same. The reply was that he had no formal knowledge of any such report, but believed that Mr. Atwater had reported verbally to others. "Is it not a fact," asked Kelley, attorney for the Anaconda company, "that he did make such a report and that later it was reported to have been lost, and Mr. Atwater sent you a copy?" To this question Mr. Nelson replied that it was not. There is an interesting story in connection with this question as told by Anaconda company people to the effect that Mr. Atwater made a thorough examination of the property and afterward made a report which was not considered a favorable one, and that it was never given out. After the plaintiff announced that there was no further testimony to be introduced the defendant company stated that at this time no testimony would be introduced, admitting that a case sufficient to justify the judge in granting the injunction had been made out. This concluded the case for the present, and the judge accordingly made the order. The case will next be heard on the action of the Anaconda company to recover $750,000 from the Butte & Ballaklava company for ore alleged to have been extracted from the disputed ground. Two and possibly three months will elapse before this suit is heard.

KALGOORLIE, WESTERN AUSTRALIA

Collapse of the Bullfinch District Boom. — An Engineer's Report. — New Field of Ora Banda.—The Fuel Problem.

Australia has witnessed mining booms during the past few years, in which ore may have been found in one lease, followed, of course, by finds on others; then there were flotations in which shares soared to absurd prices, and when the truth came out, the booms burst at once. As a few instances of this sort of thing, take the Smith Creek tin, and Cloncurry copper in Queensland; Brisels Extended tin and Mt. Balfour copper in Tasmania; the Arltunga goldfield in South Australia; Mt. Maroomba lead and silver in the Northern Territory; and lastly, the Bullfinch rush in Western Australia. The only good point about these booms is that they attract numerous prospectors to the locality, so that the district is examined promptly. But the pegging out of leases, publishing reports of high value of ore, extravagant press reports, reckless company flotations, serve no good purpose in legitimate mining. The Bullfinch mine is no doubt of exceptional value, and has produced some remarkable ore, and it is to be hoped that it will continue; but it does not follow that every lease adjacent, or miles away, is of equal value. Yet this is what the press and others would have the public believe. The truth was bound to come out, and it did, with a vengeance, from the Chaffinch, a lease next the parent mine. Here was a showing with a market value of about $1,000,000. On what? On the strength of a small bunch of rich ore that was all easily put in a few bags. There were such differences of opinion between the manager, Greenway, and the director, Arthur, that the report of an outside mining engineer was demanded, and the following is the report of Mr. Grut, of Kalgoorlie: "Acting under your instructions, and after preliminary delays due to Greenway's accident, I have inspected your property in presence of Greenway's representative and Arthur. Five bags of ore deposited with bank by Greenway, stated to be taken from trench soon after Arthur obtained rich ore, assayed 20 oz. gold per ton of 2240 lb. At the time of my inspection, the trench had been deepened and widened about one foot. Arthur expressed himself confident of finding more rich ore, but after digging some time in my presence, failed to show me any gold. This trench, 30 ft. long, is situated near the northwest corner, close to the west boundary, and was designed to open a vein of quartz 6 in. wide, which, even if it carried a good class of ore, would be unimportant because it is dipping out rapidly from it. However, the highest assay of the ore is under $2 per ton. This sample was obtained within 18 in. of the spot where Arthur obtained his rich ore. This sampling was carried out in sight and approval of both parties. Shaft has been sunk 30 ft. in oxidized formation at southwest corner, but samples less than $1. The only other work of importance is a 90-ft. trench at northwest corner, and 130-ft. trench next the shaft. No ore whatever has been found elsewhere in these. Greenstone outcrops practically all over the lease. Nothing payable has been met with as yet, nor any reasonably promising lode or reef found. Very little is really known of the main geological features of the field. On account of this it is impossible at present to form any reliable judgment respecting the future prospects of your property, on which but little work has been done. I should advise systematic and careful prospecting, shaft sinking, driving, and crosscutting to prove formation. The recent absolutely unwarrantable rise in shares, it appears, was caused by injudicious publicity given to Arthur's find, followed by irresponsible journalism." The boom collapsed on this report, and the market prices fell. Grut has made enemies through his condemnation of the Chaffinch as it now stands. The Government has instructed the Detective Department to investigate, and find out who sent certain telegrams. The Bullfinch has crushed 399 tons and extracted $105,000. From No. 2 shaft, 70 tons of ore has been mined averaging $420 per ton. Stripping the lode at No. 1 shaft, west drift, 100-ft. level, ore in face samples $123 per ton. The miners on the field are all on strike for the same wage as is paid in Kalgoorlie, namely, $2.80 per 8-hour shift, in place of $2.60 which is paid in the Southern Cross district, where conditions are rougher than here. The second sale of 59 blocks at the Bullfinch townsite brought $48,000. Probably some people will regret having paid as high as $2000 to $4000 for these blocks. One block on which the owner will be granted a license, brought $15,000. It is probable that the Corinthian leases will be floated before long. Both the Mountain Queen and Transvaal mines are well opened and are ready to mill ore. The telegraph line has been extended to Bullfinch, while the water-pipe and railroad work is eleven miles out, or about half way. The field at Ora Banda, 40 miles northwest from Kalgoorlie, is attracting attention, a great deal of work has been done, considerable ore has been crushed, and mining men favor this field more than the Bullfinch district. Lack of water and crushing facilities militate against the progress there. As a whole, the Ora Banda may be described as a medium-grade field. The ore is soft, slimes a great deal, and may average $12. So far as work has been done on the sulphide ore in the Gimlet mine, it is promising. The Minister for Mines has visited the field, and promised a water-supply and other necessaries. The Government, acting probably on the suggestion of the Chamber of Mines, is to increase the geological staff by several members. The Golden Treasure lease of the Horseshoe has 8 ft. of $8 ore at 350 ft. Tributers working at 100 ft. in the Paringa mine, north of the Associated Northern, crushed 297 tons of ore assaying an average of $25 per ton, and 163 tons worth $13; all of this was the typical sulphide ore mined in this section. This mine has a shaft 1300 ft. deep, and it has been thought that it would open some of the shoots from the larger adjacent mines. Tributers have always done well on this lease.

We are threatened with another wood strike. The men want 6 cents more for cutting, and a few other small concessions. Some interesting correspondence has been published lately on the relative efficiencies of our local fuel and Newcastle coal. The evaporative power of the wood is about 3.5 to 5 lb. of water from and at 212°F., against the coal evaporating 8.5 to 13 lb. from and at 212° F. The Western Australian coal is not of great evaporative power, and will not stand much handling and exposure. It would pay to use the New South Wales coal when our firewood supplies give out, although we may also be able to get cheap oil from the Wolgan shale field in New South Wales before long. The Inspector of Forestry in Western Australia, in his annual report for the past year, states that the firewood consumed by the mines of the 'Golden Mile' of Kalgoorlie totaled 474,434 tons; this is a trifle lower than the consumption of the previous term on account of the fire at the Perseverance. The fuel was valued at $1,460,000. Domestic fuel used in Kalgoorlie amounted to 23,500 tons, and mining timber, 12,400 tons. The various electric light and power stations are supplied with wood from the district. The report further says: "The continued alienation of State forests and timber country for agricultural purposes causes some anxiety as regards the future supplies for mining timber. Firewood supplies, however, are greatly dependent on the advance of science toward obtaining a maximum of power from a minimum of fuel, as the production and use of natural oil, gas, and electricity are coming into favor and taking the place of wood."

The November gold yield was valued at $2,650,000, and dividends totaled $225,000. The Associated Northern mill is treating custom ore and concentrate from all parts. The new plant at the Horseshoe is completed, and the new stamps, Wilfley tables, 60-ft. tailing wheel, and tube-mills should soon be in operation. The new 7½ Gates breaker is at work, and the 1000-kw. low-pressure turbo-generator (A. E. G.) is running. The Perseverance mill is operating, and costs are down to $2.26 per ton, which is the lowest of all dry and wet mills, except the Ivanhoe, at which they are as low as $1.96 per ton. The Perseverance ore averaged $5.52 per ton extracted, the Rand average being $6.24, yet the former makes a profit of $18,000 on such low-grade ore, using high-wage white labor. It makes one think a little on colored labor efficiency.

NEW YORK

Copper Production. — United Metals Selling Co. — Possible Selling Agent. —New Copper Producers. — Comment on Copper Mines. —Silver Review.—Production and Demand for Tin.

The Copper Producers' Association statement places the stocks of copper on hand January 31 at 142,439,490 lb.; stocks on hand December 1, 122,030,195; increase, 20,409,293. Production, 115,696,591; domestic deliveries, 42,078,550; exports, 53,208,739.

The Guggenheim faction has successfully entered into the selling end of the metal market. One of the prizes for which the line-up of forces has been made has been the handling of the metal. It follows, therefore, that nothing could more fully illustrate the getting together of the copper people than the rumored dissolution of the United Metals Selling Company. This concern has long been known as by far the largest copper broker in the world. Its fortunes have been closely connected with those of the Amalgamated Copper Co.; it was formerly controlled by the Lewisohn Brothers, of whom Adolph Lewisohn is the surviving partner, but more recently has been under the management of Urban H. Broughton, son-in-law of the late Henry H. Rogers. Mr. Broughton has been for some years the controlling factor in Utah Consolidated. The bulk of the copper handled by the United Metals Selling Co. comes from the Amalgamated Copper Co.; formerly the selling agency owned the refinery, at Raritan, N. J., but when the Cole-Ryan interests started to build up the International Smelting & Refining Co. this plant was sold to the new concern. Mr. Broughton is evidently held responsible for the policy adopted by the United Metals Selling Co., of keeping up the price of the metal and accumulating stocks, in opposition to which the Guggenheims have kept sold well ahead, marketing copper as fast as it could be turned out, and making the price such as to induce buyers to come into the market. The manner in which the Guggenheims have prospered as selling agents has evidently not been pleasing to Mr. Broughton's associates. The latter gentleman is about to retire, it is said, from active business life and return to England to live. Following this determination, made public some little time ago, comes the rumor that not only is the United Metals Selling Co. no longer 'to hold the umbrella,' but will, in all likelihood, be liquidated and go out of business. The Amalgamated Copper Co. has been paying some $250,000 annually in commissions on copper sales, an amount which, it is conceived, could easily be saved in large part to the shareholders by the appointment of a general sales agent who could act for the various mining companies, dividing the actual marketing expense pro rata. It is thought this could be done without coming into contact with any of the statutes, State or Federal. The elimination of so important a factor as the United Metals Selling Co., if indeed such elimination is to be accomplished, points out very strikingly the economies now being enforced in the handling of copper, while the formation of a voluntary association or the appointment of a selling agent, to act for the various companies, will simply be another step toward a final consolidation. The metal market was improved materially this week by the sale of some 30,000,000 pounds, mostly for European account.

The near future will see some of the developing coppers go into the ranks of the producers. The Miami mill is to start up in about three weeks. D. C. Jackling has just returned to New York from a visit to the Ray Consolidated and the Chino, and says that the Ray mill will start up about February 20 and will be running at half capacity—4000 tons daily—by July, and at full capacity by the end of the year. The Chino plant is to handle 3000 tons daily and will be in operation in July. The Ray Consolidated product is expected to cost 9c. per pound, but Chino is to go after Nevada Consolidated's record as a maker of cheap copper. The two are expected to produce 40,000,000 lb. of copper marketable in 1911, though it will probably be late in the year before it actually reaches the market. Both properties are said to be financed up to the point of production; Ray Consolidated represents an outlay of $7,000,000; Chino, $4,500,000. Ohio Copper is to be raised out of the rut in which it has fallen if present plans materialize. The report is that Edwin Gould has agreed to take up the unsold bonds, if F. Augustus Heinze will step down and out, turning over both physical and financial management to the new interests and giving up the Mascotte Tunnel end of the Ohio Copper organization to the Denver & Rio Grande. Mr. Heinze's failure to do anything with any of the properties in which he has lately been interested, except to snarl them up in difficulties, has not added to his prestige. Just at this time Mr. Heinze is seeking new fields of endeavor and is said to have just purchased the Foster property or the Dome Extension in Porcupine, the purchase being made with funds of the Davis-Daly Copper Co. and on behalf of the Davis-Daly stockholders. There is no apex law in Ontario, so that other mine-owners in Porcupine do not necessarily consider the coming of Mr. Heinze as any particular menace. The annual meeting of the Pacific Smelting & Refining Co. was held in New York this week. Theodore Douglas, who was originally the controlling factor in the company as the head of the old Douglas Copper Co., retired from the board, and Frank H. Williams, Nelson S. Haughwout, and C. M. Vollers were elected as directors. New investors are said to have taken over the option on the unsold bonds of the Ray Central Copper Co., and to have taken up a sufficient block to insure a completion of the development work now planned. There has been no announcement as to who controls the new interests. The market in Ray Central has suffered on account of the withholding of the report known to have been made and completed by Weed & Probert. This report was to have been given out at the annual meeting, but is still being held back; which action does not tend to reassure the shareholders.

The situation in silver is reviewed by Edward Brush, vice-president of the American Smelting & Refining Co. Mr. Brush, who is considered one of the chief authorities in regard to the white metal, says: "While India remains by far the most important consumer, no silver has been purchased by the India Government during this past year for coinage purposes. It is now approximately four years since the India Government has been in the market for silver. During 1910 the total reduction of the treasury reserve, from October 1909 to May 1910, was 250,000,000 rupees. If a similar reduction takes place this year during the period of trade demand, it will leave the India Government next spring with an amount of coined rupees which would seem to demand a further coinage. It is not likely that the India Government would see its stock of coin reduced to 150,000,000 rupees without taking immediate steps to guard against a shortage." The tin market has been cornered. This week saw one or two very feverish days among the brokers and dealers in tin. Ricard & Friewall, metal brokers of London, acting for a syndicate of English and Continental capitalists, whose identity has not been revealed, have suceeded in accumulating an immense quantity of the metal in London, where there was said to be on the first of the year some 7355 tons stored in warehouse, under the control of the syndicate's representatives; with the additions made to this amount of metal since the first of the year, it is estimated that there is now in storage some $7,000,000 worth of tin. One day this week tin advanced in London £2 per ton, whereupon all purchasers on this side became panic-stricken and commenced to bid the price up, fearing further squeezes. The situation is particularly important to the tin-plate interests in this country, as our industries consume over 45% of the world's output of tin. Production in 1910 was 107,259 tons, of which the United States used 47,250 tons. More than half of the world's supply has heretofore come from the Malay Straits. The Malay mines are becoming exhausted and production has been decreased. This condition is one of the factors which has made it possible for the group of operators mentioned to achieve a position where they can make the consumer pay their own price.

General Mining News

ALASKA

The Copper River & Northwestern railway, which has been in operation for the past 18 months, has been gradually extended northerly up the Copper river, and by March it is expected to be finished as far as Kennecott, situated at the Bonanza mine. The line begins at Cordova, on Prince William Sound, and when completed to Kennecott will have a length of 200 miles. The Bonanza is noted for having vast deposits of high-grade copper ore, and these have been well developed within the last two years. It is announced that ore-shipments to the smelter at Tacoma are to begin as soon as the railroad is completed to Kennecott. During the time the railroad construction has been in progress prospecting has been active in the Copper River country, and numerous discoveries of gold-bearing ore have been made. The value of the mineral output of Alaska for 1910 is estimated at $17,400,000, divided as follows: gold, $16,360,000; copper, $740,000; other minerals, including silver, lead, and coal, amounted to $300,000. The gold production for 1910 was about $4,000,000 less than that of 1909. The principal decrease occurred in the placer mining regions.

ARIZONA

COCHISE COUNTY

The copper turned out at the Copper Queen smelting plant, at Douglas, amounts to 9,000,000 lb. per month. Of this, the Copper Queen ores yield 6,000,000 lb., the concentrate from the Moctezuma mill, at Nacozari, yields 2,000,000 lb., and 1,000,000 lb. is extracted from custom ore received from various mines in Arizona, New Mexico, and Sonora. The building of a reverberatory and roasting plant at the Copper Queen works at Douglas is making much activity there in construction. The Calumet & Arizona smelter, also situated at Douglas, turned out 4,000,000 lb. of copper in the month of January. The Centurian Arizona Mining Co. has commenced shipping ore from its copper mine at Dragoon. J. P. Richardson is in charge.

GILA COUNTY

(Special Correspondence.)—One of the churn-drills of the Miami Copper Co. was moved to the Red Spring claim, north of the centre of the company's holdings. It is intended to explore this ground as soon as possible and to hasten the work an additional crew will be put on the drill at once, thus making two shifts of twelve hours each. This hole is 1000 ft. north and 800 ft. west of the No. 4 main working shaft of the company. The other two churn-drills will be continued at exploration work in the western part of the property. In the underground workings the mine is being placed in readiness to supply the concentrator. Trolley wires have been strung in some of the main drives. The large room that has been cut 200 ft. west of No. 4 shaft on the 420-ft. level, in which will be placed the electric motors to supply the power for haulage system, has been completed and is in readiness for installation. Preparations are being made in the northwest part of the mine for handling the ore. On the 420-ft. level three drifts are being driven to the northwest, and through chutes all the ore in the level above will be sent to these drifts and transported by main haulage to the skip pocket at shaft No. 4, then hoisted and dumped automatically to the crusher bins in the concentrator. Although it was the intention to start the concentrator the first of the year, and to that end men were employed nights, so many delays have been met with it is probable that it will not begin before March 1. The non-arrival of pipe for the water-line from the pumping station to the mill has been one of the principal causes of delay. The new tramway from the concentrator on the hill to the railroad in the Miami townsite is approaching completion and should be ready in the next two weeks. Preparations are being made to build a dam across the canyon below the concentrator. This dam will form an impounding pond for the tailing from the mill. A force of men is building a wagon-road for the company from the power-house to the principal works; this road will replace the one that will be put out of service on account of the construction of the dam. Mr. Lawton, superintendent for the company, is at present in Cananea, Sonora, to complete arrangements for smelting the concentrate.

The Inspiration Copper Co. will shortly begin the installation of an electric haulage system in its mine workings. For this purpose a 100-kw. generator has been purchased and will be placed in the new power-house situated close to the Joe Bush tunnel. This generator will be of sufficient capacity to supply power for the electric motors of the lighting system and for the 75-ton experimental mill. The Colorado shaft of this company has been sunk to a depth of 635 ft., and to reach a depth to correspond with that of the station on the 500-ft. level of the Bush shaft it will be necessary to sink 25 ft. deeper. As soon as the sump and station are cut on the new level a connection will be made with the Bush shaft. At present the Inspiration company is employing four churn-drills, one of which is used in drilling on the eastern end of the property; two are used in drilling about 1000 ft. north of the Joe Bush shaft, and the other at the south end, where the drill is in ore.

MOHAVE COUNTY

Ed. Williams has opened a mine in Aquarius mountains, the ore from which is said to assay 70% tungstic acid. He has mined considerable of it and expects to make a shipment. The Frisco Mines & Power Co., operating at Union Pass, has erected a mill which is now in operation. E. H. Barton is manager, and the mill was built under his supervision.

PIMA COUNTY

The Sasco smelter of the Southern Arizona Copper Co., which had been operating on ore from the company's mines at Silverton, closed down in December. The production for 1910 was about 6,000,000 lb. of copper, as against 10,500,000 lb. for 1909. Extensive exploration by churn-drills is in progress on the company's holdings, where copper is disseminated through a porphyritic country.

PINAL COUNTY

The Ray Con. Copper Co. expects soon to have the first unit of its concentrating plant ready to operate at Hayden on the Gila river. The power plant is nearly complete, and the transmission line extending from Hayden to Ray is also nearly finished. The ore-crushing plant, situated at the mines, is likewise approaching completion. The necessary railroad ore-cars for use in transporting the crushed ore from the mines at Ray to the concentrator at Hayden are on the tracks. The reservoirs which are to hold the supply of water for the mill have been built. It is reported that work on the smelting plant has been commenced. Construction work is in charge of George O. Bradley, mechanical engineer for the company.

YAVAPAI COUNTY

The Union Development Co. is operating on two properties in Black Canyon district, close to Turkey station, on the Prescott-Crown King railroad. Sinking is in progress in two shafts, one being at a depth of 84 ft. and the other at 125 ft. Free-gold ore was found near the surface, but at greater depth the ore was sulphide. Several carloads of ore are ready to be shipped from various mines of this locality. The workings of the Hidden Treasure have been unwatered, permitting development work to begin. The mill, belonging to this property, is to be put in operation. The Jerome Tunnel Co. is to undertake the development of various properties on the United Verde lode by driving an adit 9000 ft. from a site in Verde valley, below the town of Jerome. It is estimated that it will intersect ore veins at depths ranging from 400 to 3000 ft. The plan is to have it serve for drainage and ore-haulage. The projectors figure on building a railroad from Dewey, near the Agua Fria, to the Rio Verde. This would make a direct line for ores of the Jerome district to the smelter at Humboldt. The general plan, if carried out, would obviate hoisting and pumping, and provide a market for the ore.

CALIFORNIA

CALAVERAS COUNTY

The discovery of a rich placer channel is reported at Vallicita, near Murphy's, in which nuggets and coarse placer gold were found on the Bishop claim. Ten men are employed.

INYO COUNTY

The Tecopa Con. M. Co., during 1910, shipped 9967 tons of ore to the smelter at Needles, and 8284 tons to the A. S. & R. Co. smelter at El Paso. It is stated that John B. Farish has been engaged to examine the mine and report as to its prospects and possibilities. The annual meeting of the company was held in Philadelphia on February 1. Reports from San Bernardino are to the effect that 11,840 acres have been taken up lately in the Death Valley region as claims for nitrate of potash, or saltpeter. The Villareal mine, belonging to the Domingo M. Co., situated 12 miles from Keeler, has high-grade silver-lead ore in a 30-ft. vein. Shipments of ore made to smelters in Utah, amounting to 300 tons, gave the company a net return of $42 per ton. This ore is taken from near the surface, the workings being only 46 ft. deep. The Southern Pacific Co. is to begin March 1 to change from narrow-gauge to standard-gauge the part of the railroad between

Southern California.

Owengo and Mina, which will make this a broad-gauge line from Hazen, Nevada, to Mojave, California. About 50 tons of ore daily is being treated at the 15-stamp mill of the Skidoo Mines Co. This has a gross value of about $17 per ton, and is mined from four different veins. Other mines at Skidoo consist of the Corliss, Augurbury, Valley View, King, Hoyt Bros., and Gilbert, each of which gives employment to a few miners.

KERN COUNTY

Barney Osdick, who has a 5-stamp mill in the Stringer district, near Randsburg, is to install cyaniding equipment for the purpose of leaching accumulated tailing, about 2000 tons of which is ready for treatment. His mill is to be kept in operation on ore mined in the Stringer district. He has a lease on the Gold Bug mine, which supplies part of the ore on which the mill operates, the balance being custom ore. The two shaft-houses and nearly all the equipment of the Atolia mine, at Atolia, were destroyed by fire recently. The fire is believed to have been of incendiary origin.

MARIPOSA COUNTY

The Bullion Hill mine, situated near Exchequer, in Quartzburg district, is being developed by a cross-cut, now in 300 ft., in the course of which a 30-ft. vein of ore was intersected. At this point driving on the vein was commenced, the intention being to cross-cut the vein from wall to wall at 50-ft. intervals. Along the cropping of the vein shallow shafts were sunk at regular places for a distance of 1135 ft. The vein is opened by the cross-cut at a depth of 135 ft. Work began here last September. The high-grade ore is being hauled to the railroad station at Merced Falls, and several carloads of it are to be shipped to a smelter at San Francisco this month. Assays indicate that the ore grades from $4.60 to $56 per ton. A mill is to be erected as soon as tests shall determine the method of treatment required. R. B. Binns and W. J. Stoneham are superintendent and engineer, respectively.

NEVADA COUNTY

The mill at the Central shaft, and all except 10 stamps of the North Star mill, have been closed down a few days in Grass Valley district by reason of an interruption in the supply of water. This interruption came as the result of freezing and drifting snow in the ditches at the upper ends of the flumes in Bear valley. On account of the same cause the Union Hill and Maryland mines were temporarily closed.

The Town Talk mine, situated between the Union Hill and Empire, is under option to G. V. Redmayne, who is said to be negotiating with Los Angeles and Eastern men whereby the property may be taken under bond. The Town Talk was successfully operated as a placer mine a number of years ago, but was opened to some extent later as a lode mine. There are 147 acres in the holding. It is stated that a new 20-stamp mill is to be erected at the Union Hill mine. A 10-stamp mill, formerly at Brandon, Tuolumne county, has been shipped to Grass Valley to be added to the 10-stamp mill at the Pittsburg mine.

SACRAMENTO COUNTY

This county has started injunction suits against the Placer Ditch & Mining Co., and the New Gold Run Ditch & Mining Co., charging the defendants with dumping hydraulic detritus into the north fork of American river near the town of Gold Run. A restraining order has been issued by Judge C. N. Post, prohibiting the defendants from operating by hydraulic processes during the pendency of the suit.

SHASTA COUNTY

The Balaklala Copper Co. has been operating one furnace at its Coram plant since December 28, and while the smeltermen consider that the improved Cottrell fume-controller is eliminating most of the elements that would be deleterious to vegetation, the committee of the Farmers' Association is insisting on a complete elimination of the objectionable elements as was stipulated in the decree of the court under which the plant was allowed to resume operating. Consequently, the relations between the farmers and fruit-growers on one side and the smeltermen on the other remain inharmonious.

SISKIYOU COUNTY

The Scott Bar Hydraulic Mining Co. No. 2 now owns the placer holdings of the Morrison & Carlock Gold M. Co., the Scott Bar Hydraulic Co., the C. C. Hicks & Bros., the San Jose ditch, and the mining properties of J. B. Chase, and the Mabel mine at Quartz Hill. The new company is to extend the San Jose ditch from its present terminus, near Thompson creek, to the river at a cost of $22,000. The principal stockholders in the present organization are Los Angeles and San Francisco men. Most of the properties are in the vicinity of Yreka. Dredging ground situated near Yreka, belonging to Leland and Linscott, is being tested by R. B. Cottrell with Keystone drills, and if the result be favorable a dredge will be built.

TUOLUMNE COUNTY

(Special Correspondence.)—Some work is being done on a new vein at the Dreisam, and 20 tons of ore extracted in development have been milled, the results showing $4 per ton gold. Assays of the tailing indicated from

$3.80 to $6 per ton, and hereafter the concentrate will be saved. The ore was taken from a drift at a depth of 50 ft., where the vein is from 2 to 4 ft. wide. The same vein will be tapped on the 200-ft. level in the near future. The property is being operated by James E. Conde, its owner. With five stamps and a Huntington mill, 25 tons of ore is crushed daily at the Maddox, operated under the personal direction of John Frey. The ore is taken from a shoot 4 ft. wide and yields $8.50 per ton. The system employed in the extraction of the gold is a novel one here, and is giving good results, the loss being less than 25%. Instead of clear water in the batteries, a solution of cyanide is used, the pulp and slime passing from there through an intricate system of treatment. The cyanide solution is used over and over again, being pumped back into the batteries from a receptacle into which it finds its way. A suit to quiet title to the Clio mine has been instituted by the Ora Mining Co. against the Clio Power & Milling Co. It is said the former company, which recently acquired the property, is preparing to commence operations. Driving on the 2-ft. vein from the bottom of the shaft is in progress at the Black Oak mine. It is believed that the lode is the same which made the mine famous years ago. The ore is of good grade. Ten tons of extremely high-grade ore from the rich shoot recently uncovered in the Gianelli mine, near Arastraville, will be milled at the Driesam. It is reported that the Confidence mine has been sold. A short suspension of operations at the Soulsby and other mines on the East Belt has been forced by the breaking of the Tuolumne Transmission Co.'s flume far up in the mountains.

Tuolumne, February 4.

COLORADO

CLEAR CREEK COUNTY

(Special Correspondence.)—The Sunburst, Astor, and Scepter mines, on Democrat Mt., have been taken under bond and lease by W. O. Robinson. Work has commenced and operations will be through the Scepter adit. The operator is endeavoring to open a body of zinc ore, and if the showing warrants it a mill will be constructed. The McClellan Mountain M. & M. Co. is developing the Vesper property. A streak of $70 gold-silver ore was recently opened. Another contract has been awarded by the Santiago-Montezuma M. & M. Co. to drive the drift on the Santiago vein from the Wilcox adit. The length of the drift will be 1250 ft. Several wagons and teams arrived from Denver this week to haul ore from the Santiago mine to Georgetown. It is proposed to market at least four carloads of smelting ore each week. Work is under way at the Sidney adit in East Argentine, and mining is confined to the Ontario vein. The compressor plant will be started as soon as sufficient water is available. Development has been commenced at the Rosebud, on Democrat. G. W. Teagarden, the manager, states that funds have been provided.

Georgetown, February 4.

(Special Correspondence.)—The Big Five Investment Co. has purchased from Mrs. Sarah A. Bronson the West Dove's Nest lode claim at $7500 cash. The property lies on the course of the Central adit and was a heavy producer from shaft development. Shipments are being made from the New Era mine at Freeland, average returns of $60 per ton in gold, silver, and lead being received in settlement. James Cousins is manager. The Mendick mine is again a shipper of ore. Returns of 3 oz. gold and 60 oz. silver per ton are being realized. John Owen, of Idaho Springs, is owner. The Oneida mine is classed among the heaviest shippers of the Idaho Springs district. An average of 30 tons of smelting ore is being marketed daily.

Idaho Springs, February 5.

DOLORES COUNTY

(Special Correspondence.)—The old United Rico properties of Rico are to be reorganized. Some three or four years ago United Rico was taken up by a New York Stock Exchange house and something of a manipulated market made, in which shares were forced up to $1.37 or higher. Recently stock was sold at 1c. per share. A rather elaborate reorganization plan has been submitted to the shareholders, in which the reorganizers provide for themselves nearly everything except a direct deed for the property to themselves. Stockholders' comments, so far as heard, evidently imply that they think they are to be 'strong armed' out of whatever interest they may have.

Rico, February 4.

GILPIN COUNTY

(Special Correspondence.)—A streak of solid ore containing free gold has been uncovered on the 150-ft. level of the Puzzle mine situated on Bobtail hill. The discovery was made by Ellis Vistine, a lessee. The Susan Mary mine, in Lake gulch, has been turned over to the Eastern Development Co. Operations have been commenced under direction of John Brohi. The Navajo property in Russell district has been sold by S. T. Harris to the Santiago Mines Co. Development has been started. The Howard mine has been purchased by the Cashier G. M. & R. Co. The property adjoins the Pittsburg and is situated in Russell district.

Central City, February 4.

LAKE COUNTY

Franklin Ballou, who has a lease on the Fortune mine, Little Ellen hill, is mining and shipping ore. Messrs. Butler and Hoskins, of the faculty of the Golden School of Mines, were recently in Leadville, and while there obtained 100 lb. of specimen ore from the various mines, which is to be distributed among mineralogists and universities in this country and Europe. The first carload shipment of ore was made last week from the Helena mine, on Iowa gulch. It was of good grade, and contained lead, silver, and gold. The Helena operators have had a hard problem in handling the water in the mine. It has been lowered to the 500-ft. level, on which work has been started. The Virginius, on Fryer hill, under lease to P. H. O'Brien, has been re-timbered, and mining operations have commenced. This property, previous to the letting of this lease, had been idle many years. The Garbutt shaft, Breece hill, has been equipped with an electric hoist and an air-compressor. The steam plant is now used for heating purposes. John Cortellini has charge. In the Amity mine ore is being taken out which contains an ounce of gold per ton. Formerly silver predominated in this mine, and it seems that the amount of gold is greatest in the lower levels. The Progressive shaft is being unwatered, and when the water has been lowered to the first level a pump will be installed there, and exploration work started.

SAGUACHE COUNTY

(Special Correspondence.)—A contract is about to be let for driving a 6000-ft. adit at Bonanza. It is announced that plans and specifications may be seen at the office of Dorsey & Hodges, Boston building, Denver, and the offices of Simonds & Burns, Liberty Tower building, New York City.

Denver, February 6.

TELLER COUNTY

Charles Ladd, a lessee on El Paso ground, in Cripple Creek district, has discovered a 3½-ft. vein of high-grade ore. He has a force of men mining and shipping from three to five carloads per week, the returns from which run from $45 to $90 per ton. Other lessees on the El Paso are doing well also. During January, 24 cars of ore were shipped from the Pride of Cripple Creek mine. A 5-ft. vein was opened on the 600-ft. level, the ore in which samples $18 to $25 per ton. Eight sets of lessees are at work in the Anchoria-Leland mine, all of them shipping ore, the grade of which is $12 to $22 per ton. Lessees on Block 6, in the Vindicator mine, have taken out 125 tons of ore per week for many weeks, which is reported to assay about $30 per ton. The greater part of this mine is being operated on company account. There is a large tonnage of low-grade ore on the dumps at the Ajax mine to be treated in the new mill which is to be finished in the next two months. The project of driving another drainage tunnel, 500 ft. deeper than the Roosevelt adit, is under consideration. In order that the expenses of such an undertaking may fall equitably upon all mining properties that would be benefited by such drainage, an effort will be made to secure the

enactment of drainage-district legislation, which, of course, would be applicable to all other mining regions of the State as well as to Cripple Creek district.

IDAHO

SHOSHONE COUNTY

The Federal Mining & Smelting Co. is erecting an addition to its Morning mill, at Mullan, in which 119 MacQuisten tubes are to be installed for treating the table middling, consisting of zinc and siderite, or iron carbonate, and lead. According to tests, the separation made by the tubes will result in a 50% zinc product and a lead concentrate; the siderite will come out as a tailing. The initial unit of this part of the plant is to have a capacity of 100 tons per day. The tests were made by the General Engineering Co. at Salt Lake.

MISSOURI

JASPER COUNTY

(Special Correspondence.)—The new Webb City lead smelter has started operations since the beginning of the year, making the fourth plant in the district. The smelter started with the jumbo furnace; the force of 50 men will be increased to 75 men when the slag and fume collect sufficiently to start the blast-furnace. The Old Judge mine at Oronogo, which has been operated by several companies in the past with varying success, has just been taken over by a new company. The ore here is combined with a black flint matrix which makes separation difficult and furnishes quite a milling problem. The new company is putting the large mill in order. Another company has secured a lease on the tailing pile, which contains 100,000 tons of material, and a new sludge mill has been built to treat them. Preparations have been made to reopen the Porter mine at Carthage, which has been a producer in the past, but the greatest problem has been to handle the water. Pumps have been installed and the ground will soon be so drained that work may begin. Vesuvius mine, northwest of Carthage, is to be enlarged by the addition of a rich 40-acre tract adjoining the land already worked. A 300-ton mill will be built on this property.

Joplin, February 3.

MONTANA

BROADWATER COUNTY

(Special Correspondence.)—The Keating Gold Mining Co., operating in the Radersburg district, did not sustain any serious damage to its property through the explosion of dynamite on the 200-ft. level, that caused the death of six men. Some of the timbering was damaged, but this did not interfere with the working of the mine, as the perpendicular shaft was used pending the repairs to the inclined shaft. Jesse B. Roote, a director of the company, states that shipments are being kept up and that the repairs will be made within a week or two. In October the gold averaged $17.74 per ton, November $21.20 per ton, and December $24.10. The December earnings above cost of operating were $25,000. The property is now equipped with an economical plant for the extraction of ore, and only one vein is being worked, while there is surface showing equally good on two other veins within reach of short cross-cuts. The ore consists of iron sulphide with gold.

Radersburg, February 4.

NEVADA

HUMBOLDT COUNTY

A report concerning the Seven Troughs Coalition Mines Co., for 1910, issued by L. A. Friedman, the manager, gives information as follows: There is more ore blocked out in the mine and in the bins ready for milling than at any previous time; the shoot recently followed on the 500-ft. level has a width of 3 ft.; the solidity of the formation at that depth makes it possible partly to eliminate the expense of mine timbers. There was received $2200 as royalties from lessees, and $51,715 for ore, $1380 for concentrate, $14,792 for bullion sold. Disbursements included $1612 for hauling, $4015 for supplies and construction, $5860 for milling, $29,913 for labor.

LANDER COUNTY

The Austin-Manhattan is reported as being operated successfully; the second shipment of concentrate was made recently. The process involves dry concentration and electromagnetic separation.

NYE COUNTY

The ore produced at the principal mines at Tonopah for the week ended February 4 was as follows: Tonopah, 3500 tons; Belmont, 1650; Montana-Tonopah, 1051; Tonopah Extension, 980; West End, 400; MacNamara, 50 tons, a total of 7631 tons, of an estimated value of $190,775.

Tonopah, Nevada.

WHITE PINE COUNTY

(Special Correspondence.)—For the quarter ended December 31, 1910, the Nevada Consolidated treated 592,320 tons of ore, the gross yield of which was $2,503,934.22. The cost of extraction was $399,264.06; transportation, $157,062.67; reduction, $1,285,755.95; leaving a net yield for the quarter of $661,851.54. The bullion tax for the quarter amounted to $11,913.33. This is the best showing made by the company, which, however, has not yet reached the limit of its production for its present equipment. For the past six months only six sections of the concentrating plant have been running as an average. The equipment at the smelter to provide for changing from coal to oil for fuel for the reverberatories is rapidly approaching completion, and will soon be tried on reverberatory No. 5. A trainload of oil is now on the way from San Francisco.

The first concentrate from the new plant of the Tungsten company was shipped to New York last week, and is expected to average about $500 per ton. The mill is working satisfactorily, but owing to the cold weather is running but one shift in twenty-four hours. When spring comes it will be operated on regular time, and is expected to turn out between three and four tons of concentrate per day.

The new Giroux shaft is now fully equipped. The pumps on the 1200-ft. level were started this week. The battery of eight boilers has been tried, and is working satisfactorily, and the two engines will be in operation within two weeks. Two compartments of the Giroux shaft have reached 1400-ft. depth, and work has been commenced to raise the other three compartments from the 1400 to the 1200-ft. station. A pump will then be installed at the 1400-ft. station, and a cross-cut started from that point to the Alpha workings, a distance of 700 ft. The cross-cut from the 1200-ft. level has been driven 375 ft. toward the Alpha workings, when work was discontinued owing to the heavy inflow of water. As soon as the pumps are in good working order the cross-cutting will be continued, and is expected to break through the lime into the orebodies in a short distance. Many mining engineers who have examined the equipment of the Giroux shaft pronounce it the best in the United States.

Ely, February 6.

OKLAHOMA

OTTAWA COUNTY

(Special Correspondence.)—The Midas L. & Z. Co. is a new concern working in the western part of the Miami camp. The property is turning out a carload of concentrate

per week, though the ore is being held for higher prices. Both galena and zincblende are produced, the blende being high grade. Ore is being mined on the 100 and 127-ft. levels. The Turkey Fat mine is starting new development on a lease north of mill, which will be the deepest development in that camp, the bottom of the ore face being at 335 ft. The first traces of the mineral are found at 295 ft. and a 2-compartment shaft 6 by 10 ft. is being sunk. The L. C. Church company is installing another large pump with a capacity of 2000 gal. per minute. One pump is now running day and night, and with the two pumps running steadily it is thought the entire camp can be kept drained. If this is possible, several mines and mills will resume operations, which have been shut down because of difficult water conditions. This company has completed the mill and built a tramway from one of the shafts to the mill. The Miami Amalgamated is making 12,000 lb. of lead and 10,000 lb. of zinc per day from the new drift. A large cave occurred which endangered the old workings and made it imperative to go beneath in order to get to the best grade of ore. This company has one of the largest mills in the Miami camp. Two shafts are used to hoist the dirt, one at the mill and the other to the north. The lease is known as the Sullivan tract.

Miami, February 3.

OREGON

JOSEPHINE COUNTY

(Special Correspondence.)—A recent discovery was made at the Almeda mine upon reaching the contact at the 300-ft. level from the shaft. The ore lies on the hanging wall slate and is of the character locally known as grade No. 1, being the same as that opened by levels and adits above, having gained somewhat in value, however, with the additional depth. The increase in value is mostly in copper, the gold and silver remaining about as before. Mineral occurs mostly as gray-copper and chalcopyrite, carrying gold and silver. Drifts are being driven both ways upon the ore with gratifying results, and all possible speed will be urged in reaching the vein at the 500-ft. level.

Galice, Oregon, January 23.

TENNESSEE

The Tennessee Copper Co. has reached a settlement of its smelter-fume difficulty by agreeing to cut down the roasting of ore between May 20 and September 1 to a point where all of the injurious fume can be handled by the sulphuric-acid plant.

UTAH

SALT LAKE COUNTY

The Ohio Copper Co. is drilling a well close to the settling pond, below the Lark mill, and although only 100 ft. of depth has been gained so far, the well is making plenty of water. This system of wells will afford a reserve water supply which will banish all fear of future shortages from the calculations of those in charge. No attempt is being made at the Ohio mill to force tonnage. Experience has shown, as is said, that between 1500 and 1600 tons of ore per day affords a much more satisfactory operation, a better saving of metals, and prevents wear and tear on the equipment, than were the management to crowd 1700 to 1800 tons through the plant daily. The concentrate is running from 25 to 30% copper, while the gold and silver will reach about $1.25 to $1.50 per ton of concentrate.

The Utah Metal Mining Co., having mineral holdings in Bingham and West Mountain district, is driving a drainage and transportation adit, which will be 12,000 ft. long when finished; and about half this distance has been driven. The bore is 8 by 10 ft. cross-section, equipped for electric haulage, and is to open mineral veins at a depth of 2300 ft. A connection is to be made between this and the Whitley tunnel, the latter being driven from the Bingham side. The tonnage of custom ore received by the International Smelting & Refining Co. at its Tooele plant is increasing. In addition to the ore received from the Highland Boy mine, and the concentrate from the South Utah, Beaver county, ores from ten others are being received. The December output of concentrate sent in by the South Utah amounted to 2067 tons, averaging 10.46% copper; in addition to this it contained 137 oz. gold and 2296 oz. silver. In the Ohio mill, Bingham district, a new type of crushing equipment, designed by E. A. Wall, is being installed.

CANADA

BRITISH COLUMBIA

(Special Correspondence.)—The report of the Le Roi No. 2, Ltd. covering operations at the Josie mine for December 1910, shows that 2390 tons of ore and 138 tons of concentrate were shipped. The smelter receipts were $38,324 for 2387 tons of ore, amounting to $37,539, and 98 tons of concentrate, $1785. During the same month the cost of development was $9500; ore production, $8500; and milling $1400, a total of $19,400. The drifting and cross-cutting amounted to over 460 ft. Assays obtained on the 500-ft. level showed 1 oz. 13 dwt. gold, and 3% copper for a width of 3½ ft., and 16 dwt. gold and 5% copper over a width of 4 ft. The shipments of ore from Rossland district for the week ending January 28, were as follows: Centre Star mines, 3464; Cliff mine, 120; Le Roi No. 2, Ltd., 305; Le Roi No. 2 (milled), 300; Le Roi mine, 215; Nickel Plate, 22 tons.

Rossland, February 4.

(Special Correspondence.)—The Granby company has bonded a group of mineral claims on Copper mountain near Chesaw. This deal will involve an expenditure of $100,000 if the bond is finally taken up. Diamond-drilling is to be started at once, the necessary machinery being hauled in to the group over snow roads. The shipments of blister copper from the Granby smelter for the week ended January 28, amounted to 405,000 lb. During December there was treated at this smelter 98,309 tons of ore. The copper production was 1,645,613 lb., and the value of the metallic content, $101,000. The official statement of the output for 1910 shows this to have been 20,018,048 lb. It is announced that the directors of the British Columbia Copper Co. have decided to put the stock of the company on a 10% dividend basis, payable quarterly in dividends of 2½%. The shares of the company have a par value of $5. A method of mining has been adopted at this company's big mines, intended to prevent the waste getting mixed with the ore in the glory holes and large stopes, as has been the case, to some extent, during the past two months, and which has resulted in the treatment cost being increased about 48c. per ton over what it should be. The Consolidated company will commence shipping from its Rawhide property next week. The diamond-drilling that has been in progress on the Ironclad and Fairplay claims has been stopped for the present. It is reported that the operators of the Argo development tunnel at Greenwood have opened a good vein of copper-silver ore. It is anticipated that the Hedley Gold Mining Co. will soon declare another double dividend, as the profits lately have been running close to 35%. At the Midway coal property of the Boundary Mining & Exploration Co. the engineers have decided to put in an initial plant and begin work. The work so far done has developed No. 3 vein about 500 ft. There are 6 veins on the property to be developed, which the new shaft will provide means of working. The ore shipments from the Boundary district for the week ended January 28 were as follows: Granby mines, 22,993; Jackpot, 515; Mother Lode, 6392; No. 7, 85; Rawhide, 5200; Snowshoe, 2446 tons.

Phoenix, February 4.

(Special Correspondence.)—The bond on two groups of claims on Roche de Boule mountain has been taken up by R. P. Trimble of Portland. The group comprises 11 claims at the head of Juniper creek. The purchase price was $65,000. The vein is 8 ft. wide, 4 ft. of which assays 3% copper and $3 gold and silver. The Silver Pick group on 9-Mile mountain has been bonded for $45,000. Several veins of good ore have been opened on this property.

Vancouver, February 4.

Personal

Professional men are invited to send news of their engagements and travels. Such news is interesting to friends.

C. W. MERRILL is in New York.

F. A. KEITH has gone to New York.

W. H. WILEY has returned from Peru.

GEORGE MACKENZIE is in San Francisco.

H. W. DUBOIS visited San Francisco this week.

C. H. MUNRO is returning to San Francisco from London.

THOMAS COX is at Coalinga for the Nevada Petroleum Company.

H. A. MCQUEEN is at Marysville, California, examining gravel property.

J. P. HUTCHINS and NORMAN STINES are in the Ural mountains, near Ekaterinburg.

CORTLANDT E. PALMER has removed his office to No. 2 Rector street, New York.

T. LANE CARTER lectured recently at the University of Chicago on 'Mining in Africa.'

THOMAS T. READ lectured this week at the University of California on 'Mining in China.'

E. B. WEBSTER has left the Red Cliff mine, Stewart, and is at Vancouver, British Columbia.

J. M. CALLOW, of Salt Lake, was at Denver and Leadville last week on professional business.

W. H. LEFFINGWELL, of Bishop, California, was at Salt Lake and Bingham, Utah, last week.

LEO VON ROSENBERG has removed his office to 11 Broadway, Bowling Green building, New York.

RICHARD ROELOFFS, manager for the Cresson Con. Co. at Cripple Creek, has gone to Chicago for a few days.

JAMES E. CHAPMAN, lately with the Amparo Mining Co. at Etzatlan, Jalisco, is spending a vacation at Soldiers Grove, Wisconsin.

WILLIAM E. FENWICK, JR., of Detroit, Michigan, recently left for Bisbee, Arizona, to take charge of the engineering work at the Bisbee Extension Mining Co.'s property.

W. H. ALDRIDGE, formerly metallurgist for the Colorado Smelting Co., at Pueblo, Colorado, and manager of the Great Falls Plant of the United States S. R. & M. Co., has been elected managing director of the Inspiration Copper Company.

THE SAN FRANCISCO SECTION of the Mining & Metallurgical Society of America met February 6 at the Palace Hotel. Messrs. S. B. Christy, E. A. Hersam, E. T. Dumble, Albert Burch, Charles Butters, F. W. Bradley, H. W. DuBois, A. C. Lawson, W. H. Aldridge, and H. F. Bain being present.

JANUARY COPPER REVIEW

By M. E. APPELBAUM

The fluctuation in the price of copper during the month of January was between 12¾ and 12¼ cents, the decline starting upon the publication of the December statistics and continuing well toward the end of the month. The European market strengthened considerably in the last few days of January, principally because of the report that the New York Central will electrify its railroad and requires for that purpose about thirty million pounds of copper. I do not agree with the pessimistic opinions being expressed as to the probable course of prices. It is quite true that at the present rate of consumption and production the surplus can be reduced but gradually; but, even if it takes a little longer, when it is accomplished the metal will be on a sound basis. It is certainly reassuring to find that such conservative men as are at the head of systems like the Union Pacific and the New York Central are ready to commit their roads to expenditures of large amounts of money, indicating, in my opinion, a trend toward better business.

Market Reports

LOCAL METAL PRICES.

San Francisco, February 9.

Antimony	12—12¾c	Quicksilver (flask)	46½
Electrolytic Copper	14½—15¾c	Tin	45—46½c
Pig Lead	4.75—5.70c	Spelter	7—7¾c

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

METAL PRICES.

By wire from New York.

Average daily prices in cents per pound.

Date.	Electrolytic Copper.	Lead.	Spelter.	Silver, per oz.
Feb. 2	12.28	4.48	5.40	52¾
" 3	12.28	4.48	5.40	52⅝
" 4	12.28	4.48	5.40	52⅛
" 5	Sunday.		No market.	
" 6	12.28	4.48	5.43	51¾
" 7	12.28	4.48	5.44	52
" 8	12.28	4 48	5.45	51¾

ANGLO-AMERICAN SHARES.

Cabled from London.

	Feb. 1. £ s. d.	Feb. 9. £ s. d.
Camp Bird	1 16 6	1 5 9
El Oro	1 6 9	1 6 3
Esperanza	1 10 6	1 13 9
Dolores	1 5 0	1 5 0
Oroville Dredging	0 7 0	0 7 0
Mexico Mines	7 13 9	7 7 6
Tomboy	0 15 6	0 15 0

(By courtesy of W. P. Bonbright & Co., 24 Broad St., N. Y.)

COPPER SHARES—BOSTON.

	Closing prices, Feb. 9.		Closing prices, Feb 9.
Adventure	$ 6	Mohawk	$ 43
Allouez	34	North Butte	29⅜
Atlantic	4½	Old Dominion	40½
Calumet & Arizona	53	Osceola	107
Calumet & Hecla	522	Parrot	12½
Centennial	12½	Santa Fe	1¼
Copper Range	67	Shannon	11½
Daly West	3	Superior & Pittsburg	14¾
Franklin	9½	Tamarack	44
Granby	34½	Trinity	4
Greene Cananea, ctf	6⅜	Utah Con	12
Isle-Royale	13½	Victoria	2¼
La Salle	4½	Winona	9
Mass Copper	7	Wolverine	120

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

MINING STOCK QUOTATIONS—NEW YORK.

(By wire from Catlin & Powell Co., New York.)

	Closing prices, Feb. 8.		Closing prices, Feb.
Amalgamated Copper	$ 65⅛	Miami Copper	$ 20¼
Arizona-Cananea	3¼	Mines Co. of America	5
A. S. & R. Co	80	Montgomery-Shosbone	⅛
Braden Copper	37⅛	Nevada Con	19⅜
B. C. Copper Co	6⅜	Nevada Utah	1⅛
Butte Coalition	18⅝	Nipissing	11
Chino	21¾	Ohio Copper	1¾
Davis Daly	1⅜	Ray Central	1½
Dolores	5	Ray Con	17⅜
First National	1¾	South Utah	⅞
Giroux	6⅞	Superior & Pittsburg	14¾
Greene-Cananea	6¾	Tenn. Copper	88
Guanajuato Con	½	Trinity	4½
Inspiration	8	Tuolumne Copper	4⅜
Kerr Lake	7⅛	United Copper	4½
La Rose	4⅞	Utah Copper	45½
Mason Valley	9⅛	Yukon Gold	4

SOUTHERN NEVADA STOCKS.

San Francisco, February 9.

Atlanta	$ 13	MacNamara	$ 18
Belmont	5.95	Mayflower	6
Booth	5	Midway	14
Columbia Mtn	3	Montana Tonopah	90
Combination Fraction	12	Pittsburg Silver Peak	81
Fairview Eagle	39	Rawhide Coalition	3
Florence	1 60	Round Mountain	43
Goldfield Con	6.70	Silver Pick	5
Gold Kewenas	6	St. Ives	16
Great Bend	1	Tonopah Extension	1.02
Jim Butler	29	Tonopah of Nevada	8.00
Jumbo Extension	30	West End	55

(By courtesy of San Francisco Stock Exchange.)

Decisions Relating to Mining

Specially reported for the MINING AND SCIENTIFIC PRESS.

LOCATION OF MINE—MONUMENT

Under the statute of Idaho, the locator of a mining claim is required to erect a monument at the place of discovery upon which, among other things, he must place the distance claimed along the vein each way from such monument.

Flynn Groupe Mining Co. *v.* Murphy, (Idaho) 109 Pac. 851. June, 1910.

NOTICE OF LOCATION

Where a mining claim appears to have been located in good faith, it will be deemed sufficient, if by any reasonable construction the language used in the location notice describing the claim and referring to natural objects and permanent monuments imparts knowledge of its location to a subsequent locator. Under the Idaho statutes the location notice is not required to describe the exterior boundaries of the claim. Under such a notice no technicalities will be resorted to, in order to sustain a re-location of the same ground.

Flynn Groupe Mining Co. *v.* Murphy, (Idaho) 109 Pac. 852. June, 1910.

EXCESSIVE MINING LOCATION

An excessive mineral location made through mistake, where the locator was acting in good faith, renders the location void only as to the excess; but where the locator has purposely included within his exterior boundaries an exclusive area for the fraudulent purpose of holding the entire area, then it all becomes void. So if the location is made so large that it can not be deemed an innocent mistake, fraudulent conduct in the location may be presumed. And where the exterior boundaries include such an unreasonable excessive area that such boundary lines can not be said to impart notice to a prospector of a mineral location or discovery within a reasonable distance of a lawful claim, then the location will be held void on the ground that the boundaries of the claim have not been marked and established as required by law.

Nicholls *v.* Lewis & Clark Mining Co., (Idaho) 109 Pac. 845. June, 1910.

DUTY OF MINE OWNER TO KEEP MINE SAFE

In an action by a miner injured by the falling of rock from the roof of an entry to a mine, he cannot recover without alleging and proving actual or constructive notice to the mine owner of the danger, where such an action is based on the master's common-law duty to keep a safe place for his servants to work in. But where such an action is based on the duty imposed by the statute of Kansas requiring a mine owner to keep careful watch to see that rock overhead is carefully secured against falling as excavations are advanced, a miner injured by rock falling from the roof can recover without alleging and proving that the owner had actual notice that the rock was loose, or that the rock was in such condition long enough to charge the owner with constructive notice. Under the statute a miner has the right to rely on the performance by the mine owner of the duties imposed upon him by the statute to inspect and keep the roof of the entry securely proped so as to prevent such an accident, and the miner is not guilty of contributory negligence for failure to see that the rock was loose. This statute was not intended merely to declare the common-law duty, but it requires more than ordinary diligence to furnish a safe place for the miners to work. And the negligence of the foreman to perform these statutory duties imposed upon the master is the negligence of the master himself.

Little *v.* Norton Coal Co., (Kan.) 109 Pac. 768. July, 1910.

Recent Publications

PRODUCTION OF IRON AND STEEL IN CANADA IN 1909. By John McLeish. Canada, Department of Mines, Bull. No. 79. Pp. 35. Ottawa, 1910.

PRODUCTION OF COAL AND COKE IN CANADA IN 1909. By John McLeish. Canada, Department of Mines, Bull. No. 80. Pp. 36. Ottawa, 1910.

DEPARTMENT OF MINES OF CANADA, ITS ORGANIZATION AND ITS WORK. By Alfred W. G. Wilson. Reprinted from *Economic Geology*, November 1910. Pp. 12. Lancaster, 1910.

PRODUCTION OF CEMENT, LIME, CLAY PRODUCTS, STONE, AND OTHER STRUCTURAL MATERIALS, IN CANADA, IN 1909. By John McLeish. Bull. 85, Canada Department of Mines. Pp. 47. Ottawa, 1910. A statistical report.

THE PRODUCTION OF PETROLEUM IN 1909. By David T. Day. U. S. Geol. Surv. Advance chapter from Mineral Resources of the U. S., 1909. Pp. 129. Washington, 1911. A statistical presentation of oil production by States.

PROVINCES OF CHINA. Issued as a supplement to the *National Review*, Shanghai, 1910. Description of the various provinces of China, giving much valuable statistical and other information, with an account of the Government of China.

PHOSPHATES IN MONTANA. By Hoyt S. Gale. Bull. 470-A, U. S. Geol. Surv., advance chapter from Contributions to Economic Geology for 1910. Pp. 9. Washington, 1911. This includes details regarding the new field recently discovered by the Survey officials near Butte.

GEOLOGY OF THE MOUNT RADIANT SUBDIVISION OF THE WESTPORT DIVISION, NEW ZEALAND. By Ernest John H. Webb. Geol. Surv., New Zealand, Bull. 11 (New Series). Pp. 46. Maps, index. Wellington, 1910. A geological description of the copper-bearing region of the extreme northern part of the Westport division.

MINERAL RESOURCES OF ALASKA IN 1909. By A. H. Brooks and others. Bull. 442, U. S. Geol. Surv. Pp. 432. Maps and index. Washington, 1910. An interesting account of mining in various parts of Alaska, including gold placers and quartz mines, coal, tin, and other deposits of economic interest and value. Individual papers have been distributed in advance.

TRANSACTIONS OF THE MEXICAN INSTITUTE OF MINING AND METALLURGY, 1909-1910. Pp. 262. Ill. Mexico, 1910. This, the first volume of the new Institute, is replete with important papers and maps and gives assurance that the youngest of the American national associations of mining engineers has set high standards. The volume is printed partly in Spanish and partly in English. It is well edited and printed, and contains particularly interesting information regarding cyanidation.

PROCEEDINGS SYDNEY UNIVERSITY ENGINEERING SOCIETY, 1909. Pp. 191 + 8. Ill. Sydney, N. S. W., 1910. It is apparent from the papers presented in this volume that Sydney University keeps in close touch with the engineering problems of New South Wales. As is natural, coal takes first place among the minerals discussed, though irrigation, harbor improvement, and transportation problems are not neglected. F. Danvers Power treated fully the 'Coal Industry of New South Wales' in his presidential address. This was followed by an article on the 'Crushing Strength of Coal and the Strength of Mine Pillars' by Arthur Jarman, professor of mining engineering, University College, Auckland, New Zealand. In this, data derived from American tests and practice are supplemented by the results of new tests on Taupiri lignite, but on the whole the paper serves to emphasize the need of more data before mining engineers can proceed with security to plan underground workings.

Book Reviews

Any of the books noticed in this column are for sale by, or can be procured from, the MINING AND SCIENTIFIC PRESS.

THE MINERAL INDUSTRY, 1909. Edited by W. R. Ingalls. Pp. 877. *The Engineering and Mining Journal*, New York, 1910. Price $10. For sale by *Mining and Scientic Press.*

This, the eighteenth volume of the series established by R. P. Rothwell, is, we understand, the last that will be published by *The Engineering and Mining Journal.* The work will hereafter be carried on by the McGraw-Hill Book Co., and Albert H. Fay will succeed Mr. Ingalls as editor. In a way, therefore, the volume marks the close of a period. The usefulness of 'The Mineral Industry' is widely recognized. R. W. Raymond has felicitously referred to it as the 'first aid' to an engineer, and it deserves the title. As a general summary of the business of the year it forms a convenient starting point for any investigation, and the bibliographies and references in the text enable anyone quickly to find the additional details needed. Originally the volume also gave complete statistics of production in advance of those issued by the Government. The officers of the Geological Survey concerned with the 'Mineral Resources' have, however, improved their service as to promptness, and the editor of 'The Mineral Industry,' has, in a proper effort for greater accuracy, fallen farther and farther behind, until now the two publications come out at about the same time. Despite the fact that part of the reason for publication of the volume is therefore gone, it has made a name and a place for itself in other ways and is recognized to be an indispensible handbook. The present volume is no exception to the rule of high excellence set by its predecessors, and Mr. Ingalls and his associates deserve the thanks of the mining profession for their painstaking work. In passing the duties over to his successor the editor may well be conscious of having accomplished something of real value to his fellows, something for which they are properly grateful.

H. F. B.

NORTH AMERICAN INDEX FOSSILS. INVERTEBRATES. By A. W. Grabeau and H. W. Shimer. Vol 1, Protozoa, Gasteropoda, pp. 853; Vol. 2, Conularida to Echinoidea, and appendices, pp. 909. Fully illustrated. A. G. Seiler & Co, New York. For sale by *Mining and Scientific Press*, price for the two volumes, $12.75.

Paleontology has become a highly specialized science. The refinements in classification that have been made possible by newer methods of study and the large number of species known, have buried the ordinary geologist under an excess of information. No mining man has time to know the fossils, and yet he must often hazard a guess as to stratigraphy where fossils are important. Faulting of Cretaceous against Tertiary beds may be so masked as to resemble an anticline and so indicate favorable conditions for oil, and only a knowledge of paleontology can save a blunder. It is true that a little knowledge is a dangerous thing, but in this case, and there are others, a very little knowledge would be a great safeguard. To describe the index fossils so that they may be recognized without too great special study, is the task of Messrs. Grabeau and Shimer have attempted. We believe they have succeeded, quite as well as is possible at present. Successive editions of the work will doubtless permit of minor improvements, but in general the plan adopted is correct. It is not new or untried, except in its application to this field. Gray's 'Manual of Botany' and Jordan's 'Vertebrates,' both highly useful books, were built on the same plan. If the new works do as much to stimulate intelligent interest in fossils and to help the man who must work alone to unravel stratigraphy, as was done by the books mentioned, it will have justified its existence. The 'North American Index Fossils' is the only book occupying a large field and should be widely used.

AUSTRALIAN COPPER PRODUCTION

During 1910, 54,624,800 lb. of copper was produced by the Mount Morgan, Mount Lyell, Great Fitzroy, and Great Cobar, the four largest copper mines in Australia. Of this amount 17,263,680 lb. was from Mount Lyell, 15,113,280 from Mount Morgan, 14,804,320 from Great Cobar, and 7,443,520 from Great Fitzroy. December production from Great Cobar is not yet reported. Great Fitzroy commenced operations in April, having been closed down the four previous months, during which time its smelter was being enlarged.

TIN IN THE BLACK HILLS

At the tin mines at Tinton it is reported that the company has solved the problem of treating the ore, and now returns will be measured merely by mill capacity, as a vein 100 ft. wide invites mining on a big scale. At the Pa-Ha-Sa properties (formerly the Harney Peak) in the Hill City district, development and cleaning out old workings was in progress during the year. Tin ore was found in the Cowboy mine, and Gordon Duncan, who spent two months examining the property, is to make a report. In the same district E. C. Johnson was engaged in fitting up the old Harney Peak mill with machinery to treat tin ores from his Gertie property.

NEW STEAM ENGINE

A decided innovation in the way of a steam engine has been invented by John March, of Orange, California. So radical is this engine in its departure from those of the ordinary type that it is deemed of sufficient interest to entitle it to a brief description supplied by the inventor himself.

The cylinder is open at both ends, having moving cylinder-heads which are bolted to a movable steel frame outside, which is strong enough to pull the cylinder heads backward and forward. The piston-head is placed between the moving cylinder heads, thus making two chambers, one a high-pressure, the other a low-pressure chamber, the high-pressure being the smaller. The moving cylinder-heads and the piston-head have steel or metallic packing rings, so that each chamber in the cylinder is perfectly tight. Sliding valves on each side of the cylinder open and shut to receive and let out the steam with each stroke of the piston. The valves open to receive live steam into the high-pressure chamber where the steam expands between the moving cylinder-head and the piston-head. The cylinder-head moves one way and the piston-head the other. By this motion the steam escapes from the high to the low-pressure chamber, thus utilizing the steam twice in the same cylinder, the steam being equally balanced between the piston-head and the moving cylinder-head. The piston pulls the central crank on the crank-shaft and the moving cylinder-head, which is fastened to the moveable steel frame, pushes the two outside cranks at one stroke of the piston, thereby getting the greatest purchase power and full strength of the steam pressure. There are two of these cylinders on each working shaft. When one is on centre the other is at its greatest purchase power and readily brings it over this centre. By this means, all friction is removed from the shaft, making the power equal all around the shaft, for, as stated, by one stroke of the piston, it pulls and pushes at the same time. In addition to eliminating friction it also eliminates the useless strain, jar, and vibration. In the old style, the cylinder-heads are stationary and the whole thing is securely bolted to a firm foundation. The cylinder-head is not bolted, as the power is wholly on the shaft where it is needed. The inventor claims that instead of power being wasted in pulling bolts, the waste steam is used in speed and saves from one-fourth to one-third in fuel.

Mr. March has applied this type of engine to the driving of a pump for mining and other uses, and also to air compressors. In fact, the engine can be used wherever the ordinary type of steam engine can be applied.

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EDITORIAL

TIN continues to attract attention among speculators. There have been large sales, and prices have dropped until half the rise of the last year has disappeared. At the same time it is by no means certain that the London syndicate has liquidated its holdings. Consumption is large and increasing, but production is also larger. As one of the leading metal houses says: "There is a corner, not a famine, in tin, and corners seldom last long."

ISSUING gold certificates against uncoined metal and a limited amount of foreign coin is proposed by the Secretary of the Treasury. To meet the demands of commerce, large amounts of coined gold are annually exported and imported. For this purpose bars are preferred, and gold certificates are rarely presented in large amounts for redemption, except to get gold for export in that form. It is estimated that the larger part of the $300,000 spent annually in coining gold might be saved by adopting the simple and business-like proposal of the Secretary.

OXYACETYLENE welding is rapidly becoming common. Because of the high temperature produced by the oxyacetylene blowpipe, and the portability of the apparatus, it is possible to accomplish results hitherto impossible. A careful series of tests made by Mr. Herbert L. Whittemore at the University of Illinois and described in *The Wisconsin Engineer* for January indicates that steel welds may be readily made in the field that could be improved only by forging and thorough fusion of material. This is particularly important in mining where isolated plants make repairs expensive both as to direct cost and loss of time. Thermit has been used to some extent, particularly on California dredges, but is not entirely satisfactory. A simple plan of direct welding without additional material will be welcomed and the work already accomplished by the oxyacetylene blowpipe in railway repair shops warrants careful study by mining men.

SEARCH for the Main Reef series of the Transvaal has been conducted in the Orange River Colony for some time by the New Rand Limited under the direction of Mr. A. R. Sawyer. The thirteenth bore-hole has reached a depth of 1660 feet from the surface, and Mr. Sawyer reports that the drill is in settled ground and passing through "good looking quartzite." This last bore-hole penetrated a small thickness of dolomite, but as it is unconformable to the Rand formation, perhaps little interest should be attached to it. Whether Mr. Sawyer will be able to find the Main Reef series

in this southern field remains to be seen. If he can establish the good-looking quartzite to be of Upper Witwatersrand age he will have gone a long way toward success as regards finding the horizon of the Main Reef series, but even then there will be the equally important question as to grade of the rock. Since so much money has been spent in pursuing this investigation, it is hoped that even should this borehole fail to intersect the Main Reef series or any definite indication of its whereabouts, it will not be discontinued until something definite, positive or negative, has been achieved.

Yard Decision and Oil Lands

In the 'Yard decision', so-called, it was held that where an association of locators took up a placer claim of 160 acres and, prior to a discovery of placer gold, conveyed all their interests to one of their associates or to a corporation, the subsequent discovery of mineral only operated to validate the location as to 20 acres; which is the maximum amount that an individual is entitled to locate in a single location. The decision does not go to the extent of holding that a conveyance of an inchoate location by an individual to another qualified individual would operate to invalidate the location, provided the grantee does make a discovery. It is decided, in effect, that prior to discovery, an individual is not entitled to hold more than 20 acres in a single claim, whether he locates the claim himself or whether he acquires it by transfer from others. The Land Department applied the same ruling to the Bakersfield Fuel Oil case involving oil lands. Its decision on this point has been recently affirmed by the Secretary of the Interior. The decision itself is generally considered to be good law, though it runs counter to long-established custom and, in the oilfields especially, works hardship. It is impossible, in most cases, to make a discovery of oil in advance of location, and it is equally impracticable in the California fields to obtain the capital necessary to make a discovery, except in the heart of proved territory, if but 20 acres will thereby be won. Prior to the application of this decision it had been customary for eight locators to transfer their holdings to one person or a corporation prior to drilling a well through which discovery was to be made. This, for many years, has been held to be sufficient for the consolidated, 160-acre 'association' claim. At the time the decision was so applied, many operators were drilling in good faith on land so located. It was impossible to re-locate the land, since, in the interval between original location and the application of the Yard decision doctrine, withdrawals had been made covering the lands in question. The practical effect was to defeat the clause placed in the withdrawal law passed last year and intended to secure the claimants operating in good faith at the time the withdrawals were made. The case was presented to Congress and the following remedial act was passed by the House of Representatives February 7:

"*Be it enacted, etc.*, That in no case shall patent be denied to or for any lands heretofore located or claimed under the mining laws of the United States containing petroleum, mineral oil, or gas solely because of any transfer or assignment thereof, or of any interest or interests therein by the original locator or locators, or any of them, to any qualified persons or person, or to a corporation, prior to discovery of oil or gas therein, but if such claim is in all other respects valid and regular, patent therefor not exceeding 160 acres in any one claim shall issue to the holder or holders thereof, as in other cases: *Provided, however*, That such lands were not at the time of entry into posession thereof covered by any withdrawal."

At the time this is written the matter has not yet come up in the Senate, though there is little reason to anticipate unfavorable action. In the House there was no opposition except from a few members who, not entirely understanding the California situation, feared a breach in the administration's conservation policy. Actually, the new law strengthens rather than weakens the force of the withdrawals, but in any event it is right and honest, since it gives to men operating in good faith what they had every reason to believe the Government guaranteed to them when they began exploration. It wipes the slate and prepares everything for a fair start.

Famine in China

East-central China is again visited by a famine, and it is reported that more than a million people must obtain outside aid until the next harvest, or perish. The cause of the periodic famines in China is not clear to anyone unfamiliar with the local conditions, but really is simple. Throughout China the level of the scale of living is so low that the people have almost no reserve, and if their means of support is cut off for even a brief period they quickly become destitute. In the great alluvial plain of east-central China the larger rivers run in channels on or above the level of the surrounding country. In time of flood they frequently break their banks and inundate the adjacent fields, often covering the country for miles in every direction. To a limited degree this is true every year, and the people make the best of it; only now and then are the floods great enough to entirely destroy the crops and bring the population to starvation level. The most severe cases result when one crop is partly or wholly destroyed and the water does not drain off in time to allow the planting of the next crop. The case then becomes hopeless, and if outside aid is not forthcoming those who can, emigrate, and the rest perish. One cent a day per head is enough to support the starving ones (eight cents per day is the standard wage for a laborer), and they must be supported until the end of May, when the first crops are ripe. Appeals for aid are being made to the outside world by many charitable and philanthropic organizations. In San Francisco the Matson Navigation Company has generously offered to receive and forward supplies to the famine sufferers free of charge. Is it worth $1.50 to you to keep a man from starving?

Speculation in Silver

That active, though quiet, speculation in silver is in progress in London, is indicated by the general course of the markets, as well as by the narrow fluctuations of silver in the Bombay market, the shipments of the metal from the United States and Mexico, and from London to India and India to China, to say nothing of the secret purchase of silver by the British Council for India. Recent reports by Samuel Montague & Company, Pixley & Abell, and other London houses, all give evidence pointing to the same conclusion. The silver product of the United States, 56,000,000 to 57,000,000 ounces per annum, is obtained no longer from the silver mines. Of the total produced in this country, over 40,000,000 ounces is won as a by-product of copper, lead, and zinc mining, copper mining yielding the largest amount. The metals, for the sake of economy, have to be separated in large metallurgical works, and it follows that the control of the silver product here has fallen into comparatively few hands. Through analogous circumstances, the market in London is controlled by a small group, which, as time goes on, tends to become smaller. In Bombay the ruling syndicate is another small group, and its members state that they are holding silver for an expected expansion of trade. Such gratuitous information may well be received with caution. According to Sir Samuel Montague, this group holds about $20,000,000 worth of silver; but this estimate does not agree with that of the native merchants, who believe that the Bombay holdings fluctuate between nothing and a much larger amount than $20,000,000. About $110,000,000 is reported in the Indian treasury, against about $130,000,000 at the same time last year; while the Indian banks hold about $12,500,000 against $27,500,000 last year; both reckoned at 1s. 4d. to the rupee. The amount held in the native States, not being definitely known, is not included in these estimates. Following are the known shipments from London during the past year to the principal silver-buying countries:

British India	$36,500,000
China	7,000,000
Germany	6,000,000
Russia	5,000,000
France	2,500,000
Total (market value)	$57,000,000

This is not equal to the market or gold value of the product of the United States and the exports from Mexico, to say nothing of silver from other countries; a fact that, together with the practice of 'earmarking' gold in the Bank of England for the purposes of the Council for India, the purchases of silver by China, and the large profit on the Government coinage of rupees in India, indicates that the known shipments from London form but a portion of the Oriental purchases and consumption. During 1910, the price of silver in Bombay varied from 11.38 pence gold per rupee weight of fine metal to 11.57 pence, most of the transactions having been made at or near the higher price. In round figures, the rupee weight of fine silver was purchased by the Government for a shilling, coined into two shillings, and made redeemable in gold at 1s. 4d.; a transaction very similar to our own coinage of silver dollars and fractions, though not quite so profitable. What profit the syndicate or syndicates made was the difference between a shilling and the cost of obtaining a rupee weight of silver from the American copper, lead, and zinc mines; something that is not easy for the producers, and impossible for the general public, to discover. Evidently, however, the profit has been considerable.

Congress and the Magazines

There has been much discussion of the postal deficit and the remedy proposed by the Administration. We have said nothing editorially regarding the matter, the *Mining and Scientific Press* being in a sense an interested party. The House has adopted a recommendation made by the Postmaster General, and it is expected that the Senate will take the same course. The bill as passed by the House chances not to affect the *Mining and Scientific Press*, but we wish none the less to record our protest. We have no desire to escape any just tax or legitimate expense; neither do we care to assume an unjust burden in order that a Postmaster General may continue to have positions with which to pay political debts incurred in rounding up Southern delegates for delivery at a National Convention. Everyone admits that the cause of the deficit is that the management of the Post Office Department is political. Even such seasoned and frank politicians as Mr. T. H. Carter and Mr. Bois Penrose, recognize the need of thorough reorganization in order to obtain a businesslike management, or even to learn exactly what the service costs, and, incidentally, they have been working to that end. It is certain that the Administration has not made out a clear case in laying the blame for the continued loss upon the magazines; and in advocating a bill that shoulders the burden upon the publications which, as a class, have criticized Congress and the Administration most severely, it opens the way to entirely fair imputations that punishment rather than revenue is the motive. The bill has all the look of dishonest legislation. No provision is made for increasing newspaper rates, for decreasing free service, or for reducing the cost of transporting the mail, nor is any other than a particular class of publications immediately affected. The law places in the hands of the postal officials the power to limit the growth of any magazine, and it does this at the same time that Congress refuses to take the Department out of politics. The danger in this is self-evident. We believe firmly in the good intentions of the President and of the majority of Congress; we are by no means certain but that postal rates should be increased; it is possible that a tax on advertising is a legitimate source of revenue; but the record as it stands has an ugly look and will require a deal of explaining.

The Balanced Life

By J. F. Kemp

*One day in the month of August last, I sat down on the summit of a high ridge in Swedish Lapland, far within the polar eirele. It is always an unusual experience for a dweller in our latitudes to look away from a commanding peak over these far northern landseapes. They are in themselves lonely in the extreme, and exeept in unusual eases, almost without visible life. The seattered eommunities of Lapps, with their herds of reindeer, or perhaps, in favorable meadowlands, a venturesome family or two of Finns, are all that can be normally expeeted. The surface is an expanse of lake and bog, with now and then a streteh of higher ground and oeeasionally a hill. The trees are stunted and gnarled by the storms and eold, and the smaller vegetation hugs the ground in a thick mat. And yet, right before my eyes, and not ten years old, was a town of 7500 inhabitants, with hotels, shops, comfortable homes, and sehool-houses, as good as anything in our latitudes, and a thousand ehildren in them, with pietures, maps, and even some well-exeeuted works of art upon the walls. I really saw a community in the making—the embryo of a little State. It made a profound impression upon me. Now, a eommunity in the making is not an altogether unaeeustomed sight to us in America. We who have been in the West have seen it often, and some of us have shared in the process. But in our latitudes the conditions usually permit the growing of those things which are good for food, or shelter, or warmth. The days are not twenty-four hours long in summer and no hours at all in winter. The frost does not come on the last of August, nor the snow in September, and remain till May or later. The water-pipes are not of necessity laid eight feet underground to prevent their freezing, nor are they bedded in non-eonduetors against the all-pervasive eold of winter. We seldom reaeh the almost irreducible minimum of which I speak. The ridge on which I sat constituted one of the largest and richest bodies of iron ore yet diseovered, and the eause of the railway and of the flourishing town was the plan to mine the ore and ship it to fill the hungry throats of furnaces in Europe and Amerieа. And when I thought of my friend of twenty years standing, who was the one who had developed it all and who was now the manager—realizing his almost impossible dreams—I could not help thinking of the position he held as the leader of this community so far from others of its kind. Seven or eight thousand people to be fed, clothed, warmed, educated, employed, and welded into a unit.

We in New York live in an old town. Customs, organizations, and form have been developing for two or three hundred years. We take them for granted. But a eommunity in the making is different. All these everyday matters must be ereated, developed, and guided. Conditions are plastie and the effeets of strong, governing personalities are all-important. If we go to live in new eommunities we then recall the rich heritage of the past, because we miss it. When we eome baek to old homes and surroundings we reeognize the large part whieh all this heritage plays in our lives.

On that summit in Lapland my thoughts ran over the ocean to our beloved university, and I could not help seeing in my mind's eye the long proeession of engineers who have gone out and who have in some cases, I well know, had the duty and responsibility of organizing similar eommunities. A mine or a manufactory is always the foster-mother of a community. It furnishes directly or indirectly all the means of sustenanee. The manager carries many responsibilities other than the mere business. Away off in Lapland, as I looked over the town of Kiruna, I could not help thinking of the importanee of giving it and every similar community an individuality, a eharacter, and a solidarity as the years pass. The life is more than meat and the body than raiment. The daily task must be performed, indeed, the daily wage must be earned, the commercial organization must be perfeeted, but after that, and beyond all that, a eommunity of feeling must be fostered, an interest of man in man must be established, a life of the spirit must be developed to hold men and families together. While we work in our laboratories, learn to construet our beams and girders, build our railways, smelt our ores, make our profits, and all that, it is not altogether with these material objeets that our graduates must deal, but with families and communities and all their varied interests. Pig iron, steel rails or beams, and profits, are not the whole story, but the welfare of men, women, and children is equally involved. This latter responsibility no manager can eseape.

Sometimes in our professional sehools we rather pride ourselves on the number of hours of lectures and laboratory work which we require, and we are apt to think that if we keep our students on the eonstant go with their tasks and keyed up to the last notch of effieiency we are giving them the best preparation for future eareers. The student, on the other hand, amid the eonstant exeitement and often somewhat feverish devotion to his own peculiar interests, believes that often he is thereby experiencing to the full his ideal of college life. But I sometimes think that on both sides we have gone too far; to the other extreme from the eloister, where in former eenturies men in the quiet retreat of an institution of learning had a ehance to think out the problems of life. The haste, the drive, the absorption, and the exeitement make impossible the reflection and quiet thought which are so essential to the best products of the mind and to the equitable adjustment of the complex relations in which so many are certain to be later plaeed. Over-much struggle and intensity destroy warmth of sympathy and depth of experienee. It would be best for us if we could oftener sit down upon some Lapland peak or its equivalent; be face to face with primitive nature on the one side, and with busy modern life upon the other; and there shape out our philosophy for the latter in the cool elear atmosphere of the former.

*A chapel address delivered to the students of Columbia University.

The Iditarod

By E. H. Thomas

Alaska's newest gold camp, the already famous Iditarod, is in a new region, so new that the first vague hints of the existence of gold began to reach the outside world less than a year ago. Unlike the Klondike, its glory did not burst meteor-like upon a startled world. Rather, its history has been similar to that of the Tanana. Rumors of unrivaled riches in a hitherto unknown region persisted, despite the contradictions and the pooh-poohs of the wise ones. The significant phenomenon of this stampede was that many went in and few came out. Of the few who returned, the majority were of the easily discouraged sort who always desert when hardships are to be faced. As a natural consequence the Iditarod got less praise than dispraise during the early spring and summer months of 1910. About the first week in June, Gen. M. P. Maus of the U. S. Army, and one Herbert L. Jaffe of Seattle reached the new camp. This is mentioned because the two men sent out such different reports. At the time they reached there the country was under a flood from the spring thaw and looked discouraging, at least to the army officer. Gen. Maus hurried on, but Jaffe remained. The General said in effect: "The country is overrun, and the people will starve. It can't produce more than $100,000 a year. The Government will have to send in aid in the fall to prevent suffering."

Mr. Jaffe said: "It sure looks good to me."

Gen. Maus' statement was given wide publicity, for it carried the weight of authority. It had no deterring effect, however, on the tide of feverish fortune seekers swarming from every direction to the common vortex, the Iditarod. The name itself was alluring. It is a fanciful corruption of the old Russian nomenclature, and by its strangeness and the remoteness of the district, it became a golden bait for all the restless horde of adventure-hungry throughout the West. Mr. Jaffe remained, for he had a commission from Robert Guggenheim to acquire everything good he could obtain. He was successful.

The figures of the United States Assay Office at Seattle show that up to November 10 the total gold taken in by that institution from the Iditarod was valued at $787,497, and on September 22, the date on which the last mail from the outside left Iditarod City, there was $150,000 left in the camp which will come out in 1911. At that time the weather was still open and mining operations going full blast, so it is certain that the first season's output will easily reach a round million. This makes it the banner camp of the North.

General View of Iditarod.

Mining on No. 1, Above Otter Creek.

Street Scene at Iditarod.

Operators and 'sourdoughs' like Frank Manley, George Riley, and others, noted the one-sidedness of the Iditarod stampede, and suspected from long experience that there must be some honey to hold so many flies, for the trails were all traveled in one direction—toward the new camp. There were only occasional returning pilgrims. Mr. Manley left his hotel at Hot Springs and his Tanana mines and joined the rush. Jaffe, the man with the Guggenheim commission, stuck. Manley, Madding, and the Guggenheims have now about all of Flat creek, and their ground is producing. Six weeks ago Manley had $200,000 and Madding $70,000. What the Guggenheim ground has yielded is a secret. Their bullion is sent direct to the Selby works on San Francisco Bay.

Iditarod river is a branch of the Innoko, itself a tributary of the lower Yukon. Because of its windings the Iditarod is quite as long as the parent stream. It is a shallow wide stream, slow running and wind-

ing in its course, and navigable for boats of the stern-wheel type. The valleys are flat and the muck and alluvial covering is shallow. Bedrock will not average as much as a dozen feet in depth, and the pay has been located on a large number of creeks. The country is lightly timbered and wood and lumber are high. The one sawmill of the camp sold lumber all summer at $175 per thousand feet. Sawdust brought $10 per load, and slabs 25 cents each. There are some horses there and wagons as well, but the mud was abominable all summer. Merchandise was scattered along the river front and the townsite was but an aggregation of tents until nearly fall. Some wooden buildings reached completion late in the summer, which relieved congestion and changed the appearance of the place materially. The country would be ideal for the poor man if it were not for the pernicious 'power of attorney' law, which is the curse of Alaska. Under it the first comers plastered the whole region with locations, and sold lays to the stampeders. These locators simply put down the stakes and then waited for the rush. Their foresight and their luck permit them to monopolize 25% of the new camp's output for an indefinite period. The land is a region of summer beauty. It blazes with color when the sun shines, and then lies buried under white desolation all winter. Its ground freezes and thaws with the seasons, unlike the Klondike, which is ice-locked the year round.

Weight and Volume of Ore

By L. S. Austin

If a cubic foot of quartz be taken and crushed to sand, its weight will be found to be, when loose, 95 lb.; when well shaken down in a box, 105 lb.; and when well packed by ramming, 112 lb. per cubic foot. The proportion of voids corresponding to these figures are accordingly 45, 36, and 32%, respectively. Natural sand consists of grains of various sizes, and weighs more per cubic foot than when sized. Accordingly a sharp sand, varying from quite large to quite small grains (a mixed product), may weigh as much as 117 lb. per cubic foot. If 100 measures of dry sand be poured into a graduated glass cylinder, and poured out again, and the cylinder filled with 60 measures of water, into this water may be sprinkled slowly the same 100 measures of sand. It will be found to fill the measure to the 94-mark, while the total bulk will reach to 121 measures, the difference being 27 measures. Subtracting, 60 – 27 leaves 33, the number of measures of voids in the 94 measures of wet sand. That is, the voids form 33% of the wet mass. If the sand be poured rapidly into the water, the result will be different, as air will be carried down with the grains. Accordingly, taking 105 lb. as the weight of dry sand well shaken down, the same mass made perfectly wet, so that the voids are completely filled, will be increased to 118 to 120 lb. per cubic foot.

These results show that the specific gravity, or weight per cubic foot, of ore may easily be less than that of the massive mineral, since it is made up of an aggregate of grains, crystals, or even pieces of massive material mingled with gangue. The whole of this may have been subjected to compression, but not to so much pressure as to eliminate the voids. Again, in the case of ores which have been altered in the zone of oxidation, the leaching out of soluble portions and the swelling due to oxidation or the absorption of carbon dioxide, both tend to decrease the specific gravity of the ore.

An article by Walter J. Meade on 'Relation of Density to the Specific Volume of Ore' appears in a monograph on the Lake Superior region by the U. S. Geological Survey. In it he presents a method for the determination of the specific volume of ore, taking into account porosity and included moisture. To do this three determinations are to be made:

(1) For the specific gravity determinations the hand specimen is thoroughly dried before weighing in air, and is thoroughly saturated before weighing in water. To ensure such complete saturation the specimen is boiled in water under reduced air pressure for a sufficient time. The specific gravity is computed by the rule 'Divide the weight in air by the loss (of weight) in water.' Thus, let the weight in air be 14.35 grams, the weight in water 10.21 grams; then the loss in weight is 4.14 grams, and the specific gravity $\frac{14.35}{4.14} = 3.46$.

(2) Porosity is expressed as the ratio of voids to the total volume. If the weight of the completely dried specimen, its specific gravity, and its weight after complete saturation with water be known, the procedure would be as follows:

Let Gm = specific gravity of the mineral
W = weight of the dried specimen in grams
M = moisture in the saturated specimen
W + M = weight of the saturated specimen in grams

Then $\frac{M}{\frac{W+M}{Gm}}$ = ratio of pore-space or voids to total volume.

Thus let the specific gravity = 4.25, the weight of the dried specimen be 8.5 grams, and, when completely saturated, 10 grams. Then we have

$\frac{1.5}{\frac{8.50+1.5}{4.25}} = 0.43$, or the voids are 43% of the whole volume.

(3) The percentage of moisture is determined by noting the loss in weight after drying at 110° C.

With the above data can be computed the weight per cubic foot as follows: Multiply the specific gravity by the percentage of solid after deducting for voids, and to the product add the percentage of water, then multiply by 62.5. Thus suppose the specific gravity is 4.5, the porosity 30%, and the moisture 10%. Then $[(4.5 \times 0.70) \times 1.10] \times 62.5 = 216.56$, equal to 9.2 cu. ft. per ton of 2000 lb. This requires the making of three determinations upon hand specimens, which may not be truly representative of the ore.

In a suit brought by the Silver King Con. Mining Co. v. the Silver King Coalition Co., both of Park

City, Utah, Chas. P. Brooks introduced a new method of obtaining, by one experiment, the weight of the ore per cubic foot as existing in the stopes. To this end he had a box prepared large enough to contain one or more pieces of ore as large as one or two men could lift. In fact, a piece as heavy as 400 lb. has been tested. Wheat is put into the box to the depth of two or three inches and upon this is bedded the piece or pieces of ore. Wheat is added and worked by hand into the cavities beneath the specimen. More wheat is added until the box is full, and then it is jarred down compactly by raising the ends of the box a little and letting it fall, also by revolving the box slightly. The wheat is roughly struck off with a straight edge and jarred again, then smoothly struck to a perfectly even upper surface. Another box is set close to the first and into this part of the wheat is transferred by hand. The ore pieces are next taken out, brushed to free from any grains of wheat, then weighed. Meanwhile the wheat is returned to the first box and is carefully leveled, using a straight edge short enough to be worked within the box, and is jarred to pack it as solidly as before. With care a perfectly level upper surface is obtained, and by measuring downward from the top, the space within the box, which had been occupied by the pieces, is obtained, and the volume calculated. From the weight of the specimens and their volume is determined the actual specific gravity, and consequently the number of cubic feet per ton. This method has the advantage that large pieces can be tested rather than the small selected specimens so generally used for specific gravity determinations; also no calculations are needed other than of the volume left after removal of the pieces or specimens from the box.

In the suit alluded to above, the lead ore from the Silver King mine was classified into first-class or shipping ore and second-class or milling ore. The first-class ore, as estimated by the Brooks method, was 8.96 cu. ft., and the second-class, 14.4 cu. ft. per ton, and as taken from the stopes, was in the ratio of 1 ton of shipping ore to 5 tons of milling ore. The assay-value of the shipping ore of the above specific gravity may be thus given: Pb 55.6%, Fe 3.10, S 3.16, with Au 0.16 oz. and Ag 38 per ton. The second-class ore would assay, Pb 15.8%, Fe 10.3, with Au 0.06 oz. and Ag 13 oz. per ton. Determinations of the number of cubic feet per ton as made by the different witnesses varied largely. Thus, by computing the weight of the ore from the specific gravity of its constituents, J. E. Talmage found 5.55 against 8.19 cu. ft. by the Brooks method. On cross-examination he altered this to 7.2 cu. ft. per ton. Afterward, with the assistance of Mr. Ebaugh, he found 6.17 cu. ft. per ton. Later, the matter was turned over to a joint committee of four persons, including the two just named, who by a modified method found 7.43 cu. ft. per ton. Any method that does not take account of the porosity of the ore and of the moisture subsequently absorbed, will give incorrect figures. The experiences cited show how difficult it is to obtain accurate results.

The Colorado-Toledo Mill

By W. B. Le Wald

The Colorado-Toledo Mining Co., which is developing mines on Collier mountain in Summit county, Colorado, is completing a mill that is to be put in operation early in March. The ores to be milled consist of mixed sulphides containing lead, zinc, gold, and silver. Mining is done by means of an adit, now driven 3000 ft. into the mountain and tapping veins at 1000 to 2200 ft. in depth. About 1200 ft. of driving has been done on the various veins, and the adit is still to be extended 1400 ft. to intersect additional veins. The scheme of treatment is given below.

After weighing on scales the ore from the mine is delivered in cars to two bins of a total capacity of 135 tons, situated outside the mill, and so placed that they may receive the mine ore and store it when the crusher is idle. From these bins the ore is fed to a No. 5 Austin gyratory crusher. This is

Colorado-Toledo Mill, Montezuma, Colorado.

of large capacity, and is designed to crush enough ore in 8 or 10 hours to supply the mill for 24. One man on an 8 or 10-hr. shift will therefore crush all the ore, thus doing away with labor in the crushing department for the remainder of the 24 hr. From the crusher the ore is delivered automatically to a belt-elevator with 14 by 6-in. buckets running at about 400 ft. per minute, and is elevated to a revolving screen or trommel fitted with a No. 7 wire screen with 1¼-in. openings. The undersize from this screen (1¼ in. or about 26 mm. and finer) is automatically sampled and sent to the mill-bins. These have a total capacity of 270 tons. The oversize from the screen will be returned to the crusher. It is a question whether by returning the oversize to the crusher the ore will be broken fine enough, but it is thought that with a 'choke' feed it will. If so, there will be the saving of a small crusher for the re-crushing of this oversize. The crushing department is operated by a 35-hp. motor, and is entirely separate and distinct from the main mill.

From the mill-bins the ore is fed by automatic plunger feeders to a 20-in. belt-conveyor which de-

livers it to a bucket elevator, with 18 by 6-in. buckets running at 400 ft. per minute. This elevator delivers to the revolving-screen line which consists of five trommels, three 6 ft. long by 3 ft. diam., and two 9 ft. long by 3 ft. diam. The short ones are for the coarser sizes, and the longer ones for the fine sizes. The wire used will be as follows:

Mesh.	No. Wire.	Opening, mm.
2½	13	8
3	10	5
4	11	3¼
6	13	2
12	18	1

The oversize from the 8-mm. trommel will be sent to coarse rolls, re-ground to 8-mm. size, and returned to the trommel. The 8 to 5-mm. size will be delivered to No. 2 jigs, the 5 to 3¼-mm. size to No. 3 jigs, and the 2 to 1-mm. size to No. 4 jigs. The ore 1-mm. and finer goes to a 4-compartment hydraulic classifier where the No. 1 spigot delivers to No. 5 jigs. Spigots No. 2, 3, 4, and the overflow, go to Card tables. The No. 1 jig is two-compartment, treating 8 to 5-mm. size, and will collect clean galena on the first compartment and impure galena on the second. The tailing will be sent to the No. 2 or fine rolls for re-grinding. The re-ground product is to be returned by the elevator to the trommel line. The No. 2 jig is also two-compartment, treating 5 to 3¼-mm. size. Its products are the same as No. 1 jig and the tailing is treated in the same way. The No. 3 jigs are four-compartment, treating 4¼ to 2-mm. size, and will make clean galena on the first compartment, galena and iron on the second, iron-zinc middling on the third, and zinc on the fourth. The tailing goes to the fine or No. 2 rolls, as in No. 1 and No. 2 jigs. The No. 4 jigs are four-compartment, treating 2 to 1-mm. size, and making similar products to the No. 3 jigs, and tailing going to the tailing launder. The No. 5 jigs are four-compartment, treating the discharge from the first spigot of the hydraulic classifier, the product and tailing being similar to that from the No. 4 jigs.

Of the above-mentioned jig products, the galena and the galena-iron will be a concentrate for shipment to the smelter. The iron-zinc middling is reground for further treatment. The zinc may or may not be marketable, depending on ore conditions, and how perfectly it can be separated from the other constituents. The bed-screens on the jigs will be as follows: On No. 1 and 2, 4-mesh, No. 11 wire, giving a 3¼-mm. opening; on the No. 3 and 4, 6-mesh, No. 13 wire, giving a 12-mm. opening. The same wire will be used on the No. 5, but this jig will be bedded with concentrate from the No. 3 jig. Space has been reserved so that if it prove necessary, machinery can be set for re-grinding and treating separately the zinc middling. As now arranged, the middling goes to the hydraulic classifiers, and the first spigot product is sent to the No. 5 jig. The No. 2 spigot is delivered to coarse-concentrating tables, the No. 3 spigot to other tables for medium-size, and No. 4 spigot to fine tables. All these tables will make a galena-iron and iron-zinc middling, a zinc product, and a tailing. The products will be similar to the ones made on the jigs, and be mixed with them for shipment or other disposition.

Arrangements have been made to dewater all jig tailing and concentrate, excess water from the tables being settled in large tanks and the clear water decanted and sent to waste. The thickened settling is to be delivered to a Card slimer, which will make the same products as the other tables. All concentrate will be delivered to bins by gravity. Provision is made for automatically sampling the tailing or waste from the mill, and all concentrate. The mill is heated, and driers for concentrate provided. Water for mill operation is distributed from an 8500-gal. tank, fed by a 6-in. pipe, and a fire-line, separate from the operating line, and with full main pressure, has been provided. It is expected to operate the mill with two men on a shift, with the addition of a crusherman for the 8 or 10-hr. shift.

NATURAL GAS IN 1909 AND 1910

The production of natural gas in the United States in 1909, as ascertained by a joint canvass made by the U. S. Geological Survey and the Bureau of the Census, is estimated by B. Hill, in charge of this work, under the supervision of D. T. Day, to have been $55,000,000, an increase of only about $359,626 over that of 1908. There were no great changes in the industry during the year, the production continuing to decline in Kansas, and an increase being made in Oklahoma and in the Caddo field in Louisiana and in Texas. An interesting feature was the supplying of Fort Worth and Dallas from the gasfields of Clay county, Texas. For the year 1910 the total production is estimated at $57,000,000, an increase of about $2,000,000 over 1909. During 1910 a feature of great interest was the development of what promises to be a very large supply of natural gas in the Buena Vista hills, Kern county, California, east of the Sunset-McKittrick oilfield. Arrangements were made and practically completed during the year for piping this gas to Bakersfield and other towns in San Joaquin valley.

SMELTING BY ELECTRICITY

In speaking of the work of the Electro-Metallurgical Commission, Professor Farnps, of the University of Christiania, one of the members, says: "It is quite possible, in electric smelting of iron ore, to compete with smelting of the old type in other countries. The iron ore is no more expensive here than in other places, and Norway is richer in electric energy, and electric power here is much cheaper than in other countries. Should the electric smelting of iron and steel, in spite of all this, become more expensive than smelting by the old methods, it will still be able to compete with the old method of smelting because of the much finer quality of the product. In Sweden, where the new electric smelting furnaces have been installed, the results show that the new method is a success."

Cripple Creek Metallurgy

By Thomas T. Read

The progress made toward solving the problem of how best to treat the rather difficult ores of the Cripple Creek district is perhaps more striking to one re-visiting the camp after four years absence than to those who have watched its daily growth. In any case the problem of ore-treatment at Cripple Creek posseses so much interest that no excuse is required for adding to its discussion.

The unoxidized ore at Cripple Creek consists essentially of tellurides of gold in a gangue of which the most significant feature, is its high aluminum content. These give us the governing conditions; the gold can not be recovered by amalgamation or cyanidation in the raw state, the ore can not profitably be concentrated because of the brittleness of the gold mineral, and can not be smelted except when mixed with a large quantity of easier-smelting ore. Roasting is expensive, and produces small lumps of metallic gold that are difficult to catch by amalgamation and impossible to dissolve in cyanide solution in any reasonable length of time. Some years ago the problem had been brought to this stage of adjustment; the rich ores were sacked and sent to the smelters at Pueblo, Denver, and Salida (where some five years ago the smeltermen found that Cripple Creek ore could be used to advantage to replace the lime formerly used in the pot-roasting of lead ores to keep the charge from fusing in the pots). Only the richer ores can be treated thus, as the treatment and freight charges become too severe a tax on the lower-grade material. That of medium grade was sent to mills at Colorado City where it was first roasted and then chlorinated. The low-grade ore was left in the stopes or piled on the dumps.

Meanwhile Cripple Creek was fast approaching that stage in the development of every mining camp where the former medium-grade ore becomes high-grade and the former waste is regarded as low-grade ore, the change being due both to the exhaustion of the richer ore and the lowering of the working costs. From time to time mills were started adjacent to the mines with the intention of treating lower-grade unoxidized material than could be shipped to Colorado City. These were generally unsuccessful, for a variety of causes.

About four years ago the opinion had become general that the chlorination process, preceded by roasting, was unsatisfactory because of the high gold content of the tailing and the high cost of treatment. Two improvements were made; the chlorination process was supplemented by concentration and by cyaniding the tailing; and a new process of roasting, re-grinding, running over blanket strakes to catch the free gold, followed by cyanidation of the ore.

In the face of the decreasing grade of the average ore, the items of $1 for freight to Colorado City and $0.70 (about) for roasting became painfully significant. It was clear that some method must be found of treating the ore near the mines, without roasting.

The problem of treating the unoxidized ore without roasting hinges on the fact that the gold telluride is not soluble in ordinary cyanide solution. It can be made to dissolve by using a solution that has great oxidizing power. One of the first methods tried was bromo-cyanidation. There have been no published accounts of the detailed results of experiment on these ores, but the impression is general that bromo-cyanidation fell before the crushing blow of high working costs, coinciding in a general way with Western Australian experience in this regard. It is not dead, however, as it is used in certain instances to supplement the main method of treatment, and I regard it as not improbable that with further experiment bromo-cyaniding may be found useful in many cases. The fact that the whole history of the cyanide process has been a constant struggle to perfect the mechanical equipment used must never be lost sight of in considering the merits of any proposed process.

A significant feature of progress in the past year has been the introduction of the Clancy process for treating unroasted ore. Its essential features are the use of cyanamide and iodide in the solution and the use of the electric current for producing a high degree of oxidation without excessive consumption of cyanide. The impression among the best informed is that the process obtains the desired extraction, though no actual working costs have been made public. A great deal of the discussion of this process has been footless and entirely beside the point. Metallurgy is chemistry applied to business, and if by treating gold ore with a solution of old boots a good extraction at a low cost of operation can be obtained, it is good metallurgy: and if by treating with C. P. chemicals in apparatus of the latest refinement of design the extraction is poor and the cost high, it is poor metallurgy. When the Clancy process demonstrates low costs of operation its position will be impregnable.

The present stage of development in treating the raw ore is to first crush in cyanide solution and classify the product into sand and slime, using either the Dorr or Aiken classifier. The sand is concentrated on some approved type of table, the tailing rejected and the concentrate sent with the medium or high-grade ore to Colorado City or Pueblo. The slime is treated by some process that will give the necessary oxidation. The most important mills are not yet ready to present their processes for criticism and comparison, but by the end of another year it is hoped that a more detailed discussion of progress can be made.

Meanwhile we have the brutal fact to face that the shipping ore from Cripple Creek is steadily decreasing in grade. This is partly offset by the fact that the constant pressure on the Colorado smelters to obtain silicious ores to smelt with the flood of basic ores produced in most of the Colorado camps makes them more willing to take Cripple Creek ore at a low treatment charge, even though it is aluminous rather than silicious.

Petroleum Mining, a New Branch of Engineering

By Raymond S. Blatchley

Specialization has become a potent factor in modern progress, particularly in construction work and in the development of great enterprises. Upon civil, mechanical, electrical, mining, and chemical engineers has fallen the burden of developing great industries and harnessing the forces of nature. These specialists are being turned out annually by hundreds. Great railroad problems are being solved upon a methodical basis, new machinery is being developed to minimize human toil and produce added power, new resources of mineral wealth are being unearthed and converted into value, and new industries with cheaper methods are being developed by the delving into latent mysteries of chemistry. Great results have followed the efforts of the engineers, and America has secured a world-wide reputation for energy and progressiveness. The future holds even greater promise of the advance of the nation along these same lines, in unexplored fields, for in many enterprises there has been scarcely any specialization. In the latter class falls the petroleum industry. This, though but 50 years old, has contributed a notable chapter to the world's commercial history, and particularly to that of America. It has assumed gigantic proportions in recent years. The use of various oils, gasoline, and by-products from petroleum is universal and essential to modern progress, creating a continuous demand for crude oil that will always be in excess of supply. Of the many branches of the industry, perhaps the most advanced is that of the manufacturing side. Chemists and physicists have made wonderful advance in creating new by-products, and especially in the utilization of waste materials. The future of this department of the industry is one of great opportunity to trained men, especially to chemists, for as yet the chemistry of petroleum is little known. It varies widely for oils of different fields. A second and vital branch of the industry is that of production. This offers greater opportunity to the trained man in that there has been little or no specialization, and there is need of trained engineers. The present day does not warrant any worry over the lack of production, yet the inevitable decline of all of our present fields suggests a care for the future. In some near day, production will need a new stimulus, and it seems that the proper way to create this is to develop a type of man peculiarly fitted to work out the problems of oil accumulation and to solve the many varied questions pertaining to its production.

The men who have developed the vast oil-producing areas of today have done the frontier work of a great industry. They are the pioneers, who, through pure grit, costly practical experience, and the intense lure of the game, have made possible the present industry. Their patient toil and indifference to loss is significant of American success, yet however profitable their operations may have been, it is easy to see that had they had a better knowledge of geological conditions, in many instances their losses would have been greatly minimized. The development of new fields, in practically all cases, dates back to wild-cat discovery and to the gradual 'feeling out' of pool limits. Often drilling was stimulated by oil seepage, either in outcrops or in faulted formations. Outside of these influences but little work scientifically has been done until within recent years. Lately Government and State geologists have contributed to the development and a gradual belief is arising that they are of service to the oil-men. Properly trained men are few in proportion to the enormous field. They are, for the most part, men trained in geological problems and are able to handle only certain phases of the development. They are not, as a rule, trained petroleum engineers, because these are scarcely known in America, but they are rather geologists. Whatever benefit they have been able to render to the oil-producing business is along geological lines. Their work has been practically limited to the vicinity of newly proved areas, though the results accruing from the investigation of various fields is of immense value toward a broader interpretation of the work of the future petroleum engineer, especially in his search for new areas. The questions now arise, is it possible to develop engineers who can carry on work that will build up the producing side of the oil industry and put it on a scientific basis, as in other types of mining? Is it possible to go into new territory and be able to outline oil areas? The answer to the first question I believe to be "yes," and the method toward this end is to educate men along the lines of the petroleum business and at the same time bring them in touch with the chemical, physical, geological, mechanical, and economic possibilities of the industry. The answer to the second question is, strictly speaking, "no," yet possibly something is here possible. The possibility lies in a close study of outcrops, water-saturation, dips, and of stratigraphy—the latter meaning the sequence of formations—and the construction of structural diagrams showing the position of anticlinals, synclinals, terraces, and domes. The engineers, through the determination of rock structure and water conditions, may be reasonably assured of a working basis and may eliminate a good portion of the gambling element from the business. They may direct drilling to the best favorable condition for the accumulation of oil and gas. Accompanying this phase of the work, as the advance is made into new territory, there arise problems of transportation, engineering, fuel-supply, and other intricate matters that can only be handled by the trained engineer.

Are there new fields still to be opened? As for this question, it is sufficient to say that there undoubtedly exist many untapped fields in the United States, Canada, and Mexico. The fact that most of the fields of the world have been limited to the sedimentary rocks, and that these are generally prevalent over the earth's crust, is an answer in itself.

So far the discussion has been limited to the field

for specially trained engineers. More systematic development of oilfields may be accomplished by including the operators and drillers themselves in a scheme of special training. The majority of the several hundred thousand persons connected with the oil and gas business in America are young men. Few have received any education that is of special benefit in their occupation. Why not educate the future generations with some of the technical training of petroleum engineers and thus provide them with better understanding of the scientific character of the oil business? At the same time that they are securing this they may receive the usual academic education and thus be equipped for the business of their choice. It is my opinion that the industry is ready for such action. Whether such a plan would have the favor of the oil-men is uncertain, since but little consideration has been given the subject.

Petroleum mining is a branch of engineering. The term is as yet unfamiliar to the American oil industry, since it is more particularly a foreign expression, meaning in its strictest sense the development of oil properties and the winning of petroleum. The exploration for petroleum is essentially mining, and it seems to fit no other classification. It is different from ordinary mining, however, in that it involves the laws applying to liquids rather than to those of solids. Moreover, the distribution and accumulation of petroleum is dependent on stratigraphic and structural features that do not apply directly to other minerals. Petroleum, accompanied usually by gas and salt water, is, to a certain extent, migratory and offers unsolved problems not found in any other type of mining. The underground manipulation in winning petroleum calls for peculiar machinery unlike that of ordinary mining, and thus introduces special mechanical problems. Petroleum mining is closely related to the other branches of engineering and scientific work, such as civil and mechanical engineering, physics, chemistry, and geology, and necessarily borrows from them for the development of the engineer. In fact, there is occasion for specialization within the subject of petroleum mining, and the development of petroleum mechanical engineers and petroleum chemical engineers will become necessary. The possibilities to be gained under each subject are treated individually below. Civil engineering offers training in construction work of various kinds. The surveying and laying of pipe-lines within the oilfields and from them to distant refineries requires accurate leveling, especially if extensive gravity systems are to be employed similar to those of the Illinois fields. California fields require work in the construction and maintenance of wagon-roads and in foreign fields light railways are built. Overland pipe-lines and light railways require rights-of-way. Oil areas often lie close to large bodies of water, and docks or piers are needed. The design and erection of power-plants, field buildings, storage tanks, loading racks, and pumping stations require training in civil engineering. This training is also needed in order to determine well elevations for purposes of geological and structural study. Only in this way can one determine the dip and rise of various formations, and the approximate limits of new and old areas. The oil business has developed certain types of machinery that are peculiar to its needs, and the possible development of additional useful tools and various mechanical devices opens up fields of wide opportunity to young men of an inventive turn of mind. Mechanical engineering offers a wide technical understanding of arrangement and use of machinery and the incorporation of phases of this work in petroleum mining is desirable. The design and manufacture of special drilling tools for penetrating great depths of peculiar formations and for surmounting the many difficulties that overtake the driller is an important subject, both for present knowledge and future investigation. The design of pumps for transporting viscous liquids without blockade of movement is important. The arrangement of power-plants and pumping stations, the making, setting, repairing, and recovering of casing; the manufacture, assembling, and use of steam boilers, steam-economizing devices, steam, oil, and gas engines; the knowledge of steam, gas, and electric power; methods of excluding water by means of casing, packers, and use of cement; methods of sand-pumping, boiling, and devices for inducing flow of oil, gas, or water; and many other detailed forms of mechanical need are useful, if not necessary, to the study of petroleum mining. Special opportunity is open to the petroleum mechanical engineer today in the use of various oil-burners and oil-fuel apparatus in marine, railroad, and domestic application, especially since recent experiment has shown the practicability of oil as a source of cheap and efficient power. The condensing of portions of natural gas into gasoline and other similar volatile liquids at the gas-well without the loss of the gas, is commanding present attention. Many other possibilities might be mentioned, but the above are sufficient to show the need of specialists and also of general knowledge on the part of the petroleum engineer.

The study of physics provides training to the petroleum engineer in various simple and everyday problems. The inequalities of temperature and the effect upon pipe-lines, machinery, and even the product itself, is a subject of interest. The mechanics and laws of liquids, evaporation, congealing, pressure, equilibrium, weight, and motion, form the basis of mechanical engineering in its relation to petroleum mining. The chemistry of petroleum is slightly known today except from its industrial side. It is a subject that has the earnest consideration of Government officials, and their efforts will pave the way to a wider investigation. The possibilities for additional successful research are exceedingly promising. Aside from the scientific gain through research, new methods of analysis, fuel possibilities, new methods of distillation and refining, new by-products, and more complete utilization of waste products, are open to investigation. An intimate study of the petroleum itself is needed. The problem of its origin is as yet not definitely solved, and new facts concerning its composition and organic relations may

be of considerable aid in establishing correct theories of its origin. The science of geology is one of the greatest aids toward the development of petroleum. In event that the petroleum engineer be called upon to do the bulk of outlining new fields, he will need a knowledge of the rocks of the area to be investigated. An understanding of stratigraphy and geologic structure is indispensable. Some knowledge of paleontology will be necessary to aid him to determine the character and classification of the oil formations. The study of the dip relations of outcrops will materially assist him in his structure determinations. The principles of geology will aid the operators, drillers, and other men connected with the business,

The economics of petroleum would offer a valuable addition to the education of the petroleum engineer. The subject involves the discussion of necessary steps to successful handling of oil properties. Phases of leasing, choosing well-sites, contracts for drilling, shooting of wells, taking the oil, power, and property equipment, costs of operating leases, oil investments, buying properties, gauging properties, geographical studies of distribution of oil and its transportation, storing the oil, keeping of records or samples of wells, statistics, legal phases of the business, are all worthy of study. All this suggests the need of special training for the petroleum engineer. The list of needs is long, yet by selection a good sound training can be got that will greatly aid the industry. Such training is not given, at the present writing, in any university in the world, though several foreign schools are considering the establishment of such a course and at least one American university has the plan in mind.

STAMP-DUTY ON THE RAND

Transvaal statistics for 1910 show that while a greater tonnage was treated than in 1909, the average number of stamps dropping on the Rand is 155 less than a year ago. Tube-mills have increased 44 in number. Average mill duty per stamp per day has increased from 6.86 to 7.42 tons, while the percentage sorted out at the surface has remained exactly the same, namely, 13.6%. The Roodepoort United new mill has outclassed all the others by crushing 19 tons per day, Knights Central coming next with 9.92 tons, and the new Bantjes mill 9.9 tons. The gold yield was a penny better per ton than in 1909, but costs have gone up from 16s. 11d. to 18s., so that the gold mines are actually making 1s. per ton less profit than they did a year ago. The three mines worked most cheaply are Knights Deep, 11s. 3d.; Simmer & Jack, 12s. 4d.; and Witwatersrand, 12s. 8d.; all blessed with thick reefs and big mills. Estimating the returns for December, the following probable final returns for the year 1910 may be calculated: tonnage milled, 21,400,000; gold won, £30,650,000; profits, £11,200,000; dividends, £8,875,000. In 1910 the distributed profit per ton milled was 8s. 3d., as compared with 9s. in 1909, while out of every £1 won the shareholders received 70d. in 1910, as against 75d. in the previous year.

Ore in Sight

By C. S. Herzig

The estimation of ore in sight, either in the valuation of a mining property for purposes of sale or purchase, or during the course of mining operations for the purpose of information to the stockholders of a company, is a subject which has been widely discussed in various technical publications at different times. Engineers are all, more or less, familiar with the efforts made to standardize the terms employed to express the relative importance of the ore reserves in a mine depending upon the certainty with which particular blocks of ground may be expected to yield the results stated. Perhaps the most generally accepted set of expressions is that advocated by the Institution of Mining & Metallurgy of London and referred to as 'positive ore,' 'probable ore,' and 'possible ore,' but whatever nomenclature may be affected by any particular engineer, the object to be served is the same and the impression that is intended to be conveyed remains the same: consequently, the more simple and older expression of 'ore in sight' or 'ore reserves' continues in favor among most engineers.

The establishment of the value of certain blocks of ground must depend, under ordinary circumstances, upon the actual exposure of this material on three or more sides. Only in cases where the geological characteristics of an orebody are firmly established by careful investigation or by experience of the distribution of the valuable metals in the ore, can estimates of tonnage and value be prognosticated with any certainty when a block of ground is not opened on three sides.

Sampling of ore exposures under ordinary circumstances is a purely mechanical operation calling for but a small amount of experience and judgment on the part of the sampler, so that such work may be, and usually is, entrusted to younger men. The interpretation of the sampling results, with a view to determining the future possibilities of an orebody, is one that calls for, not only a large fund of experience, but also a factor not ordinarily taken into consideration, namely, the natural aptitude of the engineer for this class of work. There are many cases where an estimate of the ore reserves in a mine can be made with accuracy by one who has never visited the property, simply from assay plans. On the other hand, there are instances, by no means few, calling for a higher skill in the interpretation of sampling results and where the actual assay returns can not be taken as an absolute gauge of the possibilities of a property. Instances of this character would refer to ore deposits where the values are erratic, due to the irregular occurrence of high-grade bunches, streaks, or seams in a larger mass of lower-grade material. In cases of this sort, sampling by the ordinary methods may show results of such a character as to indicate no profit. This comes from the fact that during development operations when the high-grade spots are found, they are usually mined out, as the raisins can be picked

out of a pudding, leaving only indentations to mark the spots where they occurred. In deposits like these, it becomes necessary to make a detailed and minute geological investigation of the mode of ore occurrence and to predicate the conclusions largely on the result of such investigation instead of altogether relying on the result of the samples taken at regular intervals in the mine workings.

Recently I had an opportunity of visiting a gold mine in Nevada that had been examined by a well known engineer, a man who is prominent among the copper engineers of the country, and the result of this engineer's sampling of the mine in question, according to information given by the management, showed the ore to be of an unprofitable grade. The faces exposed, at the time of this engineer's visit, were the drifts and various other development openings, besides a number of old lessees' stopes from which high-grade ore had been mined. These old stopes represented the raisins in the pudding. Despite the unfavorable report of the engineer in question, the operation of the mine has continued, a mill has been erected, and profits have been regularly accumulating month by month. Other mines in Nevada present a similar state of affairs, and for their successful and intelligent operation, require careful and continuous hand sampling in order to obtain the best results. This, unfortunately, is a practice which does not seem to obtain to any great extent in that State. The mine managers consider hand-sampling underground an unnecessary expense.

A mine of considerable importance has recently become the subject of a great deal of unfavorable comment due to the repudiation by the manager in his annual report to the company of his quarterly estimates of ore reserves. This is one of the most startling illustrations of the calamity which may befall any company, due to a lack of the proper data necessary to enable the accurate estimation at all times of the ore reserves in the mine. A case of difference of opinion among engineers, still fresh in the minds of the mining community, is the great variance in the estimates of ore reserves made by two sets of well known and competent engineers on the Utah Consolidated. That there may be an honest difference of opinion as to what constitutes ore in sight by different engineers, is easily conceivable, and may be admitted without cavil. Many engineers are so ultra-conservative as not to figure any ore as being in the reserves, unless it is actually exposed on three or more sides, ignoring the almost equally weighty geological evidence at hand. It is rare for an individual to frankly confess that estimates of ore reserves made during the year are "at best inaccurate and unsatisfactory" and that among the principal reasons given, it is stated that:

"Estimates of ore in sight have been made quarterly during the year, but these estimates are at best inaccurate and unsatisfactory, for the following reasons: First—Estimates of tonnage have been found to vary between wide limits, according to the methods used in making the estimates, and according to the engineer's conception of what is 'ore in sight.' It should be remembered in this connection that it is impossible in the normal conduct of mining to expose any large percentage of the ore on more than two sides; much of it is exposed only on one side. Second—It is useless to fix a tonnage without also fixing a value for the reserves. This is exceedingly difficult, and must necessarily be somewhat in the nature of guesswork, on account of the presence of some extraordinarily high-grade ore in the midst of large bodies of average ore. One shipment of 150 tons averaged $1400 per ton. One ton of 50-oz. ore is equal in value to 50 tons of 1-oz. ore, and a mistake of 1000 tons of 50-oz. ore is equal to a mistake of 50,000 tons of 1-oz. ore. In the Consolidated mine the high-grade ore is far more erratic than the average ore, and there is enough of it to make quite possible a mistake of several thousand tons in estimating it."

It can hardly be stated that these are weighty reasons, and it is hard to reconcile the difference of the same engineer's conception of what constitutes ore in sight within such a few months. Apparently, during the last quarter of the year, there was an awakening on the part of the management to a divergence between the actual condition of the ore reserves and the previously reported tonnages. The case in point is not only one of great interest to engineers, but also to mining capitalists and every mining stockholder in the country. The divergence between the published returns during three successive quarters and the summary for the year may cause a stock-market debâcle such as recently witnessed by the stock of the mine in question, thereby affecting the financial interests of thousands of stockholders who depended on the heretofore published reports of the company, suddenly to awake and find that a condition of affairs previously supposed to exist, had no foundation in fact. At this mine, according to my information, it has not been customary to hand-sample the faces of stopes, nor to use hand-sampling for the preparation of assay plans, the management rather depending for information on the result of grab samples of broken ore from development and stoping operations. That such practice may lead to error can easily be appreciated. Aside from the effect that a mine manager's report of ore reserves may have on the stock-market value of a property, the all-important question of professional justification of estimates made, should be the mainspring of the motive inspiring an engineer at all times.

Engineers are only human, and often are influenced to an extent greater than they realize by their surroundings, so that even an estimate of ore reserves may suffer from the physical discomforts an engineer may be subjected to at the time of his estimation, or, on the other hand, an undue inflation may be the result of psycho-suggestion from interested parties having a close familiarity with the property extending over a period of several years and who are thereby able to influence an otherwise cool judgment. The human factor in a mine examination is usually left out of consideration, but it is an important one.

The Iron Industry in Japan

By T. Haga

Great importanee is attaehed to the development of the iron industry by the Government of Japan, but in spite of the faet that the mineral production of the eountry shows a steady growth, the total production amounting to 110,000,000 yen* in Japan proper, it makes little progress. The amount of pig iron and steel produeed by the Government Yahata Iron Works at Kyushu is 150,000 tons per annum; adding to it the output produeed at Kamaishi and Senninyama under the eontrol of private corporations, the total output is plaeed at no less than 200,000 tons. On the other hand, the consumption of iron materials is approximately 700,000 tons. Foreign eountries must be depended upon to supply the remaining 500,000 tons. The imports of iron and steel for 1909 inelusive of bars, plates, pipe, and rails, were 500,000,000 kin in quantity and 21,092,000 yen in value, a deerease of 180,067,709 kin and 10,212,910 yen, respeetively, as compared with the preeeding year. This eurtailment of the industry is aseribable to the economie depression.

In 1909 England led in supplying the iron imported, furnishing 270,566,258 kin or 52% of the total; next eame Germany with 101,399,366 kin, or over 20%, and America, Belgium, China, and Franee followed in order. To depend upon the foreign market for a supply of iron is not only a great economie disadvantage, but it is neeessary to have domestie supply from a strategie point of view. The depression of the iron industry has been aseribed to the want of iron ore in the country, but the Tayeh mine (China), with whieh the foundry has contraeted for a supply for thirty years, beginning with 1903, possesses an inexhaustible supply, and in Korea there are many iron deposits. The real source of the depression of the iron industry in this eountry is the poor result obtained at the Government iron works as well as the diseouragement of private enterprises.

It is not fair to criticise the Government administration, but a deseription of the present condition of the Government iron foundry may be of service. To begin with, the foundry is situated at Yahata, Kyushu, west of Japan proper. It was established twelve years ago with a view to developing the domestie iron produetion in the faee of enormous imports, at the same time aiming at an independent supply of materials for ordnanee as well as for ship and railroad building. During this time there have been remarkable developments, but at an expenditure of 50,000,000 yen per annum and a yearly loss of 1,000,000 to 1,500,000 yen. Therefore the foundry is one of the diffieult problems in the Diet eaeh year. Thanks to the efforts of authorities eoncerned, Japan is tolerating the present expenditure and loss in expeetation of final sueeess. The yearly loss results from three eauses: (1) the high priee of eoal; (2) the laek of skilled workmen; (3) the want of iron. Coal, however, is not supplied to the works in question alone at a high rate. All industries in Japan are carried on with coal at the same price. With regard to the laek of skill by the workmen, the experience during the decade past should have been sufficient. Iron ore is not wanting in Japan proper, but the faeilities for importing good ore from China and Korea have prevented its development. The desired results have not been obtained by the Government works, and hence the yearly discussion of this question in Parliament. The Government is now considering the introduction at this session of Parliament of a bill to increase the capital to the amount of 15,000,000 yen for the purpose of increasing the yearly production 150,000 tons. This means that the Government may avail itself of the opportunity afforded by the tariff revision to take steps to check the imports of iron and iron manufactures. The members of the Parliament are not in favor of the Government works because of the losses incurred every year. It is expeeted, therefore, that there will be mueh diseussion during its passage through both Houses.

In such countries as Ameriea, England, and Germany, the iron industry is not carried on under Government patronage, but sinee conditions in Japan were so unfavorable in the beginning, it would have been difficult to have obtained good results speedily if the work had been undertaken as a private enterprise. The authorities consulted recommended that the portion taken under Government eontrol and the portion entrusted to private eoncerns be kept distinct, but the Government authorities did not follow this policy. A Government monopoly eheeks development in any industry beeause in the first plaee the methods of keeping aeeounts are too involved, and in the second plaee the officials carry on the work without striving to improve their methods. These are two reasons for the poor results obtained at the Yahata works. Therefore, well known authorities have declared that it would be wiser to turn them over to private enterprise. Unless, however, some indueement be offered, capitalists will not eare to undertake the management. It is possible that the hopes of the Government will be realized and that with the aid of heavy taxes on imports, and with an equipment of excellent machinery obtained by the additional capital, the losses of preeeding years may be reeouped, and even some profit made. In the meantime private works have been established in the north. In November 1910, Armstrong & Co. and Viekers, Sons & Maxim, Ltd., in co-operation of Hokkaido Colliery & Steamship Co., established the Nippon Iron Foundry, with a eapital of 15,000,000 yen and 10,000,000 yen debentures, of whieh mention in detail will be made in the future.

*One yen equals $0.50 gold; one kin, 1⅓ pounds.

In the ancient rivers of California some of the gravel is free washing—that is, it may be sluiced like ordinary gravel, but some of the ehannels are eemented more or less thoroughly with calcium earbonate, iron oxide, elay, or other matter, and the gravel requires some sort of mechanical disintegration before sluicing. In a few instanees the material is so firmly eemented as to require crushing by stamps, before the gold ean be freed.

Grand Gulch Copper Mine

By W. P. Jennings

The Grand Gulch copper mine is situated on the north side of the Colorado river in the Bentley mining district, Mohave county, Arizona, about seventy miles east of Moapa, Nevada, the present shipping point on the S. P., L. A. & S. L. railroad. It is on the high plateau forming the eastern rim of the 'Grand Wash', and one of the many plateaus or terraces that exist near the Grand Canyon of the Colorado. The rocks of the entire country are the flat bedded limestones and sandstones of the Plateau region. It is in the flat bedded limestones that the ore channel of this mine has been found, breaking through a sandstone capping of nearly one hundred feet to the surface. The ore channel is elliptical in horizontal section and measures about 200 by 300 ft. diam. The ore, consisting of malachite, azurite, chalcocite, and the red and black oxides of copper, all carrying a few ounces of silver, but no gold in the lower workings, extends out into the limestone along bedding planes. These beds extend out from the rim of the ore channel 20 to 30 ft. into the limestone, being 6 in. to 6 ft. thick and as much as 300 ft. long. The ore found in these beds is usually high in grade, being in some places pure chalcocite.

The inside of the ore channel, below the 100-ft. level, as shown by present workings, is not mineralized to any extent, being composed mostly of brecciated limestone mixed with some iron. The ore above the 100-ft. level, where it occurs in the sedimentary sandstone, forms beds very similar to those on the lower levels, but not so regular, and instead of extending out into the country rock, is found all through the inside of the ore channel. The ore is found to extend all the way around the channel at irregular intervals. The mine is worked through a double-compartment shaft now at a depth of 460 ft. The sulphide zone has not yet been reached and probably will not be for some distance.

The Grand Gulch mine was discovered by a Shiwits Indian about the year 1871. He made known his discovery to men living at St. George, a small Mormon settlement in the southern part of Utah, about eighty miles north of the discovery. The extreme high grade of the ore excited considerable attention. A mining company was soon organized and the property located. It was worked in a primitive way for several years. Several attempts were even made to smelt the ore. The long distance from a railroad made the shipping of crude ore impracticable and the smelting of the ore at the mine also proved a failure. The high cost of fuel and fluxes, together with the poor facilities for transportation, were too much for even such high-grade copper ore as that of the Grand Gulch. About ten years ago the extension of the railroad to within 140 miles of the mine and an 18c. copper market caused a revival of interest in the mine; the old company was reorganized and work resumed. For the next five years, with still a long wagon haul of 140 miles, the company, by shipping a product averaging about 48% copper, was enabled to do considerable development work and equip the property with a 25-hp. gasoline hoist and all the necessary tools and buildings for a working force of thirty men. When the Salt Lake route built through to Los Angeles, the wagon haul was reduced to 70 miles, and about that time copper moving up to about 25c., new life was put into the company. With brighter prospects, an active campaign of development was begun and the shipment of ore resumed. A lower grade of ore could then be shipped at a profit, and instead of sorting to a 48% grade, a more general average of the high-grade ore as found in place in the mine was maintained, the shipments assaying 35%. The high-grade ore is now being mined in sufficient quantities to carry on the development, $350,000 already having been sold to date. All the proceeds have gone back into the property except that which has been consumed in transportation, taxes, etc. Despite the obstacles encountered in mining so far from civilization and market, the mine pays its own way and keeps up its splendid standard of equipment both for the operation of the mine and the comforts of the employees. A considerable tonnage of 18% ore is being stored for shipment when the market or transportation conditions are a little more favorable, while a product of 6 to 8% is piling up in huge dumps all around the property.

The company operates its own stage line between the mine and the nearest settlement, 45 miles, where it connects with the stage line from Moapa, giving a weekly mail and express service to the mine. The freighting of ore to the railroad is done mostly by the farmers from the adjacent settlements. They freight when they are not busy putting in or harvesting their crops, and since they turn out in goodly numbers when they do come, they move all the ore the company cares to ship. Several six-horse outfits, which are kept continuously on the road, keep some ore moving all the time and take care of all back freight. The roads, though long, are kept in good condition and are better than most freight roads of shorter length. The climate is ideal excepting in midsummer, when it is extremely hot, the thermometer registering from 110° to 120° in the shade, and not much shade. The winters are mild, a fact that is very much in favor of the farmer freighter. At present there is an excellent prospect of the Salt Lake route building a branch line down the Muddy River valley, thus reducing the wagon haul from 70 to 45 miles, a comparatively short distance as against 140 miles. Every year the country grows and better facilities keep opening for the easier development of the property. As the mine is well worthy of all that can be done for it, it is only a question of a short time before it will be heard of among the big producers.

An inquisitive rancher in Nevada put a blast in the slag-dump of an old smelter site, some time since, and uncovered several thousand pounds of black copper that had leaked from the old brick stack built years previously, and which had for years been idle.

Discussion

Readers of the MINING AND SCIENTIFIC PRESS are invited to use this department for the discussion of technical and other matters pertaining to mining and metallurgy. The Editor welcomes the expression of views contrary to his own, believing that careful criticism is more valuable than casual compliment. Insertion of any contribution is determined by its probable interest to the readers of this journal.

The Clancy Process

The Editor:

Sir—In the *Mining and Scientific Press* of December 31, 1910, there appears an abstract of a paper presented before the Electrochemical Society, December 16, 1910, on 'The Clancy Process.' In the paper referred to, Mr. Clancy claims as novel the application of calcium cyanamide as a cheap cyaniding agent in the place of the more expensive sodium or potassium cyanide universally employed in the treatment of gold and silver ores by cyanidation. I beg to take issue with Mr. Clancy regarding his claims to originality in this matter. I can show priority in the application of this material to the extraction of gold and silver from ores. Mr. Clancy may claim some novelty, though of doubtful value, in adapting the use of calcium cyanamide to gold and silver extraction by means of electrolysis instead of the more direct method which I have proposed; its transformation into calcium cyanide by subjecting the cyanamide at a red heat to acetylene, water gas, or any hydrocarbon gas rich in carbon. This can be effected during the process of manufacturing the calcium cyanamide from calcium carbide. I cannot understand how Mr. Clancy could possibly have presented calcium cyanamide as a cheap and novel substitute of his own invention in place of the more expensive KCN or NaCN for use in the cyanide treatment of ores, when I had already written up its application several years ago.* The essential parts of the patent specifications are quoted below. The whole paper is easily available.

"In the treatment of ordinary gold and silver-bearing ore and tailing by the cyanide process, a cyanide solvent must be used which is not only stable in dilute solutions, such as 0.05 to 0.50% KCN, but must withstand exposure to the atmosphere as well, without decomposition. It must also not contain impurities, such as sulphide, carbide, etc., which would greatly depress the gold and silver-extraction co-efficient of the cyanide solvent. The cyanides ordinarily used, therefore, are the potassium and sodium salts, KCN and NaCN. These are highly refined, snow-white, and almost chemically pure. In this state they are sent to market for precious-metal extraction purposes, and are, necessarily, very costly; from 20 to 25c. per pound. In recent years, however, there has been great development in the cheap production of alkaline-earth cyanide, such as calcium cyanide, $Ca(CN)_2$, and barium cyanide, $Ba(CN)_2$, by means of the electric furnace, from atmospheric nitrogen. I have found that these electric-furnace products, even impure as they are, if they contain 80 to 90% of the theoretical quantity of cyanogen $(CN)_2$, may be adopted and used, in ammonia solutions, as gold and silver solvents. In carrying out my invention, the crude calcium cyanide or barium cyanide is dissolved in ammonia solution of sufficient strength, the insoluble residue solution to settle, and the clear solution applied in the treatment of gold and silver-bearing ore and tailing, not amenable to ordinary cyanide treatment, either on account of excessive cyanide consumption due to cyanicides, or on account of percentage of metals such as copper, nickel, zinc, or cobalt, which render inert the gold or silver solvent powers of a dilute cyanide solution (KCN or NaCN), such as is commonly used, and cause an excessive loss of the cyanide. A working solution, according to my invention, may be made up as follows: Solution of ammonia, 1% or less to 10% (NH_3); calcium cyanide or barium cyanide, 0.05 to 1%. If this solution be too alkaline, a salt of ammonia, such as the sulphate, may be added to counteract such excessive alkalinity. The treatment of the ore or tailing with this solution is carried out in any of the usual or known manners, as by leaching or agitating them with such solution; and, where the ore or tailing contains, in addition to the gold and silver, such metals as copper, nickel, zinc, or cobalt, all these metals are simultaneously extracted, and the separation of the gold and silver afterward effected in any ordinary manner. It will be seen that by my improvement, a very cheap gold and silver solvent is obtained, which overcomes all the objections and conditions above referred to."

Having thus described my invention, what I claim as new and desire to secure by letters patent is: (1) The improvement in treating ore and tailing containing gold and silver, which consists in extracting the precious metals with a solution of ammonia and alkaline-earth cyanide. (2) The improvement in treating copper, nickel, zinc, and cobalt ore and tailing containing gold and silver, which consists in simultaneously extracting all the metals with a solution of ammonia and an alkaline-earth cyanide. Then the following periodicals published articles and abstracts relative to the subject: *Mining and Scientific Press*, May 15, 1909; *Engineering and Mining Journal*, April 17, 1909, February 27, 1909; *Pacific Miner*, March 1910; *Mexican Mining Journal*, August 1910; *Chemical and Metallurgical Engineering*, May 1910; 'Mineral Industry,' Vol. 18, 1909, p. 365. In the above articles, abstracts, and letters, calcium cyanide as a cheap cyanide salt substitute produced from calcium cyanamide as per equation, $Ca_2CN_2 + C = 2Ca(CN)_2$, was several times noted and its use recommended by me as a cheap cyaniding agent for extracting gold and silver form their ores.

I trust I have made clear my position in regard to the Clancy process as relates to the use of cyanamide, and the cyanide-engineering profession may judge for itself if Mr. Clancy is entitled to any credit in presenting calcium cyanamide as a novel product for use in the cyanidation of ores. In its intended use, as described in his last paper before the Electrochemical Society, Mr. Clancy, perhaps unknowingly, but none the less certainly, infringes on my rights and prerogatives in the matter. The fact that Mr.

*See United States Patent 911,254, filed September 4, 1907, issued February 2, 1909.

Clancy employs iodide in conjunction with the cyanamide is of no importance to the intrinsic claim of employing cheap cyanamide as a substitute for the expensive cyanides of sodium or potassium. I trust you will publish the above in justice to myself and the cyaniding fraternity.

D. Mosher.

San Francisco, January 20.

The Editor:

Sir—After a careful perusal of Mr. Mosher's communication, a copy of which I am assuming was addressed to you, as it appears that copies have been sent to several leading mining journals, and after careful perusal of his patent specifications and other references which he has made in his communication, I fail to see any cause for discussion as to "priority" in the use of cyanamide in ore treatment. Nowhere, including his patent specifications, does it appear that he suggests the use of cyanamide *per se* as a solvent for the precious metals; on the other hand, he simply proposes, as many others before him have done, the use of calcium cyanamide as a starting point in the manufacture of calcium cyanide, by heating to a red heat calcium cyanamide with other materials in an electric furnace, and the product of this mixture—calcium cyanide—he proposes to apply to the treatment of ores. The German chemists, Messrs. Frank & Caro, many years ago attempted to produce cyanides by this means, but found that it was not a commercial success. I am reliably informed by those actively interested in the manufacture of cyanamides that fortunes have been spent endeavoring to apply cyanamide in a thoroughly practical and economical way, and they have very generously and frankly conceded that I have solved the problem. It seems to me that it would be more to the point if Mr. Mosher took issue with Frank & Caro for the determination of the question of "priority," for there appears to be little, if any, difference in the result finally accomplished by either of them, since they were apparently working along the same lines and the results quite naturally were the same. It will be apparent to anyone reading Mr. Mosher's specification that he does not use cyanamide in the cyanide solution, but proposes to use his electric-furnace product, which contains calcium cyanide of about 80% cyanogen content prepared by secondary electric-furnace treatment of cyanamide, as already described. In the Clancy process any amide or amidine compound may be used in conjunction with the cyanide solution, such, for example, as urea, or guanidine. The idea of my infringing any rights and prerogatives of Mr. Mosher is amusing. Why does not Mr. Mosher claim priority to an amide or amidine compound in conjunction with the cyanide solution?

I trust that I have made the distinction clear between the Clancy process relating to the use of cyanamide in the cyanide solution, and the use of the calcium cyanide product prepared from calcium cyanamide by special treatment as described by Mr. Mosher. It is clear from reading Mr. Mosher's specification that he does not attempt to claim the use of raw cyanamide in the ore-treatment process, for the simple reason that he was not aware of the fact that cyanamide, amide, or amidine compounds could be used in conjunction with cyanide solution until the publication of my patent specifications and the articles which I have written describing my process.

John Collins Clancy.

New York, February 7.

Recent Cyanide Practice at the Montezuma

The Editor:

Sir—In your issue of January 28, 1911, appeared an article by S. F. Shaw, entitled 'Recent Cyanide Practice at the Montezuma, Costa Rica.' In this article Mr. Shaw speaks of the clogging of the spiral feed and also says that this feed throws out sand from time to time. In publishing this statement we are inadvertently done an injury. The explanation of Mr. Shaw's trouble is quite simple. He is feeding the material entirely too thick. We have never heard of a tube-mill being fed with ore containing less than 37% moisture and do not understand how he is able to do any satisfactory work with the mills under the circumstances. In most plants the solution is 1:1, but, of course, it varies on different materials. If Mr. Shaw will have his material fed to the mill with at least 40% moisture he will overcome the difficulty and may also possibly increase the grinding capacity. Furthermore, if the mixture is of the proper consistence he can pump the mill two-thirds or three-fourths full and in that way partly balance the machine and reduce the horse-power required.

Abbé Engineering Company.

New York, February 7.

Surface Indications of Ore-Shoots in Depth

The Editor:

Sir—Concerning the supposed rule of ore-shoots in relation to gulches, which generally has failed of application at the various mines and prospects that have been under my observation, a parallel case suggests itself when viewed from a practical standpoint. Readers of technical literature are doubtless more or less familiar with what has been written of the Comstock lode and will recall that it has been mathematically demonstrated that the slope of one side of Mount Davidson is in the form of a logarithmic curve and that prospectors in search of another such ore-body have been advised to scan all hill slopes looking for that curve. In this case one reader, who was certainly either sordidly practical or an irreverent wag, suggested that prospectors should include in their packs a set of templets, using them to sight against the profile of the hills and thus save many weary steps. If the subject under discussion affords some such 'practical' suggestion it will doubtless be welcomed by many who would otherwise have to depend upon the single jack and its attendant exertion for a solution of their problems.

R. P. McLaughlin.

Taft, California, January 27.

Concentrates

Most of these are in reply to questions received by mail. Our readers are invited to ask questions and give information dealing with the practice of mining, milling, and smelting.

Loadstone, magnetic iron oxide, is frequently found, but is not a regular article of commerce. There is a demand for it in small quantities in hand specimens.

No stone containing much iron or other sulphide mineral is suitable for ornamental purposes, or even for building, as it is likely to weather rapidly and crumble.

Copper may often be removed from ores where cyanidation is to be undertaken, by leaching with ammonia, and precipitating by blowing live steam through the solution. Following the leaching ammonium cyanide and then straight cyanide solution should be used.

Launders must be given slope according to the character of the material to be carried and the proportion of water in the pulp. At the Steptoe concentrator at Ely, Nevada, 1½ inches to the foot is the rule. With a 6 to 1 ratio of water to concentrate, a grade of 2 inches to the foot should be allowed.

Costean is a Cornish word coming from *cothas*, meaning dropped, and *stean*, the latter probably from *stannum*, ten. To costean is to sink a series of pits or a trench through the overburden in order to trace a vein. Roughly, costeaning is the same as trenching, and it would be better to use the common English word.

A 12-in. pipe, one mile in length, with a head of 80 ft., will deliver from 4 to 5 cu. ft. of water per second, the difference being due to the condition of the interior of the pipe, a smooth pipe carrying more than one having a rough surface. A 17-in. pipe under the same conditions will deliver 10 to 13 cu. ft. per second.

Mast machines for drilling have long been used for shallow work, but are now coming into wider use. Recently a hole 3500 ft. deep was drilled near Pittsburg with a Star machine. When a well does not need to be frequently cleaned, so that a permanent rig is unnecessary, there is economy in lumber in using the mast rather than derrick.

Manufacturing establishments where mining and metallurgical machinery is made, have, or should have, experienced engineers whose duty it is to plan machinery for special purposes. Without this expert advice and assistance, the mill founder can not hope to enter into successful competition with those concerns that have such men on their staff.

To determine the value of gold per ton of ore in the sulphides present is easy when the assay-value of the sulphides per ton and the percentage of sulphides in the ore are known. For example. An ore contains 3½% sulphide, which concentrated assays $60 per ton. Multiply the percentage by the value and divide by 100. Thus 3½ times $60 is $210, which divided by 100 gives $2.10, the value of gold in the sulphides in a ton of ore as it comes from the mine.

Cy is often used as the symbol of cyanogen in place of the proper symbol CN. This arises from the early belief that these atoms were held in a union different in some way from the ordinary one. This is now recognized as a mistake, but the incorrect usage still persists, apparently because the wrong symbol is a little easier to write than the correct one.

Never cut a shaft so small that all work to be done in it cannot be readily accomplished without being cramped for room. The manway and pump-compartment particularly should be of liberal size, as it must contain the ladders, the compressed-air and ventilating pipes, water column, and sometimes also a steam-pipe. The pump must also be handled in this compartment, and to have to work in a cramped position is far from economical. It were better by far to make the shaft an additional two feet in length.

Platinum is much used in chemical apparatus, but is expensive, and many attempts have been made to substitute cheaper materials. Plating platinum on a cheap base is unsuccessful, as the outer plating quickly separates from the inner base metal. Often articles made of nickel or nickel-chrome alloy may be used, but in most cases the prime requisite is accuracy, and it is not good business to sacrifice the accuracy for the sake of cheapness. Where accuracy is not essential, cheaper materials may be used, but it should be remembered that if an article which costs three times as much lasts three times as long it is cheaper because it saves the trouble of frequent replacement and the lower efficiency of using an article which is nearly worn out.

Testing placer ground is exceedingly difficult where the water is so abundant as to prevent sinking test pits. The usual method is to put down holes with either hand or power drills. It is customary to first drill a series of holes across the valley or ground to be prospected, dividing it into two or three blocks. If these holes yield good results the ground is systematically tested by means of holes placed in rectangular pattern at intervals of 200 feet. This amounts to one hole per acre. Systematic work of this sort in places costs more than the ground itself. Even then results are not certain. Tests on one piece of ground in California indicated a value of 18 cents per acre where the dredge recovered but 12½ cents. In another case the yield was 18 cents where the drill showed nothing. Still another dredge recovered 60% of the amount indicated by prospecting, at the same time that another dredge belonging to the same company was recovering over 200%. In a rough way, it may be stated that California dredgemen expect a recovery of 70% of the gold indicated by drilling.

Special Correspondence

NEW YORK

The Copper Market.—A Shrinkage of Domestic and Foreign Deliveries. — Giroux Annual Report. — Heinze's Affairs. — Ray Con. and Chino.— Michigan Producers. — Possible Globe Merger. — The Morning Mine.

The unfavorable report of the Copper Producers Association was foreshadowed by a general weakness in the metal market and a consequent decline in the shares of several of the leading copper issues. The adherents of the so-called policy of curtailment are pointing to the fact that January production declined 7,633,628 lb. as compared with December. Domestic deliveries were disappointing, while the export demand, which was phenomenal in December, showed a shrinkage considerably larger than was expected. There was no expectation that exports would continue at any of the record-breaking figures of December, but it was hoped that the inevitable reaction would not appear immediately, nor all at once. On the other hand, it was hoped that the conditions at home would show some improvement; the December deliveries for domestic consumption were small and January should have shown an increase. Consumers in this country, however, evidently take the position that copper cannot advance under present conditions, and are content to buy only for immediate needs.

Giroux among other stocks has been made the object of attack by bear traders. The shareholders in this company have for some months been inquiring why no definite statement as to the developed ore reserves was forthcoming. In the annual report, just issued, the ore developed by the churn-drills is estimated at 9,620,000 tons, with an average copper content of 1.36%. Inasmuch as 2% ore is considered about as low in copper content as can be worked profitably, and as previously current estimates had allowed at least double the tonnage reported, traders proceeded to sell Giroux upon the publication of the report and drove the stock from $8 to $6.25. The gold and silver in Giroux ores amount to about 60 cents per ton, making the gross value approximately $3.40. Some comparisons are drawn, as might be expected, between Giroux and Nevada Consolidated, but these are hardly fair. It has never been planned, or at least the public has never been apprised of any plans, to give Giroux any such equipment as that of the Nevada Consolidated, nor has it ever been contended that it would be possible in any event for Giroux to handle its ores as those of the steam-shovel pit of the Nevada Consolidated are handled. It may be added that the statement made as to Giroux ores does not include the ores in the Alpha workings on the limestone contact, where some comparatively high-grade ore has been developed, but which is not yet in shape to be properly measured.——The situation as to Davis-Daly has become acute; when it was learned that F. A. Heinze's reported purchase of property in Porcupine had been made at the expense of the Davis-Daly treasury, the New England shareholders began to organize in opposition. A hundred shareholders came together in response to a call issued by six Boston Stock Exchange houses, and while they were unable to force Mr. Heinze to resign as president and director, they did force his consent to the shareholders having a majority upon both the board of directors and the executive committee, and also forced from him a statement as to what was being done with the funds in the Davis-Daly treasury. Resolutions were adopted disapproving of nearly everything Mr. Heinze has done and particularly his virtual abandonment of the Davis-Daly property. With $330,000 in hand belonging to the company, Mr. Heinze has been engaged in prospecting; expending $20,000 in Alaska and $25,000 in Porcupine, the latter under a personal guarantee from himself, in return for which the company is to pay him one-third of any profits made. The only justification Mr. Heinze is said to have claimed in making such expenditure lies in there having been expended some $1,800,000 in Butte without having made a mine of the Davis-Daly, and that he thought he could do better looking elsewhere. Evidently the necessity for any formality, such as consulting with the shareholders before taking action, never occurred to Mr. Heinze. Between being asked to resign from Ohio Copper, in order that its bonds may be sold, and being asked to resign from the Davis-Daly, on account of alleged unauthorized expenditure of funds in the treasury, and being subjected to a constant fire of interrogations about what became of the funds in the United Copper treasury, F. Augustus is fairly busy.

Ray Central shareholders, who have been awaiting the promised report on the properties to be made by Weed & Probert, are evidently to be forced to be satisfied with the conclusions drawn therefrom by the officials. The vice-president has issued a statement to the effect that he considers the report highly satisfactory; that developed ores show a minimum of 7,000,000 tons. Ray Central is suffering from a lack of confidence in the public, which evidently is strong enough to prevent frank treatment being shown, which in turn has induced the public to put the worst construction upon the fact that desired reports have not been forthcoming when expected, and upon the fact that the identity of new investors said to have come into the company recently has not been revealed.——Ray Consolidated and Chino are about to leave the open, or Curb, market and will hereafter be traded in upon the floor of the New York Stock Exchange. The fact that the listing committee of the Exchange has admitted these companies to trading privileges, while both are yet really in the development stage, marks a great change in the attitude of the 'big board', foreshadowing a further recognition of the public interest in mining issues. The Guggenheims are reported to have taken over a large holding of Yukon Gold, amounting to some 20,000 to 25,000 shares, that had been held in England. Whether this move has any connection with the rumored merger of all of the Guggenheim properties is not known. The Michigan copper producers are exercised over the possibility of the imposition of a State tax of ½c. per pound upon the copper output. The Northern and Southern peninsulas of Michigan are widely separated; in fact, that part of the State known as the Northern Peninsula is geographically, politically, and commercially treated as a separate bailiwick. The farmers, fruit-growers, and automobile manufacturers of southern Michigan are frankly sectional in their attitude toward the mining interests of the Lake country. Boston is much closer to the Lake Copper region than is any part of the 'peach belt.' As a result, the copper forces are lining up to defeat the measure. The tax would cost the Calumet & Hecla $357,500 yearly, or more than $3.50 per share on its present outstanding capital.——There have been rumors of consolidations to be made in the Globe district in Arizona. The latest story is of negotiations for a merger of the Miami, the Inspiration, the Live Oak, and the New Keystone. This consolidation, if consummated, would bring together some interests which, heretofore, have not been closely allied. The Miami and the New Keystone are controlled by the General Development Co., which is a Lewisohn organization; the mine work being under the direction of J. Parke Channing, as consulting engineer and managing director. Inspiration is controlled by the Thompson-Gunn interests, who are allied with Salt Lake capitalists and who control also the Mason Valley at Yerington, Nevada. Through the connection of these people with the important Stock Exchange house of Thompson, Towle & Co., they are also in touch with the Boston investors in copper. Live Oak is also now controlled by Boston people. There is a story in mining circles that when the Lewisohns bought the Miami, what they really wanted was the Inspiration, and there is no doubt that, on acceptable terms, they would welcome a merger with the latter property. Should a new concern be formed, as outlined, it would immediately take rank as one of the important porphyry mines, as it would have a present developed tonnage of 50,237,000 tons; Inspiration having 21,737,000 tons, Miami 16,500,000, Live

Oak 9,000,000, and New Keystone 3,000,000 tons. Such a new organization would be the dominent factor in the Globe district, and, as the Miami mill is soon to begin operating, would be one of the first of the developing porphyries to produce on a large scale.

There is a renewal of interest in the affairs of the Federal Mining & Smelting Co., and some tipsters have been industriously circulating advice to buy the shares. The Morning mine, the largest producer of its properties in the Coenr d'Alene, is apparently coming back as a profit earner. The change in the ores has been met by a new method of treatment, and conditions have so far improved that instead of a monthly deficit, the Morning mine is now earning $15,000 net mouthly, and from the present outlook it is expected to double or treble this figure.

Engineers in the Cobalt camp are much interested in a recent discovery of high-grade silver ore in the Temiskaming mine at a depth of 535 ft., which is the deepest working in the district. The Temiskaming is entirely in the Keewatin, while most of the large prodncers, such as Nipissing and La Rose, are in the conglomerate. In the diabase there are only two paying ore deposits, the O'Brien and the No. 3 vein of the Kerr Lake. It has been the rule in the camp that wherever the conglomerate overlies the Keewatin, the values are found entirely in the conglomerate. While, therefore, the finding of ore at depth is important to the few properties that are entirely in the Keewatin, it does not determine the real question of the valne of deep ore at Cobalt.

LONDON

Output and Profits of Ashanti Mine. — Copper Mining in Australia. — The Phillips River Operations. — The Huelva and Rio Tinto, Spain.—The Cordoba.

The Ashanti mine continues to be the most important gold prodncer in West Africa. While most of the mines in the Tarkwa and Prestea districts are suspending production dnring vigorous development, the Ashanti goes forward in a most encouraging manner, discovering rich oreshoots and erecting modern machinery. This mine has the advantages both of good fortune in the way of ore deposits and of capable direction of operations. Some mines are made famous by nature and some hy the strennous efforts of man. The Ashanti affords an example of a combination of these two influences. A year ago in this column, I quoted W. R. Feldtmann's account of the discoveries of rich ore in the Obuasi workings of the Ashanti mine and of the new plant then in course of erection. Mr. Feidtmann has recently issned a report bringing technical details up to date. During the year ended June 30 last, 90,860 tons of ore was sent to the mill and 72,115 oz. gold recovered, the value being £306,322. This was the largest yearly prodnction yet recorded. The working profit was £175,716 and the net profit was £118,878, as compared with £44,792 the year before. As a large sum was brought in from the last year, it has been possible to distribute £149,580 as dividend, being at the rate of 75%. As regards ore reserves, the content of gold is estimated at £1,910,000, as compared with £2,000,000 a year ago. Owing to floods, and also because attention has been centred on the building of the new metallurgical plant, less development work has been done than would otherwise have been the case. Generally speaking, the developments at Justice's mine have not been so favorable, but this has been more than compensated by the discoveries in the lower levels of the Ashanti mine, in a different part from the Obuasi discoveries mentioned above. Mr. Feldtmann reports that the fourth or last unit is now practically complete and that, commencing with 1911, the yield of gold should be £40,000 per month.

The production of copper in Australia is confined to a few districts. Mount Lyell, Cobar, and Wallaroo were the only notable districts for many years. More recently Mount Morgan has been an important producer, and North Queensland has come forward. Other mines, such as Great Fitzroy in Queensland and Whim Well in the north part of Western Australia, have attracted attention. I wish in this letter to make a note of the strenuons efforts that have been made in the Phillips River division of Western Australia, situated between Kalgoorlie and the Sonthern Sea, to develop copper deposits. The Phillips River Gold & Copper Co. was formed in 1906. Part of the property acquired was sold shortly afterward to a subsidiary company called the Mount Cattlin Copper Mining Co., but has since been repurchased. A railway was bnilt to connect the mines with Hopetown, and a smelter and concentrating plant were bnilt. The orebodies have proved disappointing so far. Development has been centred on the Desmond-Elverton group of lodes, and at some points promising ore was found. Some development has also been done at the Monnt Cattlin mine. At the Ironstone property prospecting has been done by diamond-drilling. The Benson and Martin mines have been leased and a few hundred tons of ore raised by the tributers. The profitable oxide ores are exhausted and the smelter which started in July 1909 is now treating chalcopyrite from the Elverton and Cattlin mines and cupriferous pyr-

Metallurgical Plant, Ashanti.

rhotite from the latter, together with such ore as is raised by the tributers at the other mines. Pyritic smelting was tried, hut it was found that the gangue matter required more heat. The plan now is to pick out the richer parts, concentrate the remainder, and sinter the concentrate. In this way the refractory gangne is largely removed, and a smelting charge obtained which contains sufficient sulphnr to reduce the amount of coke required to a minimum. In addition to the blast-fnrnace, a converter plant has been erected. Dnring the past year 1332 tons of blister copper was produced, containing 1318 tons copper, 5435 oz. gold, and 9982 oz. silver. The Income from the sales was £62,466, and the loss on the year's work was £55,431. The expenses in connection with the starting of smelting and concentration made the costs higher than they will be in future. The company has an excellent plant, and a satisfactory method of treatment has been found. The futnre will depend on the development of the ore deposits.

Copper mining in the south of Spain has had several setbacks lately. One of the most serious accidents has been at the Hnelva copper and snlphnr mines, which are under the capable management of H. F. Collins. The dam erected a few years ago for the purpose of conserving a water supply burst, and not only disorganized everything, but caused the death of many employees. Further news comes from the Rio Tinto mine relating to landslides, and several deaths have recently been caused by this unsafety of the gronnd. It must be remembered that the Rio Tinto pyrite deposit is being worked by open-cuts, and that of recent years it has become obvious that the slope of the quarries is too steep for safety. Vast snms have been spent out of the reserve fnnd for the purpose of removing the dangerous overburden, but in spite of this, landslides are still occurring, and the engineers and workmen are well aware of the threatening state of things. As the directors of the company keep a vigilant control on news from the mine and publish nothing but the barest of half-yearly reports, neither shareholders nor the public have the least idea of the mining or metallurgical practice. It is a pity that they do not issue some authoritative statement, convincing to a mining or civil engineer, to the effect that open-cut work-

ings are permanently safe and do not threaten to collapse and bury the pyrite. In the absence of such information it is not to be wondered that in some quarters the most sinister opinions are freely expressed. One of the copper mines in southern Spain that has had troublous times is the Cordoba. The present English company was formed in August 1908 as a consolidation of the companies operating the Cerro Muriano and North Cerro Muriano copper mines, which are situated ten miles northeast of the city of Cordoba, Spain. John Taylor & Sons are the managers. The ore deposit has been difficult to follow and work, and the concentration and smelting problems have given trouble. The directors now speak more cheerfully and report that in many ways the company is in a more favorable position. Recent developments have disclosed valuable bodies of ore and the reserve has been increased, now standing at 132,903 tons averaging 3.28% copper, an increase of 10,508 tons in quantity and ¼% in value as compared with a year ago. During the year ended September 30 last, 62,299 tons of ore was raised, and sent to the picking floors. Of this, 19,943 tons was sent to the old jigs and buddles, 12,790 tons was treated in the new wet-concentration plant, and 11,198 tons went to the magnetic separator. Some of the sorted ore was sent direct to the sintering furnace. The old jigs and buddles and the magnetic separator have recently been abandoned and the whole of the output in future will go to the new mill. The Murex magnetic process has been installed for the treatment of 50 tons per day of middling and tailing from the jigs, and it promises to give satisfactory results. Sintering by pot-roasting was adopted for smelting. Hitherto the metallurgical processes have ended with the production of matte, but it is now intended to erect a converting plant.

BUTTE, MONTANA

Source of Heat in Butte Mines. — Means Adopted for Natural and Artificial Ventilation.—Fire on High Ore not Spreading.

In discussing the conditions in the Butte mines before the legislative investigating committee, John Gillie, general superintendent for the Amalgamated company, made some interesting statements regarding the temperature in the mines and the means being adopted to remedy some of the complaints made by miners. He said at the outset that the high temperature was difficult to overcome on account of the vast amount of lumber used, and the kind of ore existing in the mines. He explained this statement by saying that the mines of the company used every year 75,000,000 ft. of lumber of board measure, about 250,000 round timbers, and 275,000,000 ft. of sawed timber. Mr. Gillie said that just as soon as this timber goes into a mine oxidation begins to take place, and it is just the same as burning it, so much heat does it throw out. It may be distributed over 20 years, or 40 years, but the same amount of heat units in a stick of timber, if it be entirely rotted, is given off as though it were burned in a stove. In speaking of the character of the ore, he said it is sulphide, or contains sulphur and other compounds, and an oxidation is going on in the rock itself which produces heat. Then again, it was pointed out that the deeper you go into the earth the warmer it becomes. For some years the company was devising plans to overcome, as far as possible, the complaint about the heat, and during the past four years had equipped many of the mines with a system of forced ventilation, and at the present time, through this means, 753,000 cu. ft. of air is being put into the mines every minute. In addition a number of natural or induced-air openings or ventilating shafts have been put in. At some of these the air is being forced in, while at others the warm air is being taken out, which has to be replaced by cooler air from other places. He said the system had been found to be effective. Mr. Gillie then spoke of the underground workings of the Gagnon, the deepest mine in the district, and said that on the 2300-ft. level efficient work could not be done, as the men came to the surface at the end of the shift more tired than they would be with twice the labor on the surface. An exhaust fan was placed on the air-course as soon as it was possible to secure the electric power, with the result that the 2200 and 2300-ft. levels, the deepest in the Gagnon mine, were made comparatively good places to work. The difference could be noticed in a short time. He said that in addition to this, the company was now sinking an air-shaft in the Gagnon down to the lowest level, a piece of work which would cost $230,000. He concluded his statement regarding the temperature question with these words: "Now, we are not doing that as philanthropists; we expect to get the value back on the number of tons of ore per day per man; it is economic mining. It tends, of course, to the better health and the better conditions of the miner, and the better he is, the better it is for us."

The fire in the High Ore mine is still burning, but there is no probability of it spreading. It is confined to a limited space, and no smoke is interfering with the operation of other mines. The pumps are working on the 2800-ft. level, and the water has practically all disappeared. It will be two to three weeks before the mine is again in operation, the management not deeming it advisable to hurry the resumption of work, especially when the other properties are supplying all the ore required by the smelters. The copper production of Butte district for January was nearly 23,000,000 lb., including a little over 1,000,000 lb. from the East Butte smelter. The Washoe smelter produced 15,950,000 lb., and the Great Falls smelter 5,650,000 lb., making a total of 21,600,000 lb., which includes the ore treated at the Washoe smelter belonging to the Tuolumne company. The management of the Raven Copper Mining Co. is doing development work on the Snoozer, through the Old Glory shaft, in accordance with an agreement reached with the Anaconda company. From the 200-ft. level of this shaft a cross-cut now in 300 ft. is being driven to intersect the vein, which will be reached 50 ft. ahead. The shaft is down 500 ft., at which depth another cross-cut is being driven to the Snoozer vein. On the 200-ft. level four veins were cut and raises were made to get an idea of the dip of the vein. An impression has gotten abroad that the Colorado mine of the Davis-Daly company is completely shut down, but such is not the case. There are about 25 men at work on development on the 1400-ft. level on which a large body of ore has been uncovered. However, as it assays only about 3% copper, it would not pay to ship it at the present market price.

REPUBLIC, WASHINGTON

Interesting Data on Lone Pine, Pearl, and Surprise.— The Quilp and Knob Hill.—Belcher Mountain.—Treating Tailing.

The Republic Mines Corporation has made final payment and taken over the Lone Pine, Pearl, and Surprise mines from the Pearl Consolidated Mining Co. The superintendent reports continued improvement in the Surprise vein workings, during the last ten days. In the winze south of the 'Jim Clark tunnel,' 40 ft. below the adit-level, 8 ft. of ore, reported to assay from $225 to $400 per ton, mostly in gold, is expanding about an inch with every foot of increasing depth, and 6 ft. on the hanging wall assays close to $40 per ton, and is spreading toward the centre with every round of hole, but more gradually than on the foot-wall. The pay-shoot at the surface was 150 ft. long and 5 ft. wide; at a depth of 50 ft. it is reported to be 200 ft. long, with an average width of 12 ft., the extreme width being 18 ft., with a pitch of 70° east and rake of 50° south. The pay-shoot has been cut into on the first level from the incline shaft, designed for opening the vein at greater depth, at 190 ft. from the portal and 75 ft. below the bottom of the winze. The superintendent reports that from 8 ft. of quartz already penetrated, samples have been taken, but not yet assayed. The quartz is identical with that of the foot-wall. Next the foot-wall the material is the typical white quartz, with ribbon streaks and spots of rich sulphide which characterize the best ores of the camp. A winze has been started on the 300-ft. level of the Lone Pine claim, 150 ft. east of the main shaft, and is following down on ore which assays about $50 per ton, principally gold.

The company is shipping about 150 tons of ore per week from the Lone Pine and 450 tons per week from the Surprise.

The Quilp mine is sending 300 tons weekly to the smelter of good-quality ore, and some of it is very high grade. The Knob Hill mine is now being opened on four levels. On No. 1 ore is being mined and sacked which assays about $100 per ton, nearly all in gold, from a small lateral vein. On No. 2 the main north-south vein has been followed continuously about 400 ft. from the portal of the adit, and the breast is 165 ft. below the surface. That vein is from 3 to 8 ft. wide, and a stope has been started on ore which assays from $24 to $30 per ton, practically all gold. A raise is being made on a small vein of $25 ore from the No. 4 level. Ore is being delivered from the three levels to the ore-bin, lately constructed beside a railway spur on which the track is laid, but awaits the track bolts for completion. The mine is being put in shape for delivery of ore from each of the four levels through the underground workings instead of hauling it around the hill as at present. The Pearl Consolidated Mining Co. has one more dividend of about 1⅓ cents per share to pay, which may be paid early in March, and the affairs of the company will be closed. A streak of iron carbonate ore has been developed above the lower adit of the Anonymous mine, on Belcher mountain, which may form the connecting link of the vein system between the Belcher, Copper Key, and Oversight mines. The mines of Belcher mountain are practically idle, awaiting plans by the various companies for the future disposal of the ore. Republic and neighboring camps are witnessing a revival of mining and other interests. The tailing dumps at the old Republic mine, after lying many years apparently worthless, are being worked over and are reported to be paying a profit. The first clean-up has been made with good results, but information on details is lacking. Good headway is being made on the new mill of the North Washington Power Company.

TORONTO, CANADA

Porcupine Railroad and its Terminal.—Three Townsites may Unite.—Hollinger Development and Ore Tests.—Special District News.—Cobalt Mines.

The route of the Porcupine extension of the Temiskaming & Northern Ontario railway and its terminal at the camp were definitely settled last week after the return of J. L. Englehart, chairman of the Railway Commission, from that locality. The line enters to the north of Porcupine lake, a station being placed at Golden City, and runs down the southeastern shore of the lake, its present terminus being about one mile from the Dome property. The decision has given stimulus to building activity and dealing in real estate. It is anticipated that the line will be ready for traffic by the end of June. Although the snow is 3 ft. deep, 700 men are at work clearing, grading, and laying the steel. Next month the force will be increased to about 1200 men. A movement is on to unite Porcupine City, Golden City, and the Welsh Townsite, incorporating them as Porcupine.

At the Hollinger sinking has been done to the amount of 365 ft., and 1040 ft. of driving has been accomplished at the 100-ft. level. Two shafts are down to this depth and a winze has been sunk 100 ft. farther. Assay tests of the ore have been made from the outset, and there have been returns from the 2-stamp mill. The result of sampling and assaying shows an average of $49.80 in gold per ton, and returns from the stamp-mill give an average of over $50 gold per ton from a saving of about 85% effected without concentration, thus proving the free-milling character of the ore. P. A. Robins took charge as manager February 1. The Scottish Ontario company, which has been driving at the 100-ft. level to recover the vein which was lost at 54 ft. in the shaft, has been successful. The vein where opened was over 10 ft. in width, the ore containing free gold. On the Vipond, operated by the Porcupine Gold Mining Co., controlled by the Flynn Bros., of New York, a shaft has been sunk by the side of the vein for 100 ft. and a crosscut is being run to cut the vein. Another vein shows rich ore on the surface, which is being mined to supply ore to a small Nissen stamp-mill. The ore is stated to run $500 in gold per ton. A large mill will be built next summer. Good surface ore has been discovered on the Crown Chartered property, including a continuation of the Scottish Ontario vein. A contract has been let for diamond-drilling to the depth of 1000 ft., work to be commenced February 15. A syndicate, comprising P. Chester Thompson, W. S. Edwards, George Monteith, Alex. Fasken, and John Watson, has acquired a controlling interest in the Dome Extension property of 200 acres situated south and west of Porcupine lake. Two prospecting shafts have been sunk and a plant installed. The Standard Porcupine Gold Mining Co., capitalized at $1,500,000, has been organized to operate a property of 65 acres near Simpson lake. Dr. Guerin, mayor of Montreal, is president, and C. S. Wallace secretary-treasurer. Among recent visitors to Porcupine were F. Augustus Heinze, of Butte, and James Doyle and James C. Sweeny, of Denver.

Cobalt is attracting but little attention in view of the greater interest attaching to the rapid development of Porcupine. A rich discovery is reported at the Crown Reserve, a stringer encountered on the 200-ft. level having widened to a vein of 2 in. wide, carrying high-grade ore. The annual statement presented at the Crown Reserve shareholders' meeting at Montreal, January 25, reported ore production to the value of $1,757,824, and net profits of $1,185,100. After paying dividends and expenses of operating the Silver Leaf leasehold, a surplus of $659,986 remained on hand. Hereafter a dividend of 5% per month will be paid instead of 15% quarterly. The La Rose Consolidated sent out a statement accompanying its dividend checks showing $708,470 cash in hand and in value of ore in transit and at smelters, and $303,343 in value of ore sacked for shipment. The critics and commentators have again begun figuring as to the probability of a resumption of the old rate of dividend. The shaft of the Gould Consolidated, now down 121 ft., is to be sunk 50 ft. farther, and driving will be undertaken on the 150-ft. level. The Kerr Lake has opened a 6-in. vein, in driving from the bottom of winze No. 4, which is said to carry 3000 oz. silver per ton. The Wettlaufer of South Lorrain has declared its initial quarterly dividend of 5%. The Coniagas has declared dividends amounting to 9%, bringing the total returns up to 44% of the capitalization. The miners at the Keeley mine, in South Lorrain, have been out on a strike since January 16 against a reduction of wages.

KALGOORLIE, WESTERN AUSTRALIA

Output and Dividends for November.

In the table below is given the November record of the principal mines of Kalgoorlie, Western Australia:

Name.	Tonnage.	Yield.	Profit.
Associated	9,601	$ 68,000	$ 7,400
Associated Northern	2,371	19,000	5,000
Bullfinch Proprietary	399	105,000	.....
Chaffers	4,156	25,500	350
Golden Horseshoe	19,507	124,500	27,500
Golden Ridge	2,610	35,500	15,000
Great Boulder Perseverance	20,008	119,000	18,000
Great Boulder Proprietary	17,892	248,000	130,500
Great Fingall	10,291	79,500	14,000
Hainault	5,066	35,500	5,400
Ivanhoe	19,327	209,000	100,000
Kalgurli	10,740	138,000	75,000
Lake View & Star	13,005	78,500	6,500
Oroya-Exploration	21,706	24,500	11,500
Oroya Black Range	4,490	45,000	12,000
Oroya Links	7,070	43,500	4,400
Sons of Gwalia	13,490	117,500	50,500
Sons of Gwalia South	2,103	17,000	2,400
South Kalgurli	9,235	63,000	4,700

The properties which paid dividends are as follows: Lake View & Star, $87,500; Links, $71,500; South Kalgurli, $50,000.

SALT LAKE, UTAH

General Mining Affairs of the State. — The Trouble in the Coal Regions.—Snowslides.—Merger at Alta.

The new tramway of the Utah Consolidated has been brought to a state of efficiency materially reducing the cost of transporting ore to the International smelter. Suit has been commenced against the Ohio Copper Co. to recover $7500 due for machinery and supplies. It would hardly seem that Ohio has been making the money credited to it when such a suit is filed. The North Utah has gone into the hands of a receiver, due to the fact that plans to finance it by means of a bond issue were unsuccessful. The holdings include the Butler Liberal, which is well equipped, but the result of development work during the past year or two was not satisfactory. The Utah Metal tunnel has been advanced 4400 ft., and has cut some deposits of ore of commercial value. The flow of water has increased, which is taken to indicate that the mine workings are being drained through the tunnel. The Montana Bingham miners have cut 3 ft. of ore in the south drift which assays 13% copper, 13 oz. silver, and $4.80 gold per ton. The heading of the main cross-cut should reach the Quinn fissure at 350 ft. farther.

Greater headway has been made in the Snake Creek tunnel during the last month than in any previous month, the face having been advanced 367 ft. Progress was averaging

Slime Plant of the Ohio Copper Company.

15 ft. per day until an unusually hard formation was entered, which made the rate slower. The face is now in 2800 ft. The new vein found on the 900-ft. level of the New York mine at Park City, has been followed 140 ft. and is still holding out well. Stoping has not been commenced, but a few carloads of ore have been shipped as the result of development operations. The New York has struggled through 25 assessments, but prospects are that it will pay its way from now on. The most important event in Tintic district for some time was the adjustment by stipulation of the suit between the Beck Tunnel and the Uncle Sam. The stipulation requires a division of orebodies exposed, recognizes the right of Uncle Sam to use the new tunnel in the Beck, and specifies an agreement on extralateral rights to certain points and some minor matters. The Uncle Sam has shipped 15 cars of 30 tons each from a new orebody on the 240-ft. level, in ground not affected by the terms of the stipulation. These 15 cars of ore had a total assay value of $25,000. Two miners lost their lives in the Yankee Con. shaft, February 9. They were riding up in the cage with a load of steel when one of the drills caught between the cage and the wall plate. The sudden checking of the speed threw one man between the cage and the timbers and the other off the cage, so that he fell to the bottom of the shaft. Directors for the stockholders of the Dragon Iron and Governor mines of Tintic district will meet on March 2 to consider a plan for the consolidation of the two properties. They adjoin and can be worked to advantage through the Dragon shaft. The Governor mine is supposed to have the extension of the Iron Blossom vein.

About 400 miners, mostly Greeks, employed at the Kenilworth mine of the Independent Coal & Coke Co., went on a strike, February 4. Different reasons were given for the strike, such as shortage in weights (which the company agreed to meet by allowing the miners to put in a checker), forced trading at the company store, and a desire on the part of the men to drive out all but the Greek miners. Pickets were established who turned back the men, who attempted to work, at the points of guns. The Greeks then took up a position on the out-cropping rocks and opened fire on the town, killing Thomas Jackson, a watchman in the employ of the company. Forty special deputies were rushed to the scene from Salt Lake, and the rioters were routed after two of them had been killed and a half dozen wounded. The troublesome miners have dispersed and the mine is operating at half capacity with those who remained. The Consolidated Fuel Co. and the Castle Valley Coal Co. have filed a petition with the Interstate Commerce Commission asking for a hearing and readjustment of freight rates on coal. These companies come in competition with some owned by the railroads, and they claim discrimination in the supply of cars and freight rates.

The proposal to merge several of the Alta properties may reach a successful termination. The properties have been examined and the terms proposed. The mines included are the South Hecla, City Rocks, Continental Alta, Copper Prince, and Alta Development. The first step toward development will be to drive a drain-tunnel about four miles long, starting near the old Continental Alta mill on Tanner's Flat. This would give good depth on the veins and drain practically the entire camp, besides providing a means of shipping ore during the months when the camp is snowbound. The South Hecla has ore on the Wedge fissure. The stringer, which was only four or five inches wide, has widened to 4 ft., and contains good shipping ore. Lessees on the Columbus Con. are taking out about 20 tons of ore per day, and the company is driving toward the lime contact on the main level. The lower workings are still flooded, as the new pumps have not been installed. At American Fork the Pacific company has discovered that it was sending good ore over the dump, so it started sorting, and some shipments sampled $1000 per car. This was a stockpile which was to have been milled. One carload just shipped netted $46 per ton. The Eudora Belle has ore assaying $80 per ton, which is being sacked and shipped. W. D. Shaughnessy, manager of this mine, died recently. He was a son of one of the pioneer mining men of the State.

Four men were killed in snowslides which occurred in Alta district on January 31. One slide demolished the surface working of the Utah Mines Coalition Co., and killed three miners; another killed one man who was working at a small prospect over the divide from Alta, and a third came down the hill above Alta, but, fortunately, broke on a ledge of rock before it reached the town. Some time will be required before the Utah Mines Coalition can repair damages and resume work. Heavy snows rendered the Alta roads impassable for a few days, but 14 four-horse teams have been engaged in breaking a trail, and ore-hauling has been resumed. The Maxfield mine, which is being operated by the Howell-Johnson Leasing Co., will commence shipping ore this week. The Copper Bank Mining Co. has been organized to develop a group of six claims four miles west of the Maxfield. The recent decision of the Department of the Interior to the effect that a placer location of 160 acres made by eight individuals and assigned to one individual, or a company, is invalid unless location is preceded by actual discovery on each claim, will affect many of the oil locations in this State and throw a large number of claims open to entry. It has been customary to locate and assign as above and work the group on the strength of discovery on one claim, but the Department has held that this is not sufficient. During the month of January the U. S. assay office at Salt Lake bought gold bullion valued at $155,627, and silver bullion worth $2573, an increase of $50,000 over the corresponding month of 1910.

JOHANNESBURG, TRANSVAAL

November Output of Seven Districts.—Increase in Number of Tube-Mills.—The Labor Supply.—Reduced Profits on Rand.

The Mines Department reports that during the month of November the total production of gold in the Transvaal was 641,400 oz., of a value of £2,724,496. Output by districts is given below.

District.	Ounces.	Value.
Witwatersrand	616,844	£2,620,188
Heidelberg	5,100	21,663
Klerksdorp	2,234	9,491
Barberton	6,524	27,715
Pilgrim's Rest	10,356	43,991
Pietersburg	282	1,197
Miscellaneous	59	251

Both Heidelberg and Klerksdorp are districts which are actual extensions of the Witwatersrand banket formation, so it will be seen that were it not for the Witwatersrand and its extensions the Transvaal production of gold would be very insignificant. The total number of crushing mines is given as 97, of which 61 were on the Rand, the other districts contributing with the following number of mines: Heidelberg, 3; Klerksdorp, 5; Owoshoop, 1; Barberton, 13; Pilgrim's Rest, 12; Pietersburg, 2. Since the introduction of tube-mills the increase in the number of stamps has been somewhat checked, the tendency being to increase the stamp-duty by coarse crushing with stamps, and to finish the operation by passing the pulp through tube-mills. As a matter of fact, there are more idle stamps in the Transvaal at present than has been the case for some time, owing to the preference for tube-milling The average number of stamps dropping in the Transvaal during November was 9751, nine less than during October, 9140 of which were on the Rand. Tube-mills, however, increased from 194 in October to 199 in November, of which 188 are on the Rand. The ore milled during November amounted to 1,867,092 tons, as against 1,940,273 tons in October.

With the exception of tin and coal, the Transvaal does not possess many base-mineral prospects, but for November the total value of the base-mineral output, excluding coal, reached £45,225, and comprised the following minerals: Copper ore, £4561; tin ore, £28,356; magnesite, £165; flint, for tube-mills, £2648; lime, £9419. The amount of dynamite issued at the different mines in the Transvaal during November was 2,893,921 lb. No monthly return of the diamond output of the Transvaal is available. Regarding the labor position at the mines, about which so much has been heard, the number of whites employed has increased during the year from 24,653 to 27,441, and of colored from 194,162 to 216,414. Despite this increase, the supply of labor is still far below the requirements of the mines, some having been unable to see their way to declare the usual dividends at the close of the year, preferring to keep the amount in hand in readiness for further labor contingencies.

With the close of the year it becomes possible to compute the dividend earnings of Transvaal mines for 1910, and to compare them with the results secured in the previous year. To summarize the figures, it may be stated that the gold mines of the Witwatersrand have paid out £8,875,085, or £435,666 less than in the preceding twelve months. The gold mines of the outside districts have distributed among shareholders £243,773, which is £49,903 more than in 1909, so that the total dividend record of Transvaal gold mines for 1910 amounts to £9,118,858, or £385,763 less than in the previous year. As regards diamonds, the amount distributed is the same as last year, £180,000. Coal mines, despite the over-competition in the fuel trade and the consequent maintenance of a low price of coal, have bettered their dividend records, the total distributed amounting to £164,914, or an increase of £26,579 for 1910. The increasing growth and prosperity of the Transvaal tin industry is reflected in the declaration of £45,300 in dividends as compared with £19,100 for 1909, an increase of £26,200. The total of mining dividends amounts, therefore, to £9,509,072, or a decline of a third of a million sterling from the previous year's announcement. Over and above this, financial, industrial, and land companies have distributed among shareholders £2,817,268, a large proportion of which was derived directly from the mining companies. Taking into account the money spent on development and equipment out of profits, the dividend results for the past year may be considered satisfactory, especially so in view of the fact that there has been a certain amount of reorganization in the gold-mining industry, mainly in the direction of abolishing the idol of minimum working expenses per ton. The increase in dividends resulting from base-metal mining operations is especially gratifying.

An important amalgamation scheme has been planned for the union of three properties in the Roodepoort district of the West Rand—the Princess Estate, Roodepoort Central Deep, and West Roodepoort Deep. The basis of the proposals is that the Princess Estate company, the most prosperous of the three concerns under consideration, shall absorb the other two companies, and in order to do this the capital shall be increased from £325,000 (£265,000 in issue) to £650,000. Shareholders in the Princess Estate company will receive 265,000 £1 shares; that is, one share in the new company for each old share held. The Roodepoort Central Deep shareholders take £108,333 in £1 shares, which is on the basis of one new share for each three old shares held. As regards the West Roodepoort Deep, where the reef is very thin, although rich, and where the results

Ferreira Deep Mill on the Rand.

of development to date have been on the whole unsatisfactory, £68,160 in shares in the new concern will be issued; that is, one new share for five old shares. For cash capital, 132,700 shares will be issued at 27s. 6d. per share. The shares in reserve free of option will total 74,967, and 840 shares will be issued to the West Roodepoort Deep, Ltd., in part settlement of the company's liabilities. After liquidation of sundry debts and debentures, it is estimated that the new company will have a cash working capital of £99,000. The area controlled will amount to 680 claims, and the amount of ore in reserve at the present day in the three mines is estimated at 647,000 tons, of which 582,000 tons on the South Reef have a value of 8.11 dwt. per ton, and 65,000 tons on the Main Reef average 6.06 dwt. per ton. Crushing operations are to be concentrated at the Roodepoort Central Deep battery, the plant being designed to crush 18,000 tons per month. Development work is to be pushed and the capacity of the mine plants will be enlarged in the near future. Recent profits of the Princess Estate and Roodepoort Central Deep have averaged about £6000 per month, and as a result of the amalgamation of the mines it is estimated that the working profits will be improved by about 3s. per ton. The scheme gives promise of doing much for a district which has so far proved one of the least remunerative and most disappointing in the whole of the Witwatersrand area, and the fortunes of the mines concerned, when operating under the new management, will be watched with great interest.

General Mining News

ALASKA

(Special Correspondence.)—Knik, situated in the Cook Inlet and Susitna region, is on one of the mushing routes to Iditarod. It is also the supply point for a quartz and placer mining country about 30 miles to the north, on Willow creek, Craggy creek, and the headwaters of the Little Susitna. The Brooklyn Development Co. is to install a 3-stamp mill; the Gold Bullion M. Co. is adding 5 stamps to its mill, is building a tramway, and driving an adit-level on a vein containing free-gold ore, some of which yielded $2000 per ton last season; machinery is to be set up on two other properties of that district this season.

Knik, January 20.

Reports sent out from Valdez are to the effect that equipment for 12 stamp-mills is being shipped to that place and that these mills are to be erected in the Valdez district next summer. They are mostly 3-stamp plants, though it is claimed that among them are two or three 10-stamp plants. Among the mines being developed is one on Shoup's bay in which a vein has been opened to a depth of 400 ft. by a series of adit-levels; on the dump is said to be 800 tons of ore of good milling grade. The Big Strike group in that locality has been sold to H. W. Suesseldorf and T. J. Devinney at $35,000, of which $4000 was paid. It is claimed there are 400 men employed in the Valdez district in connection with mining.

ARIZONA

COCHISE COUNTY

The Copper Queen company probably will sink a new shaft to the depth of 2000 ft., the location for which is between Lowell and South Bisbee. The principal use of the proposed shaft will be to obtain better ventilation in the several mines, and to accomplish this a connection will be made at the 1200-ft. station with the Lowell shaft.

GILA COUNTY

(Special Correspondence.)—The station being cut on the eighth level of the Superior & Boston probably will be finished within the next ten days, when a cross-cut will be started westward for the purpose of cutting the Great Eastern vein. It is possible that when opened at this depth the vein will be found to contain the same grade of ore as was mined on the sixth level, shipments of which to the Old Dominion smelter sampled 6% copper. A raise is being cut from the sixth to the eighth level from the west drift, on the Great Eastern vein, and contains iron ore impregnated with bornite and copper glance, and assays from 5 to 7% copper. F. H. Probert, consulting engineer, visited the property recently and expressed himself well satisfied with conditions at the Superior & Boston. The Barney Copper Co., whose property adjoins the Live Oak on the west, has started its second churn-drill hole 300 ft. north and west of hole No. 44 of the Live Oak drillings. Judging from the results of the adjoining Live Oak drill-holes and the topography of the section, it would not seem probable that hole No. 2 of the Barney will strike the ore at less than 700 ft. In drill-hole No. 1 the ore was entered at 500 ft., but hole No. 2 has been started on higher ground. It is now down 100 ft. The report of Pritchett and Hamilton, consulting engineers for the Summit Copper Co., dated January 30, 1911, has just been issued. According to their estimates there is blocked out and on the dump low-grade ore of the value of $793,624, divided as follows: 33,011 tons averaging 4.36% copper; 8578 tons at 6.51%; 17,062 tons at 3%; 39,860 tons, assaying 2%. The Pasquale vein was 12 to 18 in. wide on the 300 ft. level, and where opened on the 400-ft. level had widened to 2 ft., the ore assaying 25 to 30% copper.

Globe, February 11.

MARICOPA COUNTY

(Special Correspondence.)—The 20-stamp mill built last year at the Vulture mine has been in successful operation since September. The ore is crushed in cyanide solution, the amalgamation taking place inside the mortars. The sand is reground in Australian grinding-pans, and the pulp is treated by Dorr's continuous decantation process, in which three pulp-thickeners are used in series. The property belongs to the Vulture Mines Company.

Wickenburg, February 6.

MOHAVE COUNTY

The Bi-Metal mines, situated within 3 miles of Kingman, were recently examined and sampled by James F. Parks of San Francisco. It is understood this sampling is for the purpose of deciding as to the advisability of erecting there a large milling plant. The mineral-bearing ground in the group consists of granite-porphyry and diorite, gold, partly free, being disseminated through it. The test of 100 tons made at the 10-stamp mill on the property last year resulted in a recovery on the plates of $4.92 per ton. According to information obtained some time ago, the property belongs to the Arizona Gold Mines Co., the manager for which is E. M. Lamont, of Colorado.

Bi-Metal Mines and Mill.

PINAL COUNTY

The Magma Copper Co. owns claims covering the Queen fissure-vein at Superior, situated 30 miles north of Florence. This is an east-west vein cutting at right angles the Superior contact. It is close to the old Silver King mine and was discovered at about the same time as the latter. The Magma company's Queen vein is developed from a shaft, cross-cuts having been driven to the orebody from the 300, 400, and 650-ft. stations. The cross-cut at 650 ft. is a recent accomplishment. The ore found on the 300 and 400-ft. levels was phenomenally rich, and it is claimed that the value in copper and silver of the ore being mined on the 650-ft. level is $800 to $1000 per ton. Driving on the vein is progressing both east and west from the cross-cut at the last-named level, and this work shows the vein to be 8 ft. wide.

YAVAPAI COUNTY

The Alta mine, in charge of E. Haney, has a 6-in. stringer of ore, samples of which have assayed 400 oz. silver per ton. There is some copper and antimony associated with it. The property is situated near Iron Springs, and the discovery was made while driving an adit toward a porphyry dike.

YUMA COUNTY

The Big Eye mine, a new property, but little developed, situated in Castle Dome district, has been sold by Amos Adams, W. C. Prewitt, L. W. Schooler, P. O. Spitter, and J. L. Huffman to H. V. Ketchersides, T. S. Overholtzer, Thos. Finch, and others at $160,000. H. C. Johnson, who held an interest with the original owners, retains such inter-

est. The title to the mine is vested in the Big Eye M. Co. An adit is being driven, and future development is to be facilitated by installing a hoisting-engine, an air-compressor, and drills. Castle Dome camp is situated about 45 miles northeast of Yuma. The Dunkirk mine, situated in Whipple mountain, and controlled by Santa Fé railroad men, is yielding gold ore of high grade. A fight between a stubborn hog and combative dog led to the discovery.

CALIFORNIA

AMADOR COUNTY

The South Eureka M. Co., which is paying 3c. per share in dividends, has 60 stamps in operation on a fair grade of ore. C. P. Vicini, while driving an adit on the east side of Butte mountain, opened a channel of material containing free gold in coarse particles. The discovery was made at a place high on the mountain-side where no mining had been done previous to this. J. S. Garbarini and others have a lease on a copper property situated on the Johnson ranch, 3 miles west of Jackson. They have sunk a 100-ft. shaft, and have copper ore of good grade, which contains some gold. The Central Eureka mine, with 20 stamps operating in the mill, yielded $13,500 in December, and $14,500 in January.

ELDORADO COUNTY

The Landecker gravel property, now called the Hope, embraces an area of 412 acres at Placerville, has three placer channels, and has been developed by 2000 ft. of adits. The equipment consists of an air-compressor, driven by water-pressure, three air-drills, cars, and trackage. It is estimated that a sufficient tonnage of gold-bearing gravel has been blocked out to keep the mill operating six months. The operators mine and mill not only the channel gravel, but they take out and mill about 3 ft. of the bedrock, all the material yielding about $5 per ton. The property was taken into possession January 1 by the Hope M. Co. The Mother Lode Mines Co., of New York, has a bond on the Kelsey mine, situated four miles north of Placerville, which is to be prospected and developed this season. The property covers a mile on the Mother Lode, where there are numerous croppings of quartz. W. A. Hooten, the company's representative, is proceeding with the work outlined and may install some machinery later.

INYO COUNTY

The Keane-Wonder mine, situated on the west slope of Funeral range, facing Death valley, is producing 60 to 70 tons of ore per day, and this is being treated at the Keane-Wonder mill, the clean-up of free gold amounting to close to $20,000 per month. Rhyolite, Nevada, is the supply town for this mine, the distance between the two places being about 20 miles.

KERN COUNTY

The Arondo mine, situated in the Argus range, is being operated now with a force of 20 men, under direction of J. K. Miller. A supply of ore has been accumulated, and the mill is soon to be in operation, the water for mill-work being delivered from a distant source through a line of pipes. The mill, equipped with a crusher, rolls, and facilities for cyanidation, is to be increased in capacity; the force of miners and millmen is to be doubled. The lease of the Butte mine, at Randsburg, to Ed. Shipsey took effect February 1. The lessee is performing some preliminary work prior to commencing regular mining operations. The shaft is being straightened, ladderways are being built, and in the stopes the ground is being caught up and timbered. The shaft is to be sunk till a depth of 150 ft. shall have been reached, and levels are to be driven from the 100 and 150-ft. stations. The Rice lease expired on February 1, at which date the lessee made a clean-up of $6000 from 40 tons of ore that was treated at the custom mill of the Stanford M. & R. Co. at Johannesburg. It is said that a number of sub-leases are to be let on the Butte mine. Jas. Rice has taken over the Zachry lease on the King Solomon mine.

NEVADA COUNTY

Buck Bros., owners of the German Bar mine, drove an adit-level some distance on the vein, from which rich ore was taken, but they reached a point where the vein faulted, and recent efforts have been for the purpose of finding the vein in its faulted position. E. M. Parish has a bond on the Gold Canyon property, on which there is a force of men working under direction of O. D. Woodman. At the Plumbago mine the usual number of miners is engaged, with C. W. McMeken in charge. This mine has an orebody from which ore of good grade is being taken. The Delhi mine, farther down-stream on the middle Yuba, has water-power for all purposes. The water has been pumped out of the workings, a shaft is being sunk, and other mining operations are in progress.

The project of driving a deep adit from a site on Rush creek, near Jones bar, in Nevada City-Grass Valley district, is being considered. A plan for accomplishing this was outlined by Geo. W. Downey a few years ago. A bore, starting at the place proposed, would give a depth at several mines of about 1400 ft., and if it were driven as far as the Champion mine it would have a length of 11,000 ft. The possible discovery of new veins of ore is one of the strong incentives to carrying out the project. The Gaston mine is operating, and the mill is running at part capacity. Repairs are being made on the supply ditch by which water is brought to the mill.

PLACER COUNTY

The Pioneer mine and mill, situated in Humbug canyon, near Alta, are to be operated again under direction of Jack Patrick and Harry Morris. The Pioneer was operated profitably in early days.

RIVERSIDE COUNTY

The Riverside Gold M. & M. Co., having 10 claims on Riverside mountain, close to the Colorado river, has been developing there two years, and recently it opened a vein of copper-gold ore by driving a cross-cut. This was followed by driving on the vein, the face of the drift being in ore having a width of 5 ft.; and the grade is such as will justify the expense of mining and shipping. In addition to this, there is said to be 4 ft. of ore of milling grade. This district is within practicable hauling distance of the Parker branch of the Santa Fé railroad.

SHASTA COUNTY

Gould & Burg, of Contra Costa county, have been engaged by the Shasta County Farmers' Association to make analytical investigations as to the character of the fume being emitted from the stack of the smelter at Coram. The Balaklala Con. Copper Co., in 11 months of 1910, produced 9,666,595 lb. of copper, 446,135 oz. silver, and 10,310 oz. gold. The Heroult electric iron-smelter is operating, and is turning out 15 to 20 tons per day of pig iron at a cost of $14 per ton. It is stated that an ample voltage of electricity is now available for use. The plan is to erect five more furnaces. The mines of iron and chrome ores have been well developed.

SIERRA COUNTY

A small force is employed this winter at the Golden Scepter mine, near Bunker Hill. Profitable gold-bearing gravel has been made accessible by sinking a 40-ft. incline. This stuff yields at least $2.50 per mine-car. In the spring a larger force is to be employed. The property is owned by M. A. Cutten, B. M. Atkinson, and others, of San Francisco. The Brown Bear gravel mine, on St. Charles hill, is being operated by those holding it under bond. The ore-channel has been opened. A 600-ft. adit has been driven, the face of which is in pipe-clay and gravel, and the ore deposit is believed to be close by. The property, situated near Downieville, is owned by H. S. Tibbey, August Costa, D. Burgess, and F. P. Roddy; the work is in charge of J. H. Schofield. The Sierra Buttes and Phoenix mines were closed down last week by reason of the flumes being crushed by heavy snow. It is also reported that the mill and other buildings of the Keystone mine have been partly destroyed in a similar manner. The powder magazine at the Bullion mine, in which was two tons of powder, was carried down the hill by a snowslide, but it was not demolished.

TUOLUMNE COUNTY

(Special Correspondence.)—Encouraged by the recent finding of a body of good-grade ore in the lowest level of the Black Oak mine, the management of that property may sink an additional 100 ft. The Spring Gulch mine, bonded to W. B. McCubbin and George Ash, is being unwatered, preparatory to beginning mining operations. The shaft is 600 ft. deep and the vein from 4 to 10 ft. wide. Twenty more stamps have been ordered for the Tarantula mill and will be installed as soon as they are received, making 40 in all. It is said this may soon be followed by another addition to the plant, the intention being to ultimately have a 100-stamp mill. A shaft will be sunk at the Jumper which will be connected with a raise 200 ft. below surface. Thus, a suspension of mining operations while straightening and enlarging the present working shaft will be obviated. Work is to be commenced at the property of the Dugan-Dodsworth Mining Co., near Jamestown. Large orebodies have been opened on the Heslep vein at the App. This new source of ore supply enhances the value of the mine, the outlook at which is better now than in many years. J. H. Alling, representing Chicago investors, has secured a bond on the Rough and Ready gravel mine. The instrument calls for the commencement of work within 60 days, and it has been decided to drive an adit approximately 400 ft. to properly open the gravel deposits. Mining operations will soon be commenced on a 40-acre tract on Woods creek, midway between Sonora and Jamestown, believed to contain gold in gravel deposits. A Pittsburg company has taken a bond on the Hunter and Hardtack mines, on Hunter creek, and it is understood operations will soon be in progress. The Sure-Shot claim, in the Basin district, owned by G. B. Connally, gives promise of becoming a producer. The vein is 10 ft. wide and assays of the ore average $7 per ton.

Tuolumne, February 12.

YUBA COUNTY

The Summit Hill M. Co. has been incorporated by F. B. Bininger, J. G. Ramm, Wm. Herlitz, R. C. Elge, and K. H. Ellis, to develop and mine ore on a property close to the Dobbins ranch.

COLORADO

The State legislature has enacted into law what was introduced as the Hurd eight-hour bill, bringing under its provisions all classes of employment in mines, smelters, reduction plants, and cement mills.

CLEAR CREEK COUNTY

The January ore-shipments from the mines of this county amounted to 128 cars, which is 18 cars in excess of shipments for January 1909. The concentrating plants are crowded with ore, and there is every indication that the mining industry is in a prosperous condition. Two of the big mines of the county are the Saratoga, at East Argentine, above Georgetown, and the Donaldson, in Trail Run district, both controlled by the North American Smelter & Mines Co., operator and owner of the Golden smelter. The Donaldson orebody has been opened to a depth of 1500 ft., samples of the ore assaying about $45 per ton. The development has been accomplished under the direction of J. H. Robeson. The property is entered through the Rockford adit, and shipments of ore to the smelter amount to nearly 1000 tons per month. Shipments being sent out from the Santiago are restricted to the tonnage that can be hauled to Georgetown, but they are to be increased as soon as the East Argentine railroad can be kept open for traffic. The greater number of the mills of the county are situated at Idaho Springs, where much of the ore of this county and considerable of the Gilpin county ores are treated.

GILPIN COUNTY

The facilities for deep drainage, thorough ventilation, and modern milling in Gilpin county is making it practicable to mine ore averaging as low as $6 per ton. The drainage of the Quartz hill mines through the Newhouse tunnel, is resulting in the opening of bodies of ore to depths of 1200 to 1500 ft. The Gunnell mine is being drained by making a raise from the Newhouse tunnel to connect with a winze which was sunk from its lowest level.

LAKE COUNTY

The Nevada mine, east of the Ibex, on Breece hill, under lease to Thos. Simpson and associates, has been unwatered down to a point below levels formerly worked. In mining rich lead and gold ore in the higher workings, it was found that the orebody dipped on a steep incline, making it necessary to get at the ore on the lower levels which were then under water. One of the formerly submerged levels was found to have been partly filled by caved ground. The débris is being cleared away, and mining will soon begin there. The Kankakee tunnel has been driven 2000 ft., and it is expected to be driven on to the London fault. The portal is at Linderman, in Birds-Eye gulch. The work is in charge of Joseph Franks of Denver. A box containing 35 lb. of blasting powder exploded at the Garbutt mine, Breece hill, wrecking the ore-bins, the damage amounting to $2500. The explosion resulted from some mistake in

Map of Colorado.

connection with thawing. The thawed powder caught fire, the fume of which served as a warning to the men at the plant, enabling them to escape only a minute before the explosion occurred. F. C. Dinsmore, S. H. Alexander, W. W. Theobold, and A. O. King are principally interested in the Garbutt. The Cofield lease, on the Little Johnny group, recently produced a car of ore that sampled 15 oz. gold per ton at the smelter; in addition to this, 33 lb. of gold ore yielded $130 per pound at T. D. Kyle's melting furnace.

SAN JUAN COUNTY

The Slide mine, owned by W. E. Porter of Denver, and leased to L. Lowe and John Yeager, has a new body of ore containing argentite and free gold. The pay-ore has a width of 10 to 16 in., and assays about $100 per ton. The property is in Galena basin. The big mill of the Gold King company is to be started again in a few weeks. Its location is at Gladstone, on Cement creek.

SUMMIT COUNTY

The King Solomon tunnel, being driven near Frisco, in Ten-Mile district, has a length of 4900 ft. and has intersected 11 veins in that distance. Considerable driving has been done in ore on several of these veins. Samples of ore taken from vein No. 2 assayed over $300 per ton; ore taken from a 50-ft. winze assayed 120 oz. gold. While veins No. 7 and 10 have good ore, that in vein No. 11, which was opened at a depth of 1800 ft., is mostly steel galena, accompanied by gold, silver, and copper, and is exceptionally high grade. Most of the development and blocking-out of ore is being confined to this vein, and a considerable tonnage is to be shipped next spring.

TELLER COUNTY

The Cripple Creek mines produced 71,105 tons of ore in January, of an estimated value of $1,326,117. Of this output, only 4250 tons was smelted. The 66,855 tons treated at the various milling plants were distributed as follows:

Plants.	Tons.	Av. per ton.	Value.
U. S. R. & R.	14,000	$22.00	$308,000
Golden Cycle	23,850	20.00	477,000
Portland	10,000	20.00	200,000
Portland, C. C.	9,005	3.40	30,617
Stratton's Independence	9,000	3.25	29,250
Wild Horse	1,000	5.00	5,000

The ore shipped to the smelters had an average value of $65 per ton. The mills treating the higher-grade ore are situated in the valley; the last three named, treating the low-grade ore, are at their respective mines in the district. For the same month the Portland paid $60,000 in dividends; the Vindicator, $45,000; Golden Cycle, $30,000; Acacia, $7200. The operations of the Trilby Mines Co. were stopped by order of the State Commissioner of Mines, who enjoined the company from further operations until dump cribbing was repaired and made safe. The company complied promptly. M. B. Rapp, a lessee on Dante No. 2, Bull hill, is mining ore from a 4-ft. vein, 11 in. of which is high grade. Selected ore recently shipped sampled several hundred dollars per ton. His operations are between the third and fourth levels. H. D. Gortner shipped a carload of ore from the Mollie Kathleen, Tenderfoot hill, which sampled $14 per ton. The Consolidated Gold Fields of South Africa, Ltd., has purchased the Golden Cycle mine, at Cripple Creek, and the Golden Cycle mill, at Colorado City.

IDAHO

For 11 months of 1910, January to November, inclusive, there was received at the U. S. assay office, Boise, 25,139.58 oz. gold, and 15,751.47 oz. silver, mine operators of 21 counties contributing to make up these results. These figures, however, are not given as a representation of the output of gold and silver of the State, as some of the bullion produced was sent to Seattle and Salt Lake, and not any part of the silver recovered from lead ores appears in the figures of the Government assayers.

BLAINE COUNTY

Hamilton Swift, A. Farnlun, and R. Leach, who purchased the property containing the Moonlight lode, have discovered a body of ore at 25-ft. depth, a ton of it containing a high percentage of lead and several hundred ounces silver. An adit is to be driven to open the ore at 250-ft. depth. The property is eight miles from Ketchum. The Relief and Minnie Moore mines, situated at Bellevue, and belonging to the Idaho Con. Mines Co., have extensive bodies of concentrating ore, which are well developed. It is said that a reorganization of the company is in progress. The Idaho Democrat mine is to be equipped with a hydro-electric plant. Lessees are to resume work on the Red Elephant mine. There is 500 tons of concentrate at the Boulder mine ready to be hauled to Hailey for shipment. Reports indicate that Wood River district mines will be more active than usual this year.

IDAHO COUNTY

The Northern Idaho Gold M. Co., made up of Minnesota men, has made the final payment for the Gilt Edge group of claims in Ten-Mile district, on which it has been operating under a bond for the last 18 months. The vendors were A. D. Bennett and John Grindi, and the price was $25,000. The Seventeen property, in the same district, which has been worked under a bond during the past year by Nathan Haas, has been taken over by him on the final payment of the agreed price. The former owner is W. B. Houston.

The Jumbo mine and mill, in Buffalo Hump region, are being operated by H. E. Gray and partners, as lessees, who are mining ore fast enough to keep two 5-stamp batteries in operation. They are having a raise made from No. 4 to No. 3 level, a distance of 380 ft. Much of the ore being milled is mined on a shoot opened by an intermediate, between levels No. 2 and 3. No. 4 is the mill-level, and on this a great deal of development is to be done. The supply town for this district is Grangeville.

LEMHI COUNTY

The Latest Out mine, situated at Gilmore, ranks second among the shipping mines of this county. Since the Gilmore & Pittsburg Railway Co. began operating trains, six months ago, the ore shipments from this mine have amounted to 3700 tons. It is claimed there are 9000 tons of ore in the mine ready to be broken, and development extends to a depth of only 365 ft. The ore being shipped samples 33% lead, 17 oz. silver, and 50 to 90c. in gold per ton. The mine is 1½ miles from the railroad, making wagon haulage of that distance necessary. R. Nicholls is at the head of the company that controls the mine.

OWYHE COUNTY

The Gray Eagle & Silver City M. Co. has been organized at Caldwell to develop two mineral lodes on West Sinker creek, four miles north of Silver City. Some work has been performed, and the ore obtained assays high in gold and silver.

SHOSHONE COUNTY

(Special Correspondence.)—Reports of a favorable character are received from Heinze's Stewart mine at Kellogg. In a short time the output of milling ore is to be increased to 450 tons per day, and in addition to this, first-class ore shipments will be made to the East Helena smelter. With an output now running 350 tons per day it is stated that the mine is earning about $20,000 per month net. There is a debt of $125,000 on the property, and it is stated that this will be paid off inside of six months from earnings which it is estimated will reach at least $30,000 per month by April 1.

Wallace, February 11.

MONTANA

DEER LODGE COUNTY

(Special Correspondence.)—A company is being organized by persons of Butte and the East for the purpose of constructing an electric railway for hauling ore from Georgetown district to Anaconda. In this district is located the Southern Cross, Cable, Oro Fino, and other mines. The Southern Cross company is employing 75 men and is shipping its ore to the Washoe smelter, necessitating a wagon-haulage of 12 miles. The parties who are principally interested in the electric road are the owners of the Bonanza mine in which rich ore was recently discovered. The line has already been surveyed, and it is stated that sufficient capital has been subscribed to ensure its construction. It looks as though there would be much activity in this district.

Anaconda, February 11.

NEVADA

NYE COUNTY

The Goldfield Consolidated company, on February 14, shipped to the Selby Smelting & Lead Co., San Francisco, 19 bars of bullion, weighing 1480 lb., valued at $426,000. It was sent by Wells, Fargo & Co. express under guard.

STOREY COUNTY

Recent development in the Mexican mine, at Virginia City, is of importance. The north drift on the 2500-ft. level, from the east cross-cut, opened ore, 15 mine-cars of which assayed $44.50 per ton. The driving is entirely in ore. The north drift has been extended 460 ft. The discovery of ore on this level demonstrates the existence of orebodies in the northern part of the mine. It is considered the best showing of ore made in recent years in this mine. The north-end mines produced, for the week ended February 4, ore of the value of $16,222, distributed as follows: Ophir, $7407; Con. Virginia, $2501; Mexican, $6313. The Ophir product was 340 mine-cars, averaging $21.78 per ton; the Con. Virginia produced 237 mine-cars averaging $10.25 per ton; the 108 cars taken from the 2500-ft. level of the Mexican sampled $58.46. The vein in the Mexican, where the recent discovery was made,

has a width of 10 ft. The joint winze, being sunk from the 2000-ft. level for the Union and Sierra Nevada, has reached a depth of 85 ft. Work continues on the south drift of the 2000-ft. level of the Ward shaft. Similar work is in progress on the 2250 and 2450-ft. levels at the Ward. At the Yellow Jacket mill there was crushed 715 tons of ore for the week, 431 tons having been supplied by the Crown Point, and 284 tons by the Belcher mine. Of the Crown Point ore, 378 mine-cars assayed $3.27, and 549 cars assayed $8.05; and of the Belcher ore, 171 cars averaged $9.35, and 99 cars ran $6 per ton. Storey county mines, from October 1, 1909, to September 30, 1910, produced 129,225 tons of ore of an assay-value of $451,784.37. Of this amount, the Ophir yielded $220,418; the Yellow Jacket's output was $56,476; that of Con. Virginia was $53,885; Crown Point, $49,032; the Butters company, $44,209; Belcher, $19,293; Hale & Norcross, $12,091; Savage, $1700; Silver Hill, $3453; Comstock-Phoenix, $1050; Mexican figures are not given. The output for the year 1910 would be considerably greater than for the year ended September 30, as there was a substantial increase during the last quarter of the year. Dietrich & Hahnewald Bros., having a one-year lease on the Butters concentrator and cyanide plant, have 100 men employed at the mill, and on the Chollar & Potosi and Hale & Norcross mines on which they have leases.

NEW MEXICO

SOCORRO COUNTY

(Special Correspondence.)—At the Socorro mines the east and west drifts have been advanced 1000 ft. on the orebody at the 600-ft. level, with good ore at both faces. This is the deepest development on the vein, and all ore broken is milled. The width of the vein varies from 5 to 20 ft. The same vein will be cut on the 700-ft. level within the next month. During January, 26,000 oz. of gold and silver bullion was produced and shipped. The Ernestine M. Co. opened its western orebody at 700-ft. depth several weeks ago by driving the main adit. The ore in this vein assays $15 to $20 per ton. The eleventh level has been driven west into No. 3 orebody. These two recent developments have resulted in adding greatly to the ore reserves. The extraction from 692 tons of ore milled during the week was 8474 oz. gold and silver bullion and 45 sacks of concentrate. The mill at the Deadwood mines crushed 250 tons of ore during the first week of its operation. The Treasure M. & R. Co. employs the fill-stope method in mining on its big orebody. Air-drills have been ordered for development work. An Oliver filter has been installed in the mill. Power for all purposes is supplied by the company's hydro-electric plant. The Enterprise M. Co. has sacked and shipped some high-grade ore to the smelter.

Mogollon, February 12.

CANADA

BRITISH COLUMBIA

(Special Correspondence.)—The shipments of blister copper from the Granby smelter for the week ended February 4, amounted to 440,000 lb., which exceeded all previous records. The Granby copper output for 1910 was 20,018,048 lb.; of silver, 355,997 oz.; gold, 44,130 oz. The gross proceeds of these metals at average prices would be about $3,635,191. The work being done by the Granby company at the Hidden Creek mines, according to O. B. Smith, superintendent, is promising. Five thousand feet of diamond-drill core has been taken out of the holes since November 15.

Phoenix, February 10.

(Special Correspondence.)—During the first six months of the current fiscal year the Consolidated smelter at Trail produced metals of the value of $2,294,000, which is a satisfactory increase over that of previous years. Over 35,000 tons of ore per month is being treated at this plant, the gross output per month averaging $351,000, of which about 53% is gold.

Rossland, February 9.

Technical Schools and Societies

C. K. Leith lectured recently at Northwestern University, comparing the geology of the Lake Superior, Brazilian, and Cuban iron ore districts.

The University of Illinois has issued, from its Engineering Experiment Station, bulletin No. 43, on 'Freight Train Resistance, Its Relation to Car Weight,' by Edward C. Schmidt.

Robert H. Richards has recently returned to Boston from New York and Pennsylvania. He also made a visit to the John Hays Hammond Laboratory at the Sheffield Scientific School, New Haven, Connecticut.

A. P. Merrill delivered an address on 'Some Important Considerations in the Design of Hydro-Electric Power Plants' at one of the recent monthly meetings of the Utah Society of Engineers, held at Salt Lake.

The Board of Geological Survey of the State of Washington has issued its biennial report for the years 1909-10. It has issued numerous bulletins relating to the geology of coal and metalliferous regions; also a topographical map of the State.

The Lewis Institute, Chicago, opened its Winter Quarter January 3. An evening course in gas-engines is being given. There are 2700 students registered. The course includes mechanical, steam, and electrical engineering, drawing, shopwork, and chemistry.

The Montana Society of Engineers held its twenty-fourth annual meeting at Helena January 12 to 14. The members visited the smelting plant at East Helena, and the Hauser Lake dam. There were 26 members in attendance. F. W. C. Whyte was chosen president; Clinton H. Moore, secretary; Samuel Baker, Jr., treasurer and member of board of managers. W. L. Miller talked on the construction of the Hauser Lake dam; C. W. Goodale told of his visit to the Panama Canal.

Directors of the American Mining Congress met in Salt Lake last month. The number of members comprising the board was increased from 9 to 13, of which 5 are to constitute a working quorum. The executive committee, acting on authority of the other members, appointed Geo. W. E. Dorsey, of Nebraska, James Douglas of New York, and B. F. Bush of Philadelphia, to serve as three additional directors till the next session of the Congress; the selection of the fourth member was deferred till the place for holding the next annual meeting shall be chosen, when a resident of that locality will be appointed, and this is to be decided upon about March 1. The board of directors, as now constituted, consists of the following members: John Dern, Salt Lake; E. R. Buckley, Rolla, Mo.; D. W. Brunton, Denver; E. A. Montgomery, Los Angeles; A. G. Brownlee, Denver; Samuel A. Taylor, Pittsburg; L. W. Powell, Warren, Arizona; Geo. Wingfield, Reno; Chas. A. Barlow, Bakersfield; Geo. W. E. Dorsey, Nebraska; James Douglas, New York; B. F. Bush, Philadelphia.

Mine-rescue work and first-aid practice are to become a part of the course at the Colorado School of Mines, and each year this school is to co-operate with the U. S. Bureau of Mines in affording members of the senior class special practice in this line of work. One of the Rescue Cars of the Bureau of Mines, detailed for service in Colorado, was at Golden a week in charge of J. C. Roberts, assisted by Thomas Tweeddale and Thomas Harvey, who with A. J. Hoskin and A. C. Smith, professors in the School of Mines, divided the class into squads of seven, assigned special duties to each squad, and gave each student practice in the use of the Drager oxygen helmet under conditions requiring severe physical exertion in an atmosphere of noxious gases. The climbing of hills while wearing these helmets was practised. The students also worked in the School of Mines tunnel, which was filled with gases, such as might be found in coal mines in cases of explosions or fires. There was practice on assumed victims of poisonous gases, suffocation, and drowning, as well as in reviving persons injured from any probable cause.

Personal

Professional men are invited to send news of their engagements and travels. Such news is interesting to friends.

WILL CLARK is in San Francisco.

LEE FRASER has gone to Lima, Peru.

W. H. ALDRIDGE was in San Francisco.

HOWARD D. SMITH is at Sonora, California.

S. H. BALL has been at Lexington, Kentucky.

CHARLES JANIN is at Grass Valley, California.

COURTENAY DE KALB has been in San Francisco.

J. H. RICHARDS was in San Francisco Wednesday.

O. H. PACKER has returned from Butte county, California.

RALPH ARNOLD has been visiting the California dredging fields.

A. E. ROBINSON has been appointed State Engineer for Idaho.

E. M. HAMILTON is at the Dolores mine, Madera, Chihuahua, Mexico.

GEORGE A. TWEEDY is now general manager at Minas del Tajo, Rosario, Mexico.

F. OSKAR MARTIN is making examinations in the Panoche and Coalinga oilfields.

H. B. KAEDING has gone to Nicaragua to take charge of the Siempre Viva mine.

J. P. HUTCHINS and NORMAN C. STINES are at the Polefskoy Syssert Estate, Perm, Russia.

HUGO WACHENFELD is in San Francisco, having been visiting American metallurgical plants.

M. S. GRIFFITHS is general manager for the O. y T. Braniff company at Doctor, Queretaro, Mexico.

F. L. RANSOME, having examined the Ray and Miami mines, is about to return to Washington, D. C.

V. B. SHERROD, for several years mill superintendent for the Real del Monte company, Pachuca, Hidalgo, has resigned.

FRANKLIN W. SMITH, consulting engineer for the Alvarado M. & M. Co., is at the company's mine at Parral, Chihuahua.

ALEXANDER P. ROGERS has left New York on a professional trip to Brazil, South America, to be gone several months.

E. H. BARTON, superintendent for the Frisco Mines & Power Co., Mohave county, Arizona, has resigned and is succeeded by Howard W. Squires.

HENRY M. LANCASTER, for several years at Wallace, Idaho, has moved his office to Spokane, where he will engage in a general practice in mining engineering.

ROBERT H. RICHARDS has recently returned from a professional visit to Joplin, Missouri, where he went to look into the operation of his jigs and classifiers.

F. O. SMOLT, formerly from Colorado, and later at Velardeña, Mexico, has gone to Manila, P. I., as representative of the Dearborn Drug & Chemical Company.

BENJAMIN RICHARDS, who has been with the La Rose and Cobalt Lake mining companies for the last four years, is now superintendent at the Hollinger mine, Porcupine, Ontario.

OBITUARY

CHARLES F. SHELBY was killed in an automobile accident near Ancon, Peru, on January 26, 1911. The deceased was for two years superintendent of the Old Dominion smelter, at Globe, Arizona, that plant, as it now stands, having been built under his direction. He held a similar position with the Greene-Cananea Copper Co. for a year, and went to Peru to take charge of Cerro de Pasco plant at Ancon. He was widely recognized as an engineer of great ability and his loss will be keenly felt.

Market Reports

LOCAL METAL PRICES.

San Francisco, February 16.

Antimony	12—12¾c	Quicksilver (flask)	48½
Electrolytic Copper	14⅛—15¼c	Tin	45—46½c
Pig Lead	4.75—5.70c	Spelter	7—7¼c

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

METAL PRICES.

By wire from New York.

Average daily prices in cents per pound.

Date.	Electrolytic Copper.	Lead.	Spelter.	Silver, per oz.
Feb. 9	12.28	4.45	5.48	51⅜
" 10	12.28	4.45	5.48	51⅝
" 11	12.28	4.45	5.51	51⅞
" 12	Sunday.	No market.		
" 13	Holiday.	No Market.		
" 14	12.28	4.45	5.53	51⅞
" 15	12.28	4.45	5.53	51⅝

ANGLO-AMERICAN SHARES.

Cabled from London.

	Feb. 9. £ a. d.	Feb. 16. £ a. d.
Camp Bird	1 15 9	1 14 7½
El Oro	1 6 3	1 5 7½
Esperanza	1 13 9	1 12 6
Dolores	1 5 0	1 5 0
Oroville Dredging	0 7 0	0 7 0
Mexico Mines	7 7 6	7 8 9
Tomboy	0 15 0	0 15 6

(By courtesy of W. P. Bonbright & Co., 24 Broad St., N. Y.)

COPPER SHARES—BOSTON.

	Closing prices, Feb. 16.		Closing prices, Feb. 16.
Adventure	$ 5⅛	Mohawk	$ 43⅜
Allouez	36	North Butte	28½
Atlantic	3⅞	Old Dominion	40½
Calumet & Arizona	51¾	Osceola	105
Calumet & Hecla	505	Parrot	12
Centennial	12	Santa Fe	1¼
Copper Range	67	Shannon	11½
Daly West	3	Superior & Pittsburg	14½
Franklin	9⅛	Tamarack	43
Granby	83	Trinity	4
Greene Cananea, ctf	6⅛	Utah Con	11½
Isle-Royale	13	Victoria	2
La Salle	7¾	Winona	3¾
Mass Copper	6¾	Wolverine	121

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

MINING STOCK QUOTATIONS—NEW YORK.

(By wire from Catlin & Powell Co., New York.)

	Closing prices, Feb. 16.		Closing prices, Feb. 16.
Amalgamated Copper	$ 65	Miami Copper	$ 19⅞
Arizona-Cananea	3⅜	Mines Co. of America	5
A. S. & R. Co.	79⅜	Montgomery-Shoshone	⅛
Braden Copper	3⅞	Nevada Con	19⅛
B. C. Copper Co.	6⅜	Nevada Utah	1
Butte Coalition	18⅞	Nipissing	11
Chino	21¾	Ohio Copper	1⅝
Davis Daly	1⅜	Ray Central	1½
Dolores	5⅛	Ray Con	16⅞
First National	1¾	South Utah	⅞
Giroux	6⅝	Superior & Pittsburg	14⅝
Greene-Cananea	6¼	Tenn. Copper	38
Guanajuato Con	½	Trinity	4¼
Inspiration	8	Tuolumne Copper	4¾
Kerr Lake	7	United Copper	4
La Rose	5	Utah Copper	45¾
Mason Valley	9¼	Yukon Gold	4

SOUTHERN NEVADA STOCKS.

San Francisco, February 16.

Atlanta	$ 12	MacNamara	$ 15
Belmont	5.85	Mayflower	5
Booth	5	Midway	14
Columbia Mtn	2	Montana Tonopah	92
Combination Fraction	11	Pittsburg Silver Peak	75
Fairview Eagle	35	Rawhide Coalition	2
Florence	1.70	Round Mountain	42
Goldfield Con	6.62	Silver Pick	5
Gold Kewenas	6	St. Ives	16
Great Bend	1	Tonopah Extension	1.02
Jim Butler	28	Tonopah of Nevada	8.15
Jumbo Extension	25	West End	51

(By courtesy of San Francisco Stock Exchange.)

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EDITORIAL

QUEBEC will entertain the Canadian Mining Institute next week and an interesting and profitable session is assured. Mr. Frank D. Adams will preside.

SIX young ladies from Boston have taken a lease on the Lucky Gus mine at Cripple Creek. Boston young ladies are known to be thorough, and the ones in question show their determination to get at the roots of mining matters by following them underground.

RECLAMATION of the great interior valley of California is proposed in a bill introduced at Sacramento, the first step being the preparation of adequate plans. Regulation of the Sacramento and San Joaquin rivers is recognized as one of the great engineering problems of California. The bills under discussion were prepared by Mr. A. D. Foote and should be endorsed by engineers generally.

CARD systems of employing men have been adopted in various Western districts where operators have had trouble with the Western Federation of Labor. In Colorado a bill has been introduced in the Legislature prohibiting the system. It is not likely to pass. While the card system lodges power in the labor secretary that makes grave abuses possible, it was devised to escape even more serious difficulties.

BUREAU OF MINES employees, when injured while engaged in hazardous work, are to be given proper compensation, if the bill now before the Senate at Washington becomes a law. It has already passed the House. The simple justice of the proposal is sufficient argument for it. Under the old system none but soldiers and sailors were compensated for injury. Extension of the principle to cover other Government employees is a belated recognition of the fact that civil service is as important as military, as it is often as hazardous.

COPPER MERGERS have been much discussed in the public prints for a year or more. We present this week an informing article on the subject, written by Mr. Horace J. Stevens, the veteran authority on all things relating to copper. Incidentally, we note that Mr. M. E. Clapp has introduced into the United States Senate a resolution directing the Attorney General to investigate the relations of the Amalgamated Copper Company, Anaconda Copper Company, United States Metal Selling Company, and allied corporations, to determine whether the Sherman anti-trust law is being violated. Here impends publicity with a vengeance!

CANADIAN geologists have selected a strong local committee to arrange for the meeting of the International Geological Congress at Toronto in 1913. Mr. F. D. Adams is chairman, and Mr. R. W. Brock, secretary. An international inquiry on the subject of the 'Fracture System of the Earth's Crust' will be made and probably an inventory of the world's coal resources will be compiled, supplementing the excellent study of the iron resources of the world that signalized the 1910 meeting at Stockholm.

INVESTORS at Vancouver, British Columbia, especially, are being invited to buy stock in the Montana Mammoth Mining Company, which has a silver-lead "orebody" that "runs a mile through the company's ground" and "ranges in width from 300 to 350 feet." This is quite too good to be true. The consulting geologist and mining engineer for the company, Mr. Samuel Aughey, who "is recognized as the leading expert mining engineer, metallurgist, and geologist in the country," has, unfortunately an unsavory record in connection with Arkansas gold discoveries.

ELY CENTRAL reorganization is under way and a stock and bondholders' committee consisting of Messrs. H. E. Lodge, Harry L. Ayer, and J. C. Guggenheimer is soliciting deposit of securities with the Federal Trust Company. Each stockholder is asked to contribute fifteen cents per share toward a fund of $240,000 which, it is estimated, will cover the cost of reorganization. A new company is to be formed and the old stock exchanged for new. In the meantime, the receivers' petition for authority to sell fifty acres of the Ely Central ground to Nevada Consolidated has been denied, but the court is insisting upon payment of debts within thirty days.

TUNNEL-DRIVING records are at best unstable things. In April 1910 the south portal of the Elizabeth tunnel on the Los Angeles aqueduct was driven 604 feet in a hard schist. In January 1911 the Laramie-Poudre in Colorado was advanced 609 feet in hard granite at one heading. Mr. D. W. Brunton, Mr. James A. McIlwee, and their assistants therefore now hold the American record for hard-rock work. European standards are still ahead of us, but the Laramie tunnel is not yet completed. Mr. McIlwee acquired his training in the Arlberg tunnel and came to America to act as foreman at the Cowenhoven tunnel when Mr. Brunton was putting through that important piece of work at Aspen. He and Mr. Brunton have hopes of surpassing the January record in March. In February the breast of the tunnel has been in shattered rock with clay-filled fissures, where progress is necessarily slow.

ALASKA'S greatest gold mine, the Treadwell, is widely known. There is, none the less, much still to be learned from the interesting deposit on Douglas Island that has forced new standards of economical work. We present this week the first part of a discussion of the geology of the mines, written by Mr. Oscar H. Hershey, who has recently completed a systematic investigation of the lode. It is the most important paper on the subject that has appeared since the United States Geological Survey published Mr. A. C. Spencer's report. It is, furthermore, an excellent example of the accurate scientific work that the large mining companies now find economical. Mr. Hershey has necessarily condensed his discussion until only his main conclusions and the reasons back of them appear. He finds that the grade of the ore was relatively high from the surface to 220 feet in depth, decreased between that and 440, and then rose irregularly until the lowest fully developed level, at 1450 feet, is the best in the mine. This result, because it is based on large workings and many samples, is extremely significant as to persistence of values in depth in gold-quartz veins.

Smelter Smoke Legislation

It can not be denied that fashions are powerful in America. The public seldom allows prosaic considerations of reason and sound common sense to interfere with an enthusiastic abandonment to whatever may happen to be the whim of the moment. The feminine members of the community, for example, can scarcely justify clothing themselves with hats too wide to pass through doors and in skirts too scant for convenience, by any argument based on reason and common sense. In the matter of feminine dress we are disposed to concede a great deal of latitude, but an extension of the logic of unreason to business life must be viewed with concern.

For some years past it has been the fashion to make a good deal of commotion over the fumes that escape from smelters. So much is this true even now that smelter managers scarcely hope to remain free from disturbance for more than brief periods at a time. In some cases large smelting plants have been abandoned and the industry moved to other localities, while the managers of plants still in operation sleep with uneasy heads. This matter derives fresh interest by the introduction into the California Legislature of an act to regulate smelters. The act is framed in such a drastic way that not only smelters but acid works and chemical manufactories will be unable to comply with its terms. That is, business interests aggregating $60,000,000 to $70,000,000 yearly will be obliged either to find another field for operation, or else carry on operations under such restrictions that it would be better to cease altogether. When we remember what efforts have been made to secure for San Francisco the Exposition of 1915 in order that a corresponding amount of business may be brought here for one year, it would seem as though restricting such an industry should call for careful consideration rather than unwise zeal. Spencer has said that the proper philosophy of life is an adherence to enlightened self-interest. In this case there seems to be involved too much self-interest and too little enlightenment to produce the best results. We will, with what measure of enlightenment we possess, endeavor to state the matter briefly.

It is acknowledged that smelters produce disagreeable smells. So do tanneries, oil-works, breweries, glue factories, and a host of other industries. The

smell is, however, borne with because these are necessary forms of business, and we should be at a loss without them. Automobiles give off disagreeable odors, but no one seriously objects to their use on that score. The effects of smells from factories are minimized by erecting the works at points where, so far as can be foreseen, there is little likelihood of the immediate neighborhood developing into an important residence or agricultural district. This is not always easy, for where many workmen are employed it is desirable to build homes for them nearby, and where many people live, it is necessary to have a food supply. In the case of smelters where an isolated position is impossible, the next best step is to take such means to prevent annoyance and injury resulting from the fumes as is economically possible. After that the problem resolves itself into whether we shall continue to have smelters operating under reasonable restrictions or no smelters at all. The question, then, is whether the present restrictions under which smelters are now operating are all that are reasonable, or are we prepared to have no smelters.

In the past few years many hearings have been held and much evidence adduced as to whether smelter fume has been the cause of any great damage or annoyance. The two principal elements of danger in the fume from smelters are the solid particles or dust, and the SO_3 gas. It has been shown that in certain cases where animals have eaten vegetation on which dust containing arsenic or lead had settled, death has resulted. Possibly the total value of all the animals that have died from this cause since the beginning of smelting operations in the United States would equal, for example, the value of the product of three hours operation of the Selby works near San Francisco. In response, however, to the representations of those injured in this way means have been introduced at practically every smelter in the United States to remove all dust from the smelter fume before allowing it to escape into the air. The means for this purpose are so effective in their action that further complaint can scarcely be made on this score, and the smelters are, in addition, willing to pay damages for authentic cases of damage. It is well known that SO_3 will injure vegetation unless it is very dilute. Sulphuric acid works are equipped with precipitating apparatus of the highest efficiency, and it is possible to reduce the amount of SO_3 allowed to escape into the atmosphere to a dilution of 2.5 grains per cubic foot, but smelters can not do this without great expense and loss of efficiency. The smelters in Shasta county, California, are operating under an agreement not to allow more than 12 grains per cubic foot to escape, and even this is difficult of attainment. The best practical test of the effects of SO_3 is to observe whether grains and fruit are able to grow in the neighborhood of the smelter, as the gas is only injurious when concentrated. If the smoke produces no visible effect close to its source, it certainly can not do injury at a greater distance after having been mixed with free air.

In addition to placing their works at a reasonable distance from centres of population, smelting companies are careful to remove the dust from their gases, dilute them with as much free air as possible, and then discharge them into the atmosphere from tall stacks so that they may be thoroughly mixed with the atmosphere by the winds before coming in contact with the earth's surface. More can scarcely be done, short of physically removing the plants to desert places, as was actually done in one case. Smelters need transportation facilities of the best, and these do not usually exist in desert places. Smelters also require workmen, and neither do these inhabit the desert. Under adverse conditions it is possible to operate in desert places, but no industry ought to be obliged to operate under the most adverse conditions. To unnecessarily burden industry is to place a wasteful tax on the community.

It is difficult to believe that a large part of the outcry against smelters is not hysterical in its nature. The Orford Copper Company operates its smelter practically within New York City without experiencing difficulty, although the New York authorities are so watchful of their atmosphere that they do not allow the burning of soft coal. There is a smelter at Perth Amboy, surrounded by large towns and valuable lands, and another at Omaha, within a mile of the post office. Neither of these excites objection. Many of us have worked without injury in smelters, where the fume is many times more concentrated than outside. While we did not enjoy the smell, a suggestion that we contribute a fraction of a per cent of our monthly wage to do away with it would have met with strenuous opposition. Unfortunately, the legal question is not, whether the annoyance of smelter fume is negligible when compared to the benefit of the smelting industry to the community, but whether anyone is annoyed by smelter fume. Those who experience the slight annoyance ought not to be able to cut off the great benefit enjoyed by the community at large.

Are large communities prepared to do without chemical works and smelters, relegating them to a distance? One phase of industrial economy is the securing of a supply of raw materials at as low a cost as possible. Finished products of high value can bear transportation charges with equanimity, but the raw material must be cheap, and usually the chief item in its cost is the freight charge. The large cost of sulphuric acid, white lead, lead pipe, copper salts, and lead and copper products, is generally due to their being produced at a distance from the point at which they are used. Any increase would work seriously to the disadvantage of each manufacturing community, and when we consider the final ramifications of the business interests involved, the total is enormous. We must be guided by reason. The smelters are making every reasonable effort to prevent injury and annoyance from the operation of their plants; any one actually injured can recover damages to the full amount, and to allow the suppression of industries so vitally connected with the prosperity of whole communities, because certain members thereof object to the smell, is not in accord with common sense, nor to the benefit of the greatest number.

A Modern Reduction Plant on the Rand

By Rowland Gascoyne

There has just been started at the City Deep mine on the Rand a reduction plant possessing several unusual points of interest. This plant has been previously described, but its many new features entitle it to more than ordinary attention.

Timber, in the past, has entered largely into the structure of mills on the Rand, but in this instance timber is almost conspicuously absent, its place having been taken by reinforced concrete, and steel girders, and other forms of steel construction. There is, of course, the risk in displacing timber by girders in a mill, that a good deal of shearing of rivets may take place; and again, steel and reinforced concrete can scarcely be expected to have the same accommodating results as timber. In the 600-stamp mill at Randfontein, on the other hand, no effort to spare the use of timber seems to have been made, and reinforced concrete has been only sparingly used.

The plant is designed to treat 65,000 tons per

Cams and Tappets.

Detail of Stamps.

Conveyor Belt and Cyanide Vats.

Collecting Sand Vats.

Precipitation Room.

Tube-Mills.

month, and as the ore is of higher grade than the average of the neighboring mines, when once it gets into proper stride the mine will rank as one of the leading producers on the Rand. Saving of labor costs and economy of handling are other prominent features, while a high percentage of extraction is regarded as certain of attainment. As all the gold will be recovered at one spot in the gold-recovery house, the possibility of thefts, loss from which is estimated to run in some cases up to 10% of the output, ought to be reduced to a minimum. The mill will be driven, as in fact will all the machines at the surface of the mine, by purchased power from the Victoria Falls Power Co., as soon as that company is in a position to supply all the motive power required. At the present time, 50 stamps out of the 200 are running. Power is carried to the required points by underground cables.

The ore is sorted and crushed at the mine in the ordinary manner before being conveyed to the mill. The transport of ore to the mill and all necessary surface work is effected by heavy electrical locomotives using 2000-volt, 50-cycle, 3-phase current.

The stamps are arranged in units of 10, the weight of the stamps being 2000 lb., and the stamps having long heads and short stems. One special feature is that there is only a layer of ½-in. felt between the mortar bases and concrete foundations. Kingposts are entirely dispensed with, the concrete foundations being carried, with indented steel-bar reinforcing, to above the level of the top of the mortar-box. Each cam-shaft is carried by a steel frame, and rests on eleven bearings, so as to minimize the risk of breakage. Stems are 4 in. by 13 ft. long, and the stamps are arranged for a very heavy duty if necessary. Each battery is provided with four Challenge feeders.

Adjoining the mill are nine 22 by 5½-ft. tube-mills, each driven by a 100-hp., slow-speed motor through a reduction-gear; all the other motors are driven by belts.

Next to the tube-mill house, and between that and the sand-plant, the gold-recovery house is placed, and under the same roof are arranged the amalgamating tables, extractor-boxes, clean-up machinery, strong-room, and refinery, as well as the office of the man in charge of the ore reduction.

The solution-sumps are ample in size to meet future extensions of the plant and are placed close to the gold-recovery house. They consist of three sumps 48 ft. by 47 ft. by 12 ft. 9 in. deep, the slime-solution sump being 122 ft. by 47 ft. and 12 ft. 9 in. in depth.

The collecting sand-plant consists of a row of 6 vats, 50 ft. diam. and 10 ft. deep, on reinforced-concrete supports. A 24-in. belt conveys the sand to the top of the sand-leaching vats, consisting of two rows of 6 vats, each 56 ft. diam. by 12 ft. deep built of steel and carried on supports of reinforced concrete.

The slime-plant consists of four conical-bottom collectors, 60 ft. by 10 ft. and 16 ft. in depth, likewise on reinforced-concrete supports. There are two steel, conical-bottomed, air-agitation vats, 32 ft. in diameter and 30 ft. deep, and 8 steel, conical, first and second-wash vats, 70 ft. in diameter.

The sand from the leaching vats is discharged by a Blaisdell excavator delivering to a 24-in. belt under each row of vats. The sand is conveyed by another 24-in. belt up an inclined steel cantilever frame, and is discharged 100 ft. above the level of the ground.

For some time past ore has been developed in the mine on ample scale. In fact, during the last twelve months, 856,879 tons of profitable ore has been developed, so that by the time the mill gets into full swing several years reserve will be in hand. The following ore has been developed during last year:

Quarter ended	Exposures: Distance, ft.	Exposures: Width, in.	Exposures: Value, dwt.	Pay-Ore: Quantity, tons.	Pay-Ore: Value, dwt.
December	2006	19.8	19.8	183,155	7.2
March	1471	19.9	26.0	177,659	10.7
June	3353	17.7	24.7	310,313	9.2
September	2506	17.8	22.2	185,752	7.3

DEMURRAGE IN DREDGING

The following table indicates the time lost on a 5-cu. ft. close-connected bucket-elevator dredge 4½ years in commission during but 12 months of operation:

	Total time lost, hr.	min.	Percentage of total time lost.
Bucket line	161	5	1.834
Tumblers	212	35	2.420
Screens	81	45	0.931
Ladder	502	10	5.717
Pumps	83	5	0.946
Winches	95	10	1.083
Lines	116	50	1.330
Spuds	28		0.319
Motors	18	55	0.215
Power	420	30	4.787
Stacker	239	5	2.722
Stepping ahead	164	10	1.869
Clean-ups	65	45	0.737
Stumps		55	0.010
Other causes	87	40	0.998
Total	2277	40	25.918
Total time running	6482	20	74.082
Total time possible	8760		100.000

Strangely, nearly all the quartz found in gold-bearing gravels is practically barren of gold. Occasionally, though rarely, quartz cobbles or boulders are discovered in the wash that are rich in gold. One reason for this scarcity of gold-bearing quartz probably is, that generally the quartz rich in gold is shattered and rather softer than that which contains little or none, and consequently, the softer quartz is more quickly reduced to sand and small fragments than the barren rock.

Mica, according to D. B. Sterrett of the U. S. Geological Survey, was produced in 1909 to the amount of 1,809,582 lb., worth $234,482. Three varieties are found in the United States—muscovite, or 'white' mica; phlogopite, or 'amber' mica; and biotite. Muscovite is the principal mica mined in this country, for the other varieties are not mined commercially.

Copper Mergers

By Horace J. Stevens

Interest in the Lake region centres in the proposed merger of the Calumet & Hecla with its various subsidiary and collateral corporations. The proposal of the Calumet & Hecla was set before the shareholders of the different companies more than a month ago, and discussion and argument have waxed strong, pro and con. Apparently the Calumet & Hecla management had considerably the better of the argument and the chances of success, until a week ago, when a bombshell was thrown into their camp by Thomas L. Chadbourne, for many years the general counsel of the Calumet & Hecla, and an attorney of wide reputation. Mr. Chadbourne protested against the merger, as the owner of 3100 shares of Ahmeek, worth at present market prices upward of $500,000. Unlike the pronunciamentos of some of the other interests opposed to the merger, Mr. Chadbourne, after stating the grounds of his complaint, also stated the specific remedy, which in this case is the introduction into the Michigan legislature of a bill, similar to the laws now existing in ten other States, providing that in case of a corporation merger, dissatisfied minority shareholders may obtain a court appraisal of their holdings, and be paid the same in cash. There seems little doubt that Mr. Chadbourne will be able to secure the prompt enactment of this bill, and it is likely it will become a law in Michigan before the date set for the proposed merger. It is a question whether the Calumet & Hecla management would care to finance at present, the purchase, for cash, of many millions of dollars worth of stock of dissatisfied minority shareholders.

While there is much talk in the press of a general copper merger, to include all of the leading American interests, and possibly some of the foreign interests also, this is not taken seriously by those who are most conversant with the finances of the copper trade, and the trend of its developments. Instead of a general copper merger, which is not contemplated in the near future, though possibly it may come eventually, it is more reasonable to look for a series of mergers along the present lines of spheres of influence and geographical relations. In this connection, it may be of interest to give consideration to the very pronounced progress that has been made in the direction of a series of large mergers since the panic of 1907. In the case of the Amalgamated Copper Co., the first great copper merger of the United States, now twelve years of age, the situation has been greatly simplified within the past year by the absorption of a number of other copper companies by the Anaconda Copper Mining Co. Most of these companies merged in the Anaconda were controlled formerly by the Amalgamated, this list including the Boston & Montana, Butte & Boston, Parrot, and others, in Butte, but the Anaconda, incidentally, has taken over the entire holdings of William A. Clark in the Butte camp, except his Elm Orlu zinc property, and also has absorbed the property of the Butte Coalition, including the Alice mine. This merger has made for greater simplicity in both operation and finances, though the financial involutions necessitated by the Consolidation have been somewhat perplexing to the uninitiated, for the reason that the Amalgamated Copper Co. has been placed in the positions of both purchaser and seller, and of parent and child, giving the appearance of turning itself inside out. Closely affiliated with the Amalgamated Copper Co. are the so-called Cole-Ryan interests, dominated by John D. Ryan and Thomas F. Cole, Mr. Ryan being the president of the Amalgamated. These interests include the North Butte, now the principal independent property in the Butte camp, the Greene-Cananea, in the northern part of Sonora; the Giroux, now developing at Ely, Nevada; the International Smelting & Refining Co., which has recently blown in a smelter near Salt Lake, and various minor properties. Affiliated with the Cole-Ryan group, through the extensive interests therein of Mr. Cole, are the Calumet & Arizona and the Superior & Pittsburg companies, which are now in the throes of a merger of their own.

The Guggenheim interests, which have made giant strides in copper production during the past few years, have been pretty thoroughly controlled from the start, but have been further coalesced through the purchase of a large interest in Nevada Consolidated by the Utah Copper Co. Affiliated with the Guggenheim interests are the holdings of the Tutt-McNeill-Penrose-Jackling interests. This group really includes the Utah Copper Co. and Nevada Consolidated Copper Co., which as yet remain the pioneers of the so-called porphyry mines, and in addition includes the Ray Consolidated, of Pinal county, Arizona, and the Chino, of Grant county, New Mexico, two prospective important mines of the first order.

The Phelps-Dodge interests are controlled, as they have been for many years past, by this old established firm, which, within the past two years, has become the corporation of Phelps, Dodge & Co., Inc. The Phelps-Dodge holdings include the Copper Queen at Bisbee, Arizona; the Detroit at Clifton, Arizona; and Moctezuma in northern Sonora, all of which are owned practically outright by Phelps, Dodge & Co., and also include the control of the Old Dominion mine at Globe, Arizona, in which there is a very considerable outstanding share interest in the hands of the public. Another copper group of importance is that of the Lewisohn interests, including the Miami mine at Globe, which promises to make a highly successful producer of the porphyry class. It is rumored that negotiations are now under way for a merger of the Miami and Inspiration mines, together with several smaller properties in the neighborhood; all of which have developed more or less ore in an extensive schist belt west of Globe.

Inspection of a list including all North American copper mines having a present productive capacity of 10,000,000 lb. or more yearly shows that a very great majority of the big producers are included in the foregoing groups. The largest interests, outside

of those before referred to, are the United States Smelting, Refining & Mining Co. controlling important properties in Salt Lake and Juab counties, Utah, and in Shasta county, California, with a present productive capacity of about 50,000,000 lb. of fine copper per year; the Copper Range Consolidated, of Michigan, with present productive capacity of nearly 40,000,000 lb, fine copper per year; the Arizona Copper Co., Ltd., a Scotch corporation operating in Graham county, Arizona, with a present productive capacity of about 35,000,000 lb. per year; W. A. Clark's United Verde, of Yavapai county, Arizona, also with a productive capacity of about 35,000,000 lb. per year; the Boleo, of Lower California, controlled jointly by the French house of Rothschild and the Banque Mirabaud, with a productive capacity of about 30,000,000 lb. fine copper per year; the Granby, of British Columbia, with a capacity of upward of 25,000,000 lb. per year; the Quincy, of Michigan, with a capacity of about 20,000,000 lb. per year; the Shannon and the Tennessee Copper companies, with 15,000,000 to 18,000,000 lb. capacity per year each; the Balaklala, of California, which, by the way, is affiliated with the Guggenheim interests through a large stock holding; the Bully Hill of the General Electric Co., also in Shasta county, California, and the Mohawk and Wolverine mines of the Stanton-Gay interests, of about 10,000,000 lb. capacity per year.

Dry Placer Mining in the Quijotoa District

By Fred. W. Fickett

There is a rich gold-placer area west of Tucson and extending north and south some distance on both sides of the Mexican line. This area has been worked in places for free gold by Indians and Mexicans for hundreds of years. It is a desert country, and it is impracticable to get water for mining purposes.

There is gold in the district from the surface down, and into a strata of *caliche* which is really a kind of lime cement. The *caliche* carries more gold than the dirt above it. The Indians work the dirt above it, and then the softer places in the *caliche*, by digging it out, pulverizing it by beating it in a rawhide bag, and then separating the gold with their hand machines, which are crude affairs. White miners have made one or two attempts to work this district, but without success, owing to their inability to pulverize the gold-bearing *caliche* in sufficient quantities and at a cost that would make their operations profitable.

This field requires, first, a machine that will pulverize large quantities of the dirt and *caliche*, thereby liberating the gold which is held in the interstices of the gravel by the *caliche*; and, second, a machine that will separate the gold from the pulverized mass without the aid of water. Both machines must be capable of handling a large tonnage, at a cost of only a few cents per ton.

Something more than a year ago, a machine called the Quinner was perfected. Its purpose is to pulverize the harder gold-bearing strata of this district. It was tried in the Altar district, Sonora, and in Horseshoe basin of the Quijotoa district, and was successful in both. It is claimed that one of these machines will pulverize thirty tons of this dirt per hour, with a gasoline consumption of about two gallons.

During the past year several tables using air under pressure have been introduced to take the place of tables using water for concentration, but I shall refer to only one—the Stebbens table—which is typical of the class. This table was set up and demonstrated in Los Angeles, where small quantities of iron and copper filings were mixed with dirt and gravel, and then the dirt and gravel run over this table. In every instance, it is claimed, the saving was complete. This machine was then brought here to Tucson and erected on the placer ground of the Manhattan company, about seventy miles southwest from this city, where it is now doing everything claimed for it, so far as I can learn.

While I was at Horseshoe basin last month, the company operating there sacked up two tons of the ground product of the Quinner machine and had it hauled by Indians forty miles over to the Stebbens table, for a sample run. This entire two tons was put over the Stebbens table in eight minutes, with a much higher saving than had ever been made before by the people sending the sample. I did not see this run myself, but it was witnessed by a number of prominent mining men. I did get to the Manhattan camp the next day in a cold rainstorm, and remained there until the following morning. The Manhattan company has no cover for this machine, and of course they were not working it during the rainstorm. The next morning I went with the men to where it was, which is about one-half mile from camp, and saw them start it and operate on local material. The wet dirt was removed from the top, and the dry dirt underneath was used. A capacity of fifteen tons per hour was claimed, and its work seemed to me to be unusually good.

A Quinner machine will cost $1500. Three Stebbens separators will cost $3000. Two gasoline engines, one to run the Quinner machine and the other to run the tables, will cost about $3000. Accessories such as shafting and conveyors to carry away the waste product, building material, and tools will cost about $2000. There will be the freighting of this machinery to the property, at a cost of about $20 per ton, and then the erection of it on the ground. This latter will not be a very expensive undertaking. The total cost of such a plant should not exceed $12.000. When completed, it can be operated by three white men and about ten Indians, at a total cost of $60 per day. The Indians work for $1.50 per day of nine hours. This plant can handle successfully from 300 to 400 tons per day of nine hours, and I doubt if it will be possible to get a day's run of the dirt that would produce less than $1 per ton (or cubic yard), while the average would probably be much greater.

Sampling Placer Ground

By J. P. Hutchins and N. C. Stines

***Treating the Sample.**—The material, as it is pumped from the hole, is dumped into a sheet-iron box. This box is 2.5 ft. long, 6 in. wide, and 14 in. deep, and is mounted on 4 angle-iron legs, about 22 in. long. It is open at one end which can be closed by a sliding gate, perforated with ⅜-in. holes to allow the water to drain off the top of the gravel dumped into it. It is sometimes advisable to pan each pumpful when extremely close track of the pay-strata is wanted, but it is usual to allow the drillings from 6 to 12 in. of core to accumulate, and to pan these larger amounts.

Assume that the drillings from 6 inches of core have accumulated in the box. The gate is raised, and the material washed with a gold-pan having a

Fig. 1. Treating the Sample.

screen lying in it. This gold-pan and screen are supported by two sticks across a tub in such a way that the water, overflowing, is caught in the tub. This is done to economize water. The screen is an ordinary gold-pan punched with ⅜-in. holes with an unpunched ring about 1.5 in. wide around the outside edge of the bottom. With such a screen, all material over ⅜-in. diameter can be removed by shaking the screen over the gold-pan without spilling. The oversize is examined to ascertain its characteristics and to insure that no nuggets or undissolved pieces of clay are being rejected. The screen is then emptied into the first panning tub. The pan containing the undersize is panned in the first panning tub, until there is a small amount of material left. The panning is finished in the second tub. This division of panning keeps the water in the second tub clean. When panning is finished, the contents of the pan are examined and the estimated weights and characteristics of the gold and other data are noted in the field-book.

*See 'A B C of Empire Drilling,' *Mining and Scientific Press*, January 7 and 28, 1911.

These data are as follows: (1) Depth from which sample was taken. (2) Whether the pipe sank by rotations or had to be driven. (3) The depth of core in the pipe. (4) The estimated weight and characteristics of the gold. (5) The quality of the material panned and the characteristics of the stratum represented by it. (6) Remarks. Under this head are included general data as to characteristics not included above, and character of bedrock and its depth from surface. (7) Time elapsed and lost time. Time elapsed includes time consumed in drilling, pulling, and moving; and lost time, that time consumed in making repairs, and their cause.

Keeping the Notes.—The following is a specimen page from the field-book:

Depth, in feet.	Rotated From—To feet.	Driven From—To feet.	Weight of gold in milligrams.
..	.....	[1]3— 7	.....
[2]7	.....	.....	0— 0— 0
[3]8	7— 8	.....	0— 0— 0
[4]9	8— 9	.....	0— 0— 0
[5]10	9—10	.....	Trace
[6]11	.....	10—11	"
[7]12	.....	11—12	"
[8]13	.....	12—13	"
[9]14	.....	13—14	"
[10]15	.....	14—15	.....
[11]16	.....	15—16	Trace
[12]17	.....	16—17	0— 2— 0
[13]18	.....	17—18	0— 0— 1
[14]19	18—19	.....	0— 0— 0
[15]20	19—20	.....	0— 0— 0
[16]21	20—21	.....	Trace
[17]22	21—22	.....	0— 0— 0
[18]23	22—23	.....	0— 0— 0
[19]24	23—24	.....	0— 0— 1
[20]25	.....	24—25	0— 0— 1
[21]26	.....	25—26	0— 0— 1
[22]27	.....	26—27	0— 0— 1
[23]28	.....	27—28	0—50—20
[24]29	.....	28—29	.....
[25]29.5	.....	.....	0— 0— 0

REMARKS

[1]Started July 3, 1909, 5:05 p. m.; 2 ft. soil; bored 3 ft. Continued in hole No. 6, July 4, 1909, 7 a. m.

[2] [3] [4] [5]Fine gravel, sand.

[6] [7] [8] [9]Fine gravel.

[10] [11] [12]Medium gravel.

[13]Medium gravel, with gray sand.

[14]Quicksand.

[15] [16] [17] [18]Sand.

[19]Medium gravel and sand.

[20] [21] [22]Medium gravel.

[23]Medium gravel and bedrock.

[24]Bedrock.

[25]Drilled 6 in. below pipe into bedrock. Bedrock soft with much clay on it.

Actual volume panned, 3.75 cu. ft.; finished at 4:20 p. m.; started pulling at 5 p. m.; finished pulling 5:35 p. m.; lost 10 minutes broken chain-tongs. Water-level, 7 feet.

Forty minutes lost in panning sticky clay off bedrock in hole No. 6, 200 ft. south of No. 5 and on same line.

The contents of the pan are emptied into a vessel kept for that purpose. This vessel is low and flat, so as to be difficult to capsize. When the hole is finished, the contents of the cup are emptied into a gold-pan, a small globule of quicksilver added, and the gold amalgamated. When particles of gold do not amalgamate freely, they are rubbed between the finger and the bottom of the pan to brighten them, after which they will amalgamate readily.

The globule of amalgam is transferred to a small glass bottle. The bottle is tightly corked and properly labeled. It is then ready for parting.

Parting and Weighing.—The operation of parting is as follows: The amalgam is emptied into a porcelain crucible or annealing cup and a 50 per cent solution of nitric acid is added. This is digested at a slow heat until all action has ceased, which is noted by the absence of further bubbling and the complete breaking up of the globule. The fluid is then poured off and the gold particles are thoroughly washed with distilled or rain water, to thoroughly clean the gold and remove all traces of nitrate of mercury. An alcohol lamp, a small retort-stand, a sand-bath or piece of wire-gauze, a wash-bottle, and a pair of forceps, though not absolutely essential, are very useful in this manipulation. A candle can be used instead of the alcohol lamp.

The gold is then thoroughly dried and is ready for weighing. In drying, care must be taken that 'spitting' does not occur as the last drop of water is evaporated. When an annealing-cup is used, it is better to remove the last drop of water, by capillary attraction, with a small glass pipette. A drop of alcohol added to the wash-water, as it is being evaporated, will prevent 'spitting.' The gold is weighed on a balance with a sensitiveness of ½ to ¼ mg. The gold is then returned to the glass bottle, and when enough has accumulated, an assay to determine the fineness should be made.

Calculating the Gold Content.—The gold content per cubic yard for each hole is ascertained by using a formula or by actually measuring the volume of material that has been taken from the pipe. The formula is derived as follows:

The outside diameter of the cutting-shoe, 0.38 ft., is taken as the diameter of the cylinder of material which is the sample. The length of this cylinder is the depth of the hole. With a diameter of 0.38 ft., each foot of the cylinder has a volume of 0.1134 cu. ft. Therefore it takes a cylinder 238.1 ft. long to make a cubic yard; therefore the actual value of the gold in cents recovered from any hole is to the depth of that hole in feet as the tenor of the content in cents per cubic yard is to 238.1; or, in symbols,

$$c : d :: T : 238.1$$

$$\text{or } T = \frac{c \times 238.1}{d}$$

where c = value of ore recovered from the hole, in cents,

d = depth of hole in feet,

T = tenor of ground in cents per cubic yard.

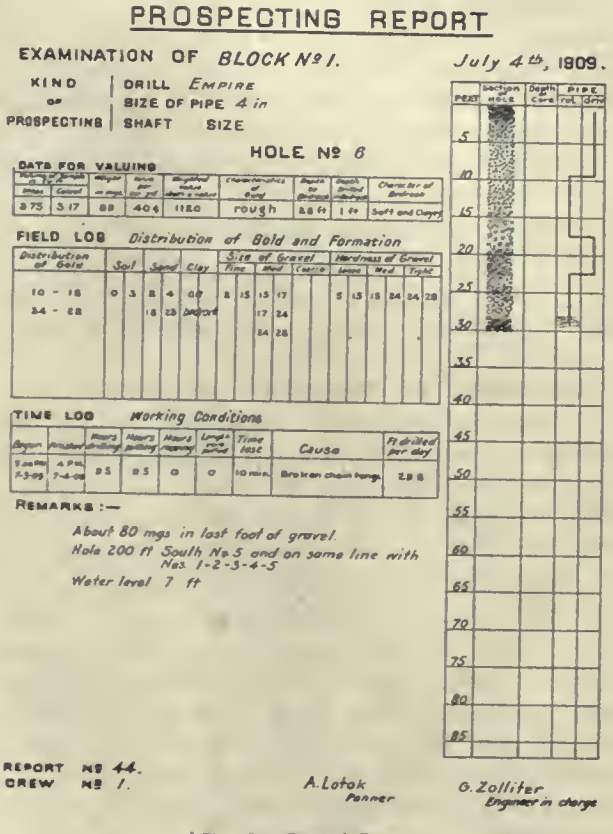
In using the actual volume recovered from the pipe, the procedure is as follows: All material is saved in the panning tubs and accurately measured in cubic feet. Then when the value of the gold, c, in cents, is determined as before, the volume of the material in cubic feet = v; the tenor, T, of the ground may be calculated by solving this proportion:

$$c : v :: T : 27$$

$$\text{or } T = \frac{c \times 27}{v}$$

where 27 is the number of cubic feet per cubic yard.

The values for T derived from the solution of these equations are not the same. This is due to the fact that in the first case the theoretical volume of the cylinder in place has been taken, and in the second the actual volume after it has expanded. Gravel that has been excavated has from 30 to 40 per cent more volume than when in place. Therefore, in using the second method, due allowance must be made for this fact. In one examination the ratio of expanded volumes to theoretical volumes in place was found to vary in extreme cases from 1.13 to 1.54, with an average of 1.37, which indicates careful work by the drill crew.


PROSPECTING REPORT

EXAMINATION OF BLOCK Nº 1. July 4th, 1909.

KIND OF PROSPECTING: DRILL Empire; SIZE OF PIPE 4 in; SHAFT SIZE

HOLE Nº 6

DATA FOR VALUING

Depth of Bench in Feet	Gravel	Weight in mgs	Value per cubic yard	Weighted value depth x value	Characteristics of Gold	Depth to Bedrock	Depth Drilled into Bedrock	Character of Bedrock
3.75	3.17	89	40.4	112.0	rough	28 ft	1 ft	Soft and Clayey

FIELD LOG Distribution of Gold and Formation

Distribution of Gold	Soil	Sand	Clay	Size of Gravel: Fine	Med	Coarse	Hardness of Gravel: Loose	Med	Tight
10 - 18	0	3	8	4	0.7	2	15	13	17			5	15	18	24	24	28
24 - 28		18	23	bedrock				17	24								
								24	28								

TIME LOG Working Conditions

Began	Finished	Hours Drilling	Hours Pulling	Hours Repairing	Lengths Drilled	Time Lost	Cause	Ft drilled per day
9 a.m. Dec 31-09	4 P.m. 7-4-09	8.5	8.5	0	0	10 min.	Broken chain hang.	2.8 6

REMARKS:—

About 80 mgs in last foot of gravel.
Hole 200 ft South No 5 and on same line with Nos 1-2-3-4-5
Water level 7 ft

REPORT Nº 44.
CREW Nº 1.

A. Lotak, Panner

G. Zolliter, Engineer in charge

Fig. 2. Record Form.

After the tenor of the ground from each hole has been calculated, an average tenor for the deposit covered by the holes is found in the following way: The tenor of each hole is multiplied by the depth of each hole in feet. This is called the 'weighted value' of each hole. The sum of these products is divided by the sum of the depths of all the holes. This gives the average gold content or tenor per cubic yard of the whole deposit drilled. To illustrate this, suppose that the following data are available:

Depth, in feet.	Value per cubic yards, in cents.	d × T.
20	20	200
15	2	30
30	3	90
25	7	175
10	100	1000
100	122	1495

By dividing the sum of the products, 1495, by the sum of the depth, 100, an average tenor of 14.95c. per cubic yard is determined. By merely dividing

the sum of the values by the number of holes, thus getting an arithmetical average, 24.4c. per cubic yard is found. The selection of the weighted average as the correct one is not arbitrary, for experience has proved that this method of calculation gives results which more nearly correspond with the results usually obtained by actual mining.

The average depth is obtained by dividing the sum of all the depths by the number of holes. Thus in the above instance the average depth would be 20 ft. The volume is obtained by multiplying the area as found from the survey by the average depth. This is generally given in cubic yards.

Prospecting Report.—The form shown in Fig. 2 is used to record the various data. The first tabulation contains 'Data for Valuing.' Column No. 1 is for the actual volume in cubic feet of the sample; column No. 2 for the theoretical volume. The 'Field Log' is a record of the physical characteristics and of the distribution of the gold. The 'Time Log' is a record of the working conditions. In the columns on the right of the sheet are recorded graphically the various strata penetrated, the depth of core, and also whether the pipe was rotated or driven to sink it.

Accuracy of the Sample.—It is probable that the core obtained by sinking rotated pipe is more truly representative of the ground being sampled, than that obtained by driving the pipe, as material properly belonging to the sample is not driven aside, and the cutting-shoe tends to cut a regular core. Further, when running ground is encountered with rotated pipe, there is much less danger of getting an incorrect sample, because the rotated pipe immediately sinks through this ground until it strikes solid material. There is no such action with the driven pipe, and the jarring due to the driving tends to aggravate the difficulties due to running ground. With the power-drill, pumping is usually done infrequently, and large masses of material and water are sucked up at one time, thereby suddenly increasing the difference of water-level between that inside and that outside the pipe, and so conducing to the flow of running-ground, with water into the pipe. There are no such conditions in the manipulations of the hand-drill. The handling of the sample when using the hand-drill is much cleaner than when using the power-drill, and there is no chance for mechanical loss.

Drilling v. Shaft-Sinking.—It is a much-mooted point whether drilling or shaft-sinking is better in prospecting alluvium. It is unquestionable that the larger sample obtained from a shaft is better than the small sample obtained from a drill-hole. However, when a certain amount of time and money is available for an alluvial examination, as is often the case, it is usual that a better idea of the property can be had by drilling numerous holes than by sinking few shafts and getting few samples, and shafts are more costly and slow. If the ground is very wet, not only is it often extremely costly to sink shafts to bedrock, but samples obtained under such conditions are likely to be unreliable. In general, if drilling is properly done, the results obtained may be relied upon. It is good practice to sink a few shafts to check results and to examine the physical conditions of the bedrock and lower gravel. However, it often happens that such work can only be done at prohibitive cost, when ground is wet and loose. As a matter of interest, ground prospected with an Empire drill, when afterward dredged, has shown, by weekly clean-ups, the prospecting results to have been about 90 to 110% of the actual content, while the average of clean-ups and the prospecting results during a great many clean-ups practically coincide.

Mewaing River Placers

By W. B. Winston

Some interesting and valuable experience was gained in prospecting the property of the Mewaing Gold Co. (No. 1), Ltd., situated on the Mewaing river not far from Rangoon, in Burma, British India. The property, which consists of a broad and comparatively flat river bed through which a slowly running stream winds its way, was at first prospected by a hand-drill operated by means of a spring pole, a casing being used and the work carried on in a method similar to that employed in prospecting with machine-drills in California. The results of this prospecting showed that the river gravel and sand extended to a depth of 20 ft., and that beyond this point the gravel became mixed with clay, in increasing proportions, until all trace of gravel was lost at a depth of 30 ft., where a false bedrock of fine clay was found. The gold was distributed through the gravel, the greatest concentration being found at a depth of about 20 ft. From this depth the gold gradually became less until it disappeared entirely at 30 ft. It was therefore proposed to order a dredge, designed to dig to a depth of 35 ft. below the surface of the water in order to insure against difficulties in dredging the deepest parts of the property.

Before ordering a dredge, N. Samwell, then consulting engineer for the company, decided to check the results obtained from drilling, by working several open-cuts across the property. For this purpose, and on account of part of the property being covered by water, he constructed a bamboo raft having in the centre a long open well extending about two-thirds the length of the raft to the forward end, whereon an **A** frame supporting a single pulley was erected. A large steel scoop or shovel was then made and attached to a handle about 35 ft. long. On the upper end of this handle a cross-piece was attached so that the scoop might be guided by men on each side of the well in the raft, and at the lower end a single rope was attached and passed over the sheave suspended on the **A** frame and thence back to the after-end of the raft, where it was attached to the drum of a crude hand-winch. In operation, the scoop was guided and forced into the gravel, by men at cross-bars on the handle, at the same time that it was dragged along the cut and hoisted by the line running to the winch. When raised above the water the scoop

was swung to one side of the raft and the contents dumped into the hopper of a long sluice mounted on the raft, the material being washed by water baled into the sluice-box by natives. Through the operations of this ingenious improvised dredge it was found that the gravel lay on a fine and very soft false clay bedrock at a depth of about 20 ft. The sides of the open-cut stood so well that it was possible to determine the amount of gravel dug up and washed by simply measuring the size of the excavation from which it was taken. The average value of the gold content of the gravel was thus closely determined, and when it was taken into consideration that the gold secured by drilling actually extended to a depth of only 20 ft., the drill results checked closely with those obtained from the open-cuts. It is evident that in drilling, the drill-bit drove portions of the gravel and gold into the soft clay, and these were gradually recovered between the depths of 20 and 30 ft. as the drill-casing advanced. The open-cuts proving that the gold extended to a depth of only 20 ft., instead of 30 ft. as originally indicated, it was determined that the average value of the ground per cubic yard was one-third greater than at first supposed, and that the property could be worked by a dredge designed to dig a little over 20 ft. below the surface of the water instead of 35 ft. On account of the less cost of the dredge digging to a depth of only 24 ft. below water-level, as was finally decided upon, and the greater net returns promised in dredging operations, the attractiveness of the proposition was greatly increased.

Water in Oil Wells

By R. P. McLaughlin

The letter from Mr. W. F. Chandler, a member of the present California Legislature, published in the *Coalinga Oil Record*, and calling for suggestions from oilmen as to legislation affecting water in oil wells, is extremely important. It should be considered thoroughly and as much concerted assistance as possible given to the legislators. Having been intimately connected with the study of the subject in most of the San Joaquin fields, particularly Coalinga, I venture the following suggestions as based on experience.

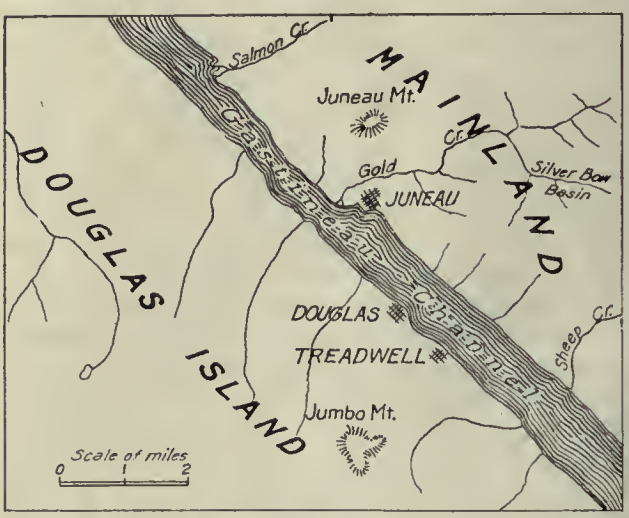
It is a self-evident proposition that all operators are desirous of shutting off the water in their wells, as they want to produce oil, and not water. Therefore, advisory methods are more likely to be of value in legislation than attempted compulsion. As the water-bearing formations are under the surface of the ground, no one person can see them better than another. However, if each operator will make a record of exactly what happened during the drilling of every well—in other words, keep an accurate log—and then will make such a record available to all other operators, it will frequently be found that some general rule can be formulated that will indicate where water is to be expected in drilling new wells. The necessity of determining where the water-bearing formations are, is also self-evident, since no one can successfully shut off water without this knowledge. Occasionally there may be cases where the position of the water can not be determined even after comparison of all the logs; but this is unusual, and every fair-minded person will admit that a guess made by the use of all available evidence, is more apt to be right than one made at random or with only the evidence furnished by one well. Logs are already kept by nearly all the California operators, so this suggestion is not new or radical. However, there is a common feeling that these logs are strictly private property, and this idea sometimes leads to misunderstandings between operators and lack of uniformity in endeavors to shut off water. Therefore, it seems not too much to require that all logs be made public property, under certain conditions, and recorded where they will be kept safely and also be open to inspection. There might be reasonable objection to making the log of a 'wild-cat' well public until the owner had finished the well and had time to reap a just reward for his extra-hazardous expenditure, in the form of securing title to surrounding lands. Consequently, a longer lapse of time after completion (possibly six months) could be allowed before requiring a log to be recorded for a well drilled a reasonable distance (as, for instance, three miles) away from other producing wells. The place for recording might be with any of a number of public officials, but probably the county recorder's office would be most convenient. If desirable, a duplicate copy might be filed with the State mineralogist.

The county water commissioner should be required to see that the record was being made in a manner that would afford the desired information. A penalty should be attached so that the commissioner would not, as at present, be powerless to enforce the keeping and filing of record. The law should also contain a provision requiring that all the logs of wells drilled in the past be recorded, as far as possible; that is, all logs that are at present in possession of the owners of wells. A penalty should also be attached to non-compliance with this clause. The requirement that logs be kept by means of daily drilling reports would not be likely to meet with opposition, as most of the operators already follow this plan in some form or other, and a little systematizing would be the only innovation. The points absolutely necessary in a useful log are as follows: (1) Name of property; (2) number of well; (3) location in section, township, and range; (4) depth to, and thickness of, each and every formation (especially noting oil, water, and tar); (5) depth at which each string of casing is landed or cut off (with note as to whether or not it was cemented, and, if so, how much cement was used and in what manner it was put in); (6) description of all tests made to see if hole was free from water; (7) depths between which each string of casing is perforated; (8) names of drillers and tool-dressers. There are probably other points necessary to legislate intelligently upon the matter, and many operators are in a position to suggest them. The matter should receive immediate attention.

Geology at Treadwell Mines—I

By Oscar H. Hershey

The Treadwell group of mines, comprising the Alaska Treadwell, Seven Hundred Foot, Alaska-Mexican, and Ready Bullion, situated on Douglas island, has been studied and described by various geologists, notably by G. M. Dawson, G. F. Becker, and A. C. Spencer. The mieroscopic character of the ore material was described by F. D. Adams,[1] and some notes have been contributed by Charles Palache.[2] Mr. Speneer's report[3] is the latest and most complete. I have reeently been engaged in a study of these mines, extending over a period of about six weeks, and have, I believe, added something to my knowledge of the conditions under which the deposits were formed. For many years, in the minds of prospectors, the Alaska Treadwell orebody has been the type par exeellenee of a large low-grade gold-quartz deposit; henee, speeifie information as to its charaeteristics will be of general interest to economie geologists. The management of



Map of Juneau District.

the mines has kindly eonsented to the publieation of this paper. I am indebted to the general superintendent, R. A. Kinzie for information and helpful discussion.

The high mountain backbone of Douglas island is eomposed of altered voleanic rocks (apparently chiefly andesites) that are commonly referred to as greenstone. These are flanked on the northeast by black carbonaceous shales, light gray quartzites and fine-grained igneous material, all striking northwest and dipping to the northeast at a high angle. This belt passes toward the northeast into a broad belt of alternating graphitie slates and sheared greenstones. The latter practically disappear at a distance of several thousand feet southwest of the mines, and nearly all the rock beyond to the shore of Gastineau channel, exeept for intrusives, is black slate. Running through the black-slate area at Treadwell there is a long band of igneous rock varying in width from 100 to 400 ft. and averaging about 200 ft., that has long been known as greenstone. Its course and dip conform to the general strueture of the country and were probably controlled by the original bedding of the sedimentary rocks. Mr. Becker[4] considered it a dike of altered gabbro of later age than that of the dikes which have been converted into ore. Mr. Speneer regarded it as a lava flow of earlier age than the ore dikes. My impression is that both are correct in part. I consider it an altered gabbro that was intruded into the sedimentary rocks before the ore dikes. Near the Ready Bullion mine, where the mass is thickest and most eoarsely crystallized, it has the extremely variable texture and general appearance charaeteristie of batholithic masses of altered gabbro. Elsewhere it is relatively fine-grained, but distinctly granular, though the augite has been largely deeomposed to chlorite and epidote, and the feldspars to museovite and caleite. As here the term 'greenstone' properly belongs only to the altered andesites of the region, I prefer to use the self-explanatory term meta-gabbro.

During the development of the slaty eleavage of the region, the borders of the dike were converted by pressure-metamorphism into chloritic sehist and slate. The band on the northeast, or hanging-wall side of the dike, rarely exeeeds 10 or 15 ft. in thickness; but that on the southwest side varies from a few feet to over 200 feet. Close to the massive rock the sehist is moderately eoarse-textured and elearly is derived from the meta-gabbro. Where the band on the foot-wall side is especially wide the texture beeomes finer and the grain straighter, at a distanee from the massive portion of the dike, until the roek is typical slate, as much so as the graphitic slate. The fact that much of the slate in the Treadwell mines is a highly altered condition of a portion of the so-called 'greenstone' has been overlooked by previous observers. The green slate is found only between the black slate and the massive meta-gabbro, and gradually changes into the latter, in one stage being a charaeteristie chloritic schist. The development of sehistosity and slaty eleavage along the borders of the dike has destroyed, or at least greatly obseured, the usual effeets of intrusive contact. Immediately adjaeent to the massive portion of the dike, the schistosity is parallel to it, but at a short distanee it takes on the prevailing strike and dip of the slaty eleavage of the region, which, however, are approximately parallel to the dike and to the original bedding. The ore-dikes have been intruded into the foot-wall band of chloritic slates and sehists, which is proof that they are younger than the meta-gabbro. G. M. Dawson[5] identified the original dike rock that has been converted into the ore of the Alaska Treadwell mine as 'granite' related genet-

[1] *Am. Geologist*, Vol. 4, 1889, pp. 88-93.

[2] Alaska: Harriman Alaska Expedition, Vol. 4, 'Geology and Paleontology,' New York, 1904, pp. 59-66.

[3] 'The Juneau Gold Belt, Alaska,' Bull. No. 287, U. S. Geol. Surv., 1909.

[4] 'Reconnaissance of the Goldfields of Southern Alaska.' Eighteenth Annual Report, U. S. Geol. Survey.

[5] 'Notes on the Ore Deposits of the Treadwell Mines, Alaska.' Read before the Royal Society of Canada, May 8, 1889.

ically to the 'granites' of the Coast Range region. Mr. Becker examined the rock after more refined methods had been introduced for study of rocks, and pronounced the original dike material a sodium-syenite, although he preferred the use of the term 'sodium-diorite' or 'albite-diorite.' Mr. Spencer preferred the latter term, and as he has expressed the latest opinion on the subject, I will adopt his term, albite-diorite.

Previous observers seem to have noted evidence of one system only of albite-diorite dikes in connection with the mines, but I believe there were two periods of albite-diorite intrusion. The product of the first I will refer to as the dark diorite and of the second as the light diorite. Most of the ore has been produced by the alteration of the latter. In the Alaska Treadwell mine where the dike is widest, the least altered portion of the light diorite has a granitic texture and resembles a typical, medium-grained, light-colored granite. As we go to the southeast along the dike, through the Seven Hundred Foot into the Alaska-Mexican mine, the less altered rock gradually changes to a semi-porphyritic, light-colored rock. It varies from a medium-grained to a coarse-grained rock having large distinct phenocrysts of white feldspar. It is easily observed in the Ready Bullion mine, where kernels of it are common within and on the borders of the orebodies on the lower levels. It is, however, best preserved in the large dikes that lie southwest of the ore-dikes. Many small dikes and lenticular bodies distributed through the slates between the large dikes are composed of the finer and medium-grained varieties of it. Locally, small needles of black hornblende are present, but it seems in general to have had very little hornblende or other ferro-magnesian minerals. Mr. Spencer describes the phenocrysts as albite-oligoclase, with mieroperthite and some pure albite in the groundmass. The accessory minerals are apatite, zircon, titanite, magnetite, and possibly rutile. Mr. Becker thought that among the ferro-magnesian silicates, augite generally predominated over hornblende, and that biotite was an original constituent. There is very little quartz present.

In the dark diorite, ferro-magnesian minerals, probably chiefly hornblende, are quite abundant. The rock is fine to medium grained, and never porphyritic. Chlorite and epidote have been largely developed, giving much of it a distinct greenish tint. Indeed, in places in the mine workings it has been classed as greenstone. It is commonly mineralized, but usually not enough to constitute ore. Its area abounds in irregular, branching, dike-like bodies of light-colored ore, suggesting that it has been intruded by the light diorite; but for a time it was a question in my mind whether these light-colored streaks did not represent portions of the dark diorite that had been modified by vein-action to resemble the ore of the light diorite. This led to the further suggestion that the two kinds of diorite represent the same intrusion, the differences noted being due to local variation in the conditions of solidification. However, much of the dark diorite seems to have become schistose before the intrusion of the light diorite. They probably bear a relation to each other similar to that between the several varieties of diorite that compose any large batholith of diorite in the Coast Range region, and the time interval between their intrusions may

Large Stope in Treadwell Mine.

have been a short one. The dark diorite occurring in the mines was intruded in two elongated masses at or near the contact between the black slate and chloritic slate. The larger body was about 1000 ft. long, but I do not know how wide, because it has been rent by the light diorite. Important remnants of it occur as a medium-grained gray crystalline in the southwestern part of the Alaska Treadwell mine, from the surface to the lower levels. The other mass of dark diorite is in the Alaska-Mexican mine and has a length of 1100 ft., and a maximum width of 130 ft. Dark diorite also enters largely into the composition of two other large albite-diorite masses lying to the southwest of the mines. A system of light albite-diorite dikes was next intruded, chiefly along two lines, of which one was mainly in or at the contact with the chloritic slate band on the foot-wall side of the meta-gabbro dike, and the other in the black slate. In the immediate vicinity of the mines, the massive meta-gabbro acted as a hanging-wall limit to the intrusion, so that while there are hundreds of small dikes and lenticular bodies in the slates on the southwest of the meta-gabbro, there are none northeast of it.

Within an area 2.6 miles long and 0.8 wide which I mapped, albite-diorite occurs in six principal masses. They are too wide relative to their length to be typical dikes, and too much elongated to be termed batholiths, but I will continue to use the term dike. The Starr dike has a known length of 5000 ft., a maximum width of outcrop of 1100 ft., and an average width of outcrop of 330 ft. However, as it outcrops on the summit and steep northeast slope of two high hills, its actual width is much less than the width of outcrop. Where the outcrop is 1100 ft. wide, the dike is probably 900 ft. wide; it is the widest body of albite-diorite in the vicinity of Treadwell. Both the dark and light diorite enter into its composition, the latter greatly predominating.

The Bear's Nest dike has a length of 3300 ft., a maximum width of outcrop of 600, and an average width of outcrop of 260, though its true width is much less. Both kinds of diorite enter into its composition. The Starr and Bear's Nest dikes and two others back of Douglas City constitute the southwest line of large dikes; this is in the black-slate area. The Treadwell-Mexican dike includes all the orebodies of the Alaska Treadwell, Seven Hundred Foot, and Alaska-Mexican mines, except a small one near the southeast end of the last mine. At the surface it has a known length of 3800 ft., a maximum width of 400 ft., and an average width of 85 ft. It consists of three enlarged parts, separated by long, narrow portions. The most northwesterly enlargement is divided by long overlapping tongues of chloritic slate into the so-called 'South vein' and 'North vein.' The first was intruded into the dark diorite, mainly in a body about 600 ft. long and 300 ft. in maximum width. Small arms of the light diorite have intruded into the dark diorite, so that little of it is entirely free from them. Where these arms are numerous they have carried enough gold into the rock to constitute profitable ore. There are also a few places where the dark diorite itself is sufficiently mineralized to be ore, but generally the area of the dark diorite on each level is not stoped. Near the surface practically all of the light diorite is ore. The remainder of the great northwestern enlargement is about 1800 ft. long and 150 ft. in maximum width, of which nearly all, near the surface, has been removed in the Glory Hole and Seven Hundred Foot pit, except a considerable body at the extreme northwestern end which was found of too low a grade. This portion of the dike has been intruded entirely in the band of chloritic slate and schist which was developed on the southwest side of the meta-gabbro dike, and the isolated horses and projecting splinters are of chloritic slate, except that a little massive meta-gabbro appears in a few horses near the hanging wall on the 110-ft. level. The larger structural features of the northwestern enlargement are remarkably persistent down to the 1450-ft. level, the deepest fully-developed level in the Alaska Treadwell mine. The chloritic slate horses vary a little in size and position, and in the South vein the relative proportions between the dark and light diorite vary considerably from level to level, but the general structural relations remain unchanged, and the size of the enlargement, as a whole, does not greatly differ. Next, there is at the surface an interval of 1000 ft. which is known from underground work to be practically a continuous 'pinch.' However, it becomes shorter with depth and finally changes into a body of workable ore which is separated from the adjacent swells by short pinches. At the most northwesterly Alaska-Mexican pit, there was an enlargement probably 200 ft. long and 50 ft. in maximum width, most of which, near the surface, was removed in the pit. It enlarges with depth into what may be called the main Mexican swell, which, on the 1100-ft. level is over 700 ft. long and has a maximum width of 100 ft. Near the surface, after another pinch, about 400 ft. in length, the dike opens into the eastern Mexican swell, which was principally mined in two surface pits and was found to be 500 ft. long and probably 75 ft. in maximum width. This swell was due to the erratic behavior, near the surface, of a mass of dark diorite into which it was partly intruded, and it has not been found below the 330-ft. level. Near the southeastern end of the Alaska-Mexican mine there is a sharp bend to the east in the meta-gabbro dike. The slaty cleavage bends also, but not so much as the dike, and since the ore follows the slaty cleavage, it is carried off into the black slates, and the eastern swell is almost entirely separated from the chloritic slate. Back of the eastern swell there is a smaller ore-bearing dike in the black slate. These are the only places in the mine where commercial ore occurs in dikes having black slate on both walls. The Ready Bullion dike at its outcrop had a length of 560 ft., a maximum width of 60 ft., and average width of 40 ft. With depth it shows a remarkable increase in width accompanied by a slight decrease in length, so that it is practically a large triangular

pipe rather than a dike. On the 1350-ft. level it is probably 500 ft. long and 290 ft. in maximum width. It comes to a rather sharp point at the southeast, but terminates northwesterly by fingering out in the chloritic slate. Its position and pitch are evidently controlled by a wedge of chloritic slate into which it has been intruded. This wedge, which is a few feet wide at one end and over 200 ft. wide on the lower levels, at the other end, may be related to an abnormal swell in the meta-gabbro dike a short distance southeast of the mine.

If the two large southerly dikes be considered as one line of dike and the ore-dikes in the mines as another, the swells in one line will be found opposite the pinches and intervals in the other line. There is a very simple explanation of this. These albite-diorite dikes did not make their way up through the strata by 'overhand stoping,' as it is supposed that many granitic batholiths have, nor did they rise freely in open fissures as many ordinary dikes have. The melted rock forced its way up through the slates under great pressure, rending them and wedging them apart. In minor detail, the contacts are splintery, and tongues of slate project far into the dikes; but looked at from a broader standpoint, the slates are found to curve around the swells in the dikes. Nearly everywhere the strike and dip of the slates are approximately parallel to the borders of the dikes. The albite-diorite had to raise the slates above it, but there was a limit to the distance to which it could force them. The larger dikes divided this space between them. Thus when one dike appropriated practically the entire space available, there was opposite it a pinch or interval in the other line of dikes. This idea has a practical bearing on the search for ore in virgin ground. In the belt of black slate between the Alaska Treadwell swell and the Bear's Nest dike there is a long band, generally 25 or 30 ft. wide at the surface, of a white to dull-buff rock that resembles a quartzite of heavy-bedded structure and conforms strictly to the slaty cleavage. However, at two places there are traces of feldspar crystals in it, and in the absence of a petrographical investigation I consider it probably an aplite dike. A short distance south of the Seven Hundred Foot pit there is a small lenticular area of a greenish, rather coarse-grained, massive crystalline rock of the mineralogical composition of diorite, but with the general appearance characteristic of meta-gabbros. It has a fresher appearance than the meta-gabbro on the northeastern side of the mines, and contains many small inclusions of porphyritic albite-diorite like that of the small dikes so abundant in its vicinity. I have never seen any albite-diorite inclusions in the meta-gabbro dike on the hanging-wall side of the mine, though A. C. Spencer states that G. F. Becker found one in it. Perhaps it came from this other, and presumably younger, meta-gabbro.

At various places in the Alaska Treadwell, Seven Hundred Foot, and Alaska-Mexican mines there are basalt dikes that vary from a fraction of an inch to 4 ft. in thickness, 6 and 8 in. being a common thickness. They have a general course nearly north-south, and stand vertical or dip steeply toward the west, or, less often, toward the east. A minette dike 2 to 3 ft. thick has been cut on the Alaska-Mexican 1100-ft. level. G. F. Becker was inclined to see a genetic connection between the largest basalt dike (the only one then known) and the ore, but I agree with A. C. Spencer that the basalt dikes are younger than the ore and have nothing to do with its origin. Not all of the Treadwell-Mexican and Ready Bullion dikes is commercial ore. The causes that have controlled the position and shape of the ore-shoots within the dikes and their variation from level to level are obscure, but I make here a few suggestions. A. C. Spencer, in the report cited above, has given a very minute description of the ore and discussed its origin at length; the necessarily limited nature of this paper will not permit of a similar treatment of the subject. Briefly stated, the ore consists of two parts, one of which is dike rock in which secondary albite has been developed (largely by replacing the interstitial microperthite, though some was deposited by vein-waters from material added), and which is impregnated with calcite and pyrite, only a little silica penetrating where there were no open fissures. The dike was in part shattered and then filled by reticulating veinlets of calcite and quartz, which also carry sulphides. Mr. Becker thinks the disseminated pyrite has probably been derived by the action of sulphydric acid on the ferromagnesian minerals and that the bunched pyrite which is accompanied by much calcite has entered the rock in a state of solution. The secondary minerals, as determined by Mr. Spencer, are albite, uralite, green mica, epidote, chlorite, zoisite, calcite, quartz, sericite, rutile, pyrite, pyrrhotite, with molybdenite, galena, sphalerite, chalcopyrite, and arsenopyrite occurring exceptionally. Some of the magnetite may also be secondary. There is probably some siderite also. The quartz and calcite veinlets, which constitute nearly one-fifth of the mass of the ore, occur chiefly in two sets of fractures, one of which is approximately parallel to the structure of the enclosing slates and in places prolongs the veins beyond the ends of the dikes as narrow quartz-veins which are said to exceed the average tenor of the ore, but are too small to mine. The most prominent system dips toward the foot-wall. In general, the best ore is that which contains the greatest number of quartz and calcite veinlets, though there are places where good ore has been formed without them, and other places where rock abounding in veinlets lacks the usual quantity of pyrite and is too low in grade to work; for the gold is apparently mainly associated with pyrite, though there are a few places where rock well supplied with pyrite yields only a very small amount of gold. The gold is generally very fine, but some has been seen in coarsely crystalline calcite, and Mr. Adams observed some mechanically enclosed in crystals of pyrite. Mr. Spencer thinks the 60 to 75% that is recovered by amalgamation may be partly in the non-metallic minerals, though the non-amalgamat-

ing portion undoubtedly occurs with the pyrite. The concentrate, chiefly pyrite, with some pyrrhotite and magnetite, averages 2% of the ore. The pyrite in places extends several feet into the slate walls and horses, but such material generally is of very low grade, though some of it is mined and known as 'brown ore.' It is evident that the formation of the ore was dependent on the fracturing of the dike. This was the result of pressure originating beyond the dike. The so-called ore-shoots consist of those portions of the dike that yielded most readily to the compressive stress, became most permeable, and hence were most strongly acted on by the vein-forming waters. The distribution of the gold is very irregular. During the progress of development samples are taken at every round. They yield by assay at the rate of from a trace to over $20 per ton. Upon being averaged for certain sections of drifts they vary from less than $1 to over $10 per ton. In the following table, No. 1 represents 210 ft. of a drift on the 1450-ft. level of the Alaska Treadwell mine; No. 2, 160 ft. on the 1210-ft. level of the Alaska-Mexican mine; and No. 3, 150 ft. on the 1350-ft. level of the Ready Bullion mine. They were selected at random and are given to show how the gold content varies rapidly in short distances within the orebodies. The figures may interest the prospector who has a large low-grade mass of gold ore with a few assays to indicate value.

No. 1.	No. 2.	No. 3.
$4.55	$0.65	$7.73
0.41	3.51	6.70
2.68	11.98	3.10
8.27	9.71	2.30
3.51	12.81	3.87
1.86	6.20	4.13
2.48	3.30	13.00
1.65	6.60	7.23
1.65	1.23	18.00
1.03	2.27	12.00
1.65	1.65	10.34
4.96	2.89	7.23
0.62	3.72	8.20
0.41	0.45	5.68
1.65	1.23	4.64
3.51	1.03	1.27
1.03	Trace	1.54
2.89	2.68	7.23
4.14	0.41	6.70
1.44	5.37	3.60
0.41	Trace	5.68
1.03	0.82	1.54
1.23	0.62	3.10
5.78	0.82	5.18
4.96	0.82	1.27
0.62	6.20	7.73
3.72	5.99	
4.55	2.07	Average.. $6.11
2.07	11.57	
0.82		
3.72	Average.. $3.67	
3.30		
0.82		
4.14		
3.72		
2.07		
0.82		
1.03		
Average $2.50		

By studying the averaged assays, one can get a very clear conception of the total gold content of the dikes on the different levels. There is a peculiar horizontal banding in the gold content of the dikes in all the mines. Thus in the Ready Bullion mine there appears to have been a rather steady decrease in the gold content from the surface to the 600-ft. level; from there, an increase to the 1350-ft. level, below which the pendulum has swung temporarily in the other direction. This variation is not directly related to the maximum thickness or size of cross-section of the dike; but, of course, it influences the size of the ore-shoot on different levels; for, where the total gold content is low, a relatively small amount of the dike is commercial ore, and on such a level as the 1350-ft., where the total gold content is the highest in the mine, nearly all of the dike is workable ore. I have been unable to determine that the ore-shoot is closely connected with any structural feature. It seems to wander about in the dike. The only point it never misses is the foot-wall side a little southeast of the centre; the part of the dike it most avoids is the extreme northwest. In the South vein of the Alaska Treadwell mine, the gold content was relatively high from the surface to the 220-ft. level; thence decreased to the 440-ft. level, thence increased irregularly to the 1450-ft. level, the present lowest fully-developed level and by far the best in the mine. This variation seems to have been more or less directly related to the variability of maximum thickness of the light diorite, the highest average gold content being found on those levels having the widest body of light diorite. The South vein contains one large ore-shoot which, where the body of light diorite is very wide, occupies nearly the whole of it, but where the light diorite is narrow, it is inclined to wander about a bit. However, as it cannot get out of the light diorite body, it must have the same general pitch. In the North vein, the gold content seems to have been rather high, down to the 220-ft. level. Thence it decreased to the 330-ft. level, after which there was no great change to the 750-ft. level. But the 900-ft. level was so poor that very little of it was ore, although the South vein on this level was good. The North vein quickly picked up again below the 900-ft. level, and on the 1050-ft. level its average assays are better than those of the South vein. Thence to the 1450-ft. level, the North vein maintains a good gold content. The principal shoot of ore in this vein is related to the widest part of this portion of the dike. It varies greatly in length, width, and value, but is absent from only one level. There is a considerable body of worthless rock at the northwest end of the North vein on all levels but one. Its notable feature is that while it has considerable quartz and calcite in veinlets, it is relatively low in pyrite.

Selenium was produced as a by-product in copper refining by one company in the United States in 1909. It sold for $3.43 per pound, but if large quantities of the element were needed it could be profitably sold at a much lower price.

Discussion

Readers of the MINING AND SCIENTIFIC PRESS are invited to use this department for the discussion of technical and other matters pertaining to mining and metallurgy. The Editor welcomes the expression of views contrary to his own, believing that careful criticism is more valuable than casual compliment. Insertion of any contribution is determined by its probable interest to the readers of this journal.

Trans-Siberian Travel

The Editor:

Sir—Traveling on the Trans-Siberian railway is much more comfortable east of Irkutsk. The division of the line between Irkutsk and Vladivostok is known as the Chinese Eastern railway, and the branch from Nikolsk-Ussuri north to Habarovsk on the Amur river is known as the Ussuri railway. This accounts for the fact that a through ticket from Vladivostok to London is issued under the name of the Ussuri railway. The hotel opposite the railway station in Vladivostok is known as the Grand, and it is a grand failure as a hotel. I have never stayed at the others, but if I may be permitted to drop into early Victorian English for a minute, one who stays at one of the hotels in Vladivostok wishes one had

Locomotive on Chinese Eastern Railroad.

stayed at any one of the others. Opinions vary as to whether the traveler starting from Vladivostok should take the International express of the Wagon-Lits company or the Government express. The first is better fitted up, but is lacking in politeness. The second is lacking in the matter of English language and private lavatories, but has better food and courteous attendants. It must be said that the Wagon-Lits company, which in western Europe supplies its patrons with fifth-class imitation of American Pullman accommodation, at millionaire prices, affords much better accommodations in the Russian Empire. The Wagon-Lits company operates the best train it possesses anywhere, between Vladivostok and Irkutsk over the line of the Chinese Eastern railway. The accommodation grows progressively worse as you approach Paris.

The expenses of a man who travels this route second-class on the Trans-Siberian and American railways, and first-class on intermediate steamers will be about three-quarters of that below. In first-class travel by the Trans-Siberian, a traveler taking the Government express is nearly sure to have a compartment to himself by paying for one berth. This is the reason the price in the list below is compared with that of a compartment in crossing the United States.

The following estimate of expenses, London to London, around the world, by way of Trans-Siberian, may be of use. The items include meals, sleeper, tips, and hotel arrivals and departures:

	Cost.	Time, days.
London-New York	$ 150	6
New York-Yokohama (via San Francisco):		
Fare (including berth and meals on steamer)	281	22
Pullman compartment	54	
Meals and extras	60	
Yokohama-Vladivostok (via Tsuruga)	35	3
Vladivostok-London (via Moscow)		12
Fare includes sleeper	215	
Meals and extras	75	
100 lb. excess baggage (100 lb. free)	25	
Extra expense and time for making connections	105	7
Total	$1000	50

The distance traveled by rail and the Channel

A Slight Disarrangement of Traffic in Manchuria.

passage from Vladivostok to London is about 8300 miles, and assuming that from New York to San Francisco at 3000 miles, the comparison of rates per mile for first-class transportation figures out at 3c. for the Siberian route, as against 4½c. for the United States. As the accommodation in the United States is proportionately better, however, the traveler gets his money's worth in both cases.

C. W. PURINGTON.

London, January 30.

Nitre in Crucible Assay

The Editor:

Sir—On page 93 of Fulton's 'Manual of Assaying' the author says, "Where large quantities of nitre are employed, the oxidizing action in the crucible is greatly increased, and it is probable that thereby losses in silver are apt to occur by the slagging of the silver. There is no accumulative evidence on this subject, but many assayers hold this opinion."

For some time I have recorded silver values by crucible with nitre, and by scorification. As these were umpire determinations, each result is the av-

erage of at least six fusions. With few exceptions, the crucible charges were ½ A. T. and the scorification $^1/_{10}$ A. T. In 85 samples, of an average value of 167 oz. Ag, the scorification averaged 0.918 oz. or 0.55% more than the crucible. The nitre varied from 6 to 25 gm. Only occasionally were the results higher by crucible, and this occurred as often with nitre high as with it low. The assay of six samples of an average value of 1103 oz. reversed this, as the crucible assay gave 4.45 oz. or 0.4% more than the scorification. On these high-grade ores ¼ A. T. crucible charge and $^1/_{20}$ A. T. scorification, gave the difference the same way. In this case the low scorification result is probably due to volatilization when rich ore floats and is wasting on the lead bath.

E. C. Woodward.

Colorado Springs, February 9.

Progressive Mill Practice

The Editor:

Sir—In your issue of January 21, under the heading of 'Progressive Mill Practice,' you suggest that California millmen be more progressive and alert to the possibilities developed by others working along the same lines, referring more particularly to the practice in South Africa of equipping the stamp-mill mortars with coarse screens and thereby increasing the capacity of the plant to about double, without a proportionate increase of power consumption.

If you will refer to the article by myself in the *Mining and Scientific Press* of April 30, 1910, you will see that at least one California millman is not so slow in the recognition of a good thing, and was more of an originator than imitator of the practice which is being so almost universally adopted in South Africa.

"At Tuolumne Mr. Elmer is crushing through a four-mesh battery screen. A short copper plate is interposed between the screen and the pebble-mill and the total product, amounting to upward of about 100 tons in 24 hours from 10 stamps, is then passed directly to an 8-ft. Hardinge mill into which is fed at regular intervals of half an hour, a spoonful of quicksilver; the regulation wooden mustard spoon being used. From the pebble-mill the pulp is run through a box distributer over a second set of amalgamating plates, where additional free gold or amalgam produced within the mill is caught." (A plan of the flow-sheet then follows.)

This innovation by Mr. Elmer was based upon the use of coarse screens on the stamp batteries of the Creston-Colorado mine at Minas Prietas, Mexico. Coarse screens were adopted there, to my certain knowledge, as far back as 1897, and have been continuously used at that mine, with the exception, however, that they are now using screens of practically ¾-in. mesh, the discharge going to re-grinding machines.

Though admitting that the California millman is practically wedded to his stamp, at the same time full credit must be given him for setting a style when he furnished his lady with a new dress which does not 'hobble' her activities. The introduction of coarse crushing by stamps was the cause of my being such a staunch advocate of the oft-repeated statement that the stamp should not be considered as a fine grinding machine, for as such it is wasteful of energy.

Our friends in South Africa deserve all the credit they are receiving for what to them is original work, but at the same time we should give credit to any young worker who makes an advance in methods, such as Mr. Elmer did, in a field of conservative stamp-mill practice like those found in many of our Western mining camps. For myself, I believe that the stamp has seen its best life; I realized this in 1897. Then why does it exist? For the same reason that a candle exists in these days of electric lights. Local conditions govern its use.

H. W. Hardinge.

New York, February 1.

A B C of Empire Drilling

The Editor:

Sir—The articles by Messrs. Hutchins and Stines appearing in your issues of January 7 and 28 on the 'A B C of Empire Drilling' were of great interest to me, and the troubles which R. B. McGinnis relates in his letter published in your issue of January 28, are due, in my estimation, to two causes, namely, his failure to constantly rotate the casing and his neglecting to start the hole perfectly plumb and with the top ground firmly packed.

I have used the Empire drill in all my work for the last two years, in some instances in ground similar to that described by Mr. McGinnis, and have not had such difficulties. I find that it is most essential to rotate the casing continually, as it makes both the sinking and pulling of it much easier, especially when one recalls the many difficulties encountered in steam drilling when driving and pulling the casing. I can sympathize with Mr. McGinnis when it comes to the troubles with the cutting shoes, as I have had some difficulty with them. However, this was about the only difficulty that I had, and I soon learned to draw the temper of the shoe just a little when drilling in hard ground, as these shoes are very hard when received from the manufacturer, and while they work well in this condition in medium gravel, for hard gravel and large boulders the temper should be slightly drawn. The cutting shoe is about the only part of the drill that ever wears, and a few extras should always be on hand, as suggested by Mr. McGinnis.

In some recent drilling in eastern Canada I put down 38 holes ranging from 38 to 73 ft. deep, averaging 36 ft. drilled per day at a cost of 41.63c. per foot, and in this entire work I used only two cutting shoes, which were occasionally ground down. This is about double the amount of work at one-half the cost of any steam drilling that I have ever done. I hope you will publish more of these articles on drilling with the Empire, as they deal with the whole process in so much detail as to be interesting.

Fred J. Siegel.

New York, February 8.

Concentrates

Most of these are in reply to questions received by mail. Our readers are invited to ask questions and give information dealing with the practice of mining, milling, and smelting.

Patents are obtainable upon any combination of old elements that produces a new or better result. On the contrary, if each performs its office independently the device is not patentable. A knife having a cutting blade, a file, and a corkscrew or other implements in the same handle is not patentable. Each instrument acts alone and not in conjunction with another to produce a new result.

A satisfactory powder for flash-lights to be used in photography may be made by mixing 20 parts by weight of magnesium, 20 parts permanganate of potassium, and 10 parts barium peroxide, to be ignited by a spark or small cap. Powder must be used with judgment. In underground work where everything is black or dark colored, a much larger quantity is required than in a stope where the surrounding walls are dazzling white quartz.

Mineral claims may be located within a National Forest (forest reserve) as readily as on any portion of the public domain outside of a reserve. There are no special regulations governing the location of a mining claim within a National Forest. The forest officers may investigate in order to determine the good faith of the locator and whether a valid discovery has been made, but this does not alter the prevailing law.

Compressed-air sewage ejectors, according to *Ideal Power*, were put in a few years ago in Guildford, England, to raise sewage from low-lying areas and permit it to discharge into the basins at the sewage-treatment works. There are eight of these ejectors in use with capacities ranging from 50 to 1200 gal. per min. The compressed air for operating them is furnished by a power station situated adjacent to the town refuse-destructor. The waste heat from this destructor generates sufficient steam to drive the air-compressors which raise the sewage.

Wool, cotton, silk, and other fibres all have more or less rough surfaces, and when spun into a thread this roughness aids in holding the mass together. While its fibres are almost infinitely finer than these, asbestos has an absolutely smooth, glossy surface, and for a long time this characteristic prevented the successful spinning of what was otherwise an ideal fibre. The overcoming of this difficulty has made possible the spinning of a fairly strong thread weighing approximately an ounce per hundred yards of length.

Fertilizers for agricultural purposes are made from various substances, the most important constituents being potash, nitrogen, and phosphoric acid in such a form that they can be readily absorbed by the plant roots. Phosphoric acid is obtained by treating phosphate rock with sulphuric acid to convert the insoluble rock into the so-called 'superphosphates,' the soluble form. As fertilizers must be reasonably cheap to be of use, deposits of phosphate rock must be adjacent to cheap transportation to be economically available, otherwise the cost of handling will be too great.

Antimony is not produced in the United States except as a by-product, according to F. L. Hess, of the U. S. Geological Survey. A considerable quantity was recovered from various wastes, such as old type and babbitt metal, and some antimonial lead was produced as a by-product at smelters and refineries. The imports of antimony were large, the total value of the metal and ore entered for consumption during the year being $774,719. In all, 1617 short tons of antimonial lead, valued at $252,252; 743 short tons of antimony from foreign ore smelted in this country, valued at $115,908; and 1556 short tons of antimony recovered from old alloys, valued at $242,736, were produced here in 1909.

Cement floors, particularly in office buildings or warehouses, which do not have the advantage of obtaining the necessary moisture from the atmosphere such as outside floors and sidewalks on which the dew falls at night, if not properly protected and kept damp, become prematurely dry and are therefore more or less porous and weak, causing easy abrasion under foot traffic. Care should be exercised in keeping such floors damp by covering with wet sand, wet hay, or straw, for a week or more, until the floor has properly hardened. If this has not been done and the floors are found to dust under foot traffic, the following remedy, devised by Albert Moyer, will be found easy and effective. Wash the floor thoroughly with clean water, scrubbing with a stiff broom or scrubbing brush, removing all dirt and loose particles. Allow the surface to dry and apply a solution of one part water-glass (sodium silicate) of 40° Baumé, and three to four parts of water, the proportion of water depending upon the porosity of the concrete. The denser the concrete the weaker the solution required. Stir well, and apply this mixture with a brush (a large white-wash brush with long handle will be found the most economical). Do not mix a greater quantity than can be used in an hour. If this solution is sufficiently thin, it will penetrate the pores of the concrete. Allow the concrete surface thus treated to dry. As soon as dry, wash off with clean water, using a mop. Again allow the surface to dry and apply the solution as before. Allow to dry and again wash off with clean water, using a mop. As soon as the surface is again dry, apply the solution as before. If the third coat does not flush to the surface apply another coat as above. The sodium silicate which remains on the surface, not having come in contact with the other alkalies in the concrete, is readily soluble in water and can therefore be easily washed off, thus evening up the color and texture of the floor. That which has penetrated into the pores, having come in contact with the other alkalies in the concrete, has formed into an insoluble and hard material, hardening the surface, preventing dusting, and adding materially to the wearing value of the floor.

Special Correspondence

LONDON

Concentrating Tin Tailing in Cornwall.—Flotation Processes at Mount Lyell.—Treating Stannite Ores.—The Ferreira Deep.

One of the most interesting ventures in Cornwall at the present time is the exploitation of old tailing heaps at the Carn Brea & Tincroft Mines at Camborne. A company was formed a year ago, called Cornwall Tailings Limited, for the purpose of acquiring and re-treating these dumps. The financial supporters of the scheme form a group well known in connection with Australian mining, the names including Baillieu, Robinson, Clark, and Lempriere. Arthur Richards is engineer and managing director, and it is due to his energy that the project was started. Most of the tailing at the Camborne mines is washed down the Red river. Owing to lack of water much of the tailing at Carn Brea & Tincroft could not be so removed, and it has been stacked in one compact dump. This was carefully sampled by boring and was estimated to contain over one million tons of material. The chemical assay showed an average content of 17 lb. metallic tin per ton. A concentrating plant was erected, and during the six months ended December 31, 24,000 tons of material was treated, yielding 93 tons of black tin which sold for £6901. This recovery is 8.68 lb. black tin per ton, which is only 30% of the content according to chemical assay. The price received per ton was 5s. 9d. and the cost including purchase was 3s. 1½d. per ton. The total profit was £3144. Additional machinery is now being erected, and by next month the capacity will have been increased to 200 tons per day. By the end of the present year the plant will have been further extended so as to treat 400 tons per day. The figures for recovery are low, but slime tin is difficult to treat. It is expected that the extraction will be gradually increased until 50 to 60% is recovered. Many people may think 17 lb. of metallic tin a high figure for a dump, but it must be remembered that much of the material was stacked 30 to 60 years ago, when the content of the ore mined was four or five times as great as that of the ore at present being mined. This constitutes one of the most interesting ventures in Cornwall at the present day, and the satisfactory results so far obtained are a matter for congratulation.

The application of flotation processes in the Mount Lyell copper district, Tasmania, is watched with great interest, and the prospects of the Elmore process at the Mount Lyell Comstock are keenly followed. The Comstock company was originally floated in England in 1898 to acquire the property from an Australian company and for years the work has been unsuccessful. The company was reconstructed in 1907, and the management was placed with Alexander Hill & Stewart. Hitherto the ore discovered has been low grade and highly silicious, and treatment at a profit has been impossible. Recent reports show that development and prospecting work has been attended with satisfactory results. It is now estimated that 300,000 tons, averaging 2.8% copper is available in existing levels, and that another 300,000 tons varying from 2.8 to 4.5% copper will be developed in other parts. In addition to these resources there are strong indications of the ore continuing laterally and in depth. The outlook is encouraging, seeing that the recently developed ore is of a higher grade than that in the upper levels. Experiments with the Elmore process show that freshly broken ore from the lower levels is amenable to this treatment, but it is not so certain that the ore that has been exposed for a long time to the atmosphere in the upper levels will give good results. Some of the sulphide is partly oxidized, thus becoming untreatable, and in other ore the gangue is so much decomposed as to make a clinging slime. The engineers recommend the provision of an Elmore plant to treat 250 tons per day. To provide the necessary funds the directors intend to place before shareholders at an early date a proposition involving the issue of preference shares.

Nearly three years ago the Comstock company became interested in the Oonah mines, near Zeehan, Tasmania. In earlier days this property had yielded silver-lead ores, but more recently lodes containing stannite, that is, sulphide of tin and copper, have been worked. The metallurgical problem was an extremely difficult one. The process eventually recommended by Alexander Hill & Stewart was smelting in a blast-furnace and producing a copper-silver matte and an argentiferous copper-tin alloy, with the subsequent refining of the matte in a reverberatory. Pot-roasting was then adopted as a preliminary to the blast-furnace treatment. The recent news has been most disappointing, for the sintering operations commenced in October soon proved to be unsatisfactory. In December it was found that the rate of operation of the process in the pots was not nearly sufficient to keep up with the blast-furnace. Operations were therefore suspended. Unfortunately the capital of the company is exhausted, and the future is uncertain.

The safety of the workings on the Rand are attracting attention in England and the recent report by Ferreira Deep is taken as a good sample of what may be expected in the future. That the movements of the hanging wall have not had more serious results is the only wonder. A year or more ago it was known that the pillars left behind were not sufficient to prevent movements of the superincumbent strata. At first attempts were made to strengthen the supports, especially near the main haulage-ways, by packing with waste, but, as this was not sufficient to meet the case, it was found desirable to resort to close timbering. Subsequently, in June last, in order to give permanent support, experiments were made with sand-filling. Up to the end of September last 87,587 tons of tailing had been deposited in the mine in this way. Under the circumstances above detailed it was natural that the mining operations were interfered with considerably and the costs increased. The amount of ore raised during the year ended September 30 was 53,910 tons less than the previous year. The development was curtailed, being not much more than was required to keep pace with the extraction of ore. The cost of treatment increased by 2s. 8½d. per ton from 16s. 2½d. to 18s. 11d., though, as the yield per ton increased 2s. 7d. per ton the actual decrease of profit per ton was only 1½d. Owing to this and to the smaller tonnage crushed the total profit was less by £80,941. The report by the manager, W. E. C. Mitchell, shows that during the year under review 454,571 tons of ore was raised and after the removal of 20% waste, 364,147 tons went to the mill. The content of the mill-feed was 11.7 dwt. and the recovery by amalgamation was 141,206 oz. or 7.75 dwt. per ton. In the cyanide plant 364,487 tons yielded 66,874 oz. or 3.67 dwt. per ton, and the residue assayed 0.5 dwt. The total yield was 208,080 oz., worth £873,337, and the working cost was £344,400, leaving a profit of £528,937. The yield per ton milled was 48s., the cost 18s. 11d., and the profit 29s. 1d. The amount distributed as dividend was £500,500, being at the rate of 55 per cent.

Ferreira Deep.

TORONTO, CANADA

Investments Made in Porcupine Claims.—Development News. — Cobalt Output.—Iron and Steel Bounties.— Brazeau Coalfields.

F. A. Heinze has purchased the Foster claims, adjoining the Dome mine, and has engaged R. Alvin Weiss to take charge of development. It is understood that the price paid was approximately $300,000. This investment is regarded as indicating a growing interest in the camp on the part of American capitalists. Of equal, or perhaps greater, importance is the organization at London, under the auspices of Bewick, Moreing & Co., of the Northern Ontario Exploration Co., capitalized at £400,000, and embracing among its promoters the Earl of Errol, Sir William Bell, David Richards, and John Barry. It is announced that Alex. Moreing, David Richards, and a staff of engineers will shortly arrive in Porcupine to investigate properties with the view of purchasing, and brokers and claim-owners are eagerly awaiting their arrival. Some investors who have recently visited Porcupine are of the opinion that the prices asked for undeveloped claims are unreasonable, and that unless owners are willing to accept lower terms with small payments of cash down, practical mining men will not buy. A number of claim-holders have had little or no mining experience, and the announcement of a good find in proximity to their holdings leads them at once to put their price at extravagant figures. The Pearl Lake Gold Mines camp is complete, having accommodations for 45 men. Sinking is to be commenced at once on a lode of free-milling ore. The Scottish Ontario has decided to sink another shaft on the vein north of the main shaft. There is one Nissen stamp in operation at the Vipond, where a 10-stamp mill is soon to be erected. The main vein, where opened at 100-ft. depth, has a width of 7 ft. The Leyson claims, in North Whitney, have been sold by A. J. Young, of North Bay, to Major Vane. The Mancha-Newman syndicate, holding 13 claims in Deloro, has 20 men at work stripping the veins. The Flynn Bros., of New York, the principal owners of the Vipond, have taken over the Hughes claim, half a mile north of Porcupine lake, at $300,000. Stripping there is being done under the direction of Thomas J. Flynn, and a shaft is to be sunk. The Porcupine Exploration Co. has acquired the three Thompson claims in Whitney, adjoining those of the Timmins syndicate. Among prominent mining men recently in Porcupine were A. C. Conway and Charles Connolly, of Colorado, and E. C. Aman, of London.

There was recently a falling off in the ore-production of Cobalt, owing to an accident to the hydraulic power machinery at Ragged Chute. Some of the mines have had their power cut off and others have been working intermittently. The Temiskaming is in good ore in the winze on No. 3 vein 37 ft. below the 500-ft. level. This is the deepest working in the camp. The main shaft of the Beaver is being put down to 400-ft. depth. A station was cut at 350 ft., and a cross-cut toward the main vein has been started. A rich ore-shoot, 11 to 16 in. wide, has been opened at the 300-ft. level on vein No. 5, and this has been followed 30 ft. A favorable statement was presented at the annual meeting of the McKinley-Darragh, January 31, showing a total silver recovery for the year, valued at $1,426,856, and net profits of $983,043. The ore reserves were estimated at $6,041,500 tons. The net profit per ounce is 37c., as against 28.08c. the previous year. The annual meeting of the Hargraves company took place February 8. The statement there made showed receipts of $71,148, and expenditures of $58,800. The cash balance on hand was $48,620, and the value of ore in stock and at the smelters was $37,612. The production during the year was 625 tons of ore of a gross value of $117,400.

There is some agitation favoring the renewal of the iron and steel bounties, particularly the bounty on steel rods, which expires in June next, the others having already terminated. An impetus has been given to the movement by the proposed reciprocity agreement, the steel interests urging that their position will be adversely affected thereby. The president and manager of the Dominion Steel Corporation have been in Ottawa in conference with the Government. Though no official announcement is made, it is anticipated that their mission will have a successful issue, as in view of the struggle over the reciprocity measure, the Government naturally wishes to conciliate as many interests as possible. Important developments this year in the Western coal mining industry is anticipated, owing to the construction of a railroad into the Brazeau coalfields. This area, which comprises about 50,000 acres, is situated at the head-waters of the Brazeau, McLeod, and Pembina rivers, about 130 miles west of Edmonton, and about 50 miles south of the main line of the Grand Trunk Pacific railway. A branch line is under construction to connect the coalfields with the main line, and it is expected that before the end of the season the work will be accomplished. The coal is stated to compare favorably with Pennsylvania coal, and occurs in veins of uniform depth and extent. Three veins thus far discovered have a depth of 27 ft., with about 10 in. of slate interspaced as layers. As there is a large area to the east to be supplied, the mines will have a ready market for any possible output, and they will probably be a genuine rival to the Crows Nest of southern Alberta and British Columbia.

NICARAGUA, CENTRAL AMERICA

A Commission Investigating Concessions to Foreigners.— The Mining Exploration Co. and Oroya.—Iniquitous Provisions.

David Arellano, a lawyer of Nicaragua, who was educated at Fordham University, and David Moffat, formerly United States Consul at Bluefields, are members of a commission appointed by the Nicaraguan Government to investigate concessions made to foreigners. Under the Zelaya régimé it is claimed many concessions were granted in the names of dummies, in the interest of Zelaya and his henchmen. Among these are banana concessions to the Bluefields Steamship Co.; others were for control of navigation. Two mining concessions which were acquired after Zelaya was deposed were by the Mining Exploration Co., controlled by Minor Keith and A. Chester Beatty, and by the Oroya Exploration Co., the latter known as the Irias concession. Whether the latter two will be deemed valid seems questionable, as both contain provisions which would tend to stifle the mining industry in that country. The Irias concession gives exclusive right for 10 years to locate mining claims, a total area of 20 square kilometres, after which the concession holds for 50 years, giving the owners free import of mining supplies during that period, regardless of any changes that in the future may be enacted in the laws of the country. The concession bought by the Mining Exploration Co. gives control over all minerals, ores, coal, oil, and precious stones that may be found in the valleys of the Siuma and Matis rivers, and that of Bambana to its junction with the Bana Cruz, and all tributaries to their sources, the boundaries being 2½ kilometres on each side of each stream and tributaries. The latter company had this concession under option two years ago, and turned it down. According to information received, the purchase price was greatly reduced from the figure at which it was originally offered, and the company is said to be depending on its ability to influence the present Nicaraguan Government to enable it to hold the concession. William Adler, main owner of the Siempre Viva and Topaz mines in Nicaragua, was recently sentenced to serve six years in the Atlanta, Georgia, penitentiary, on account of questionable banking transactions at New Orleans. He is said to have borrowed money from one of the banks of which he was president, putting up as collateral a large number of shares in the Siempre Viva company. Mr. Adler was prominent in Central American affairs and had various interests there. It is learned from a director of the Oroya Exploration Co. that a man named Nobbs has gone from Mexico to Nicaragua to take charge of the Babilonia mine, recently acquired by that company at a price stated to be $110,000. H. B. Kaeding has left San Francisco to become manager at the Siempre Viva mine.

JOHANNESBURG, TRANSVAAL

Gold Output.—Randfontein Consolidation.—Alluvial Mining.

The gold output of the Transvaal for the month of December has been declared at 640,995 oz. of a value of £2,722,775. The output of the province for 1910 amounts to a total value of £32,001,735, of which the Witwatersrand has contributed £30,703,912. The Rand's yield in the previous year was £29,900,359; the whole of the Tranvaal producing £30,925,788. The December output of the Southern Rhodesian gold mines has not yet been announced, but the output of that country for 1910 may be estimated at practically the same yield as the yield for the previous year, namely, £2,623,709. Taking into account one or two producers in Natal, Cape Colony, and Northern Rhodesia, the gold output of British South Africa for 1910 may be approximated at £35,000,000.

At the moment the two features of most vital interest to Witwatersrand mining are the absorption of the mining interests of the great South African house of Wernher, Beit & Co. by the Central Mining & Investment Corporation, Ltd., and the proposed consolidation of the Randfontein South and Randfontein Central mines. For the past half a dozen years the keynote of Transvaal mining policy has been concentration. Whereas at the conclusion of the Boer War there were many scores of companies' claims, syndicates, and mines in various stages of development; there are at the present time not more than five dozen different mining concerns of first-rate importance operating on the Witwatersrand, and it is clear that before the end of the present decade consolidation will have been carried out to such an extent that a dozen mines will account for 85 or 90% of the production of the entire Main Reef field. The transfer of the Wernher-Beit interests to the Central Mining & Investment Corp. appears to have been advised mainly in order to secure provision for the efficient administration of the firm's affairs in the years to come. Sir Julius Wernher—the Grand Old Man of South African mining—makes no secret of the fact that he is getting up in years and that in all probability the time is not far distant when it will be impossible for him to devote the energy to the manifold interests of his firm that he has cheerfully given in the past. Some few years ago Wernher, Beit & Co. formed a powerful trust to acquire and regulate many of their holdings. That trust was the Central Mining & Investment Corporation, and at this juncture it is only fitting that the sphere of the concern's usefulness should be increased and the other interests of Wernher, Beit & Co. taken under its protective wing. The holdings which the corporation will take over are valued at about £1,250,000. With the consummation of this project the familiar name of H. Eckstein & Co. will practically disappear, although happily for the Witwatersrand the able lieutenants of the firm who have done such a tremendous amount for the mining industry in South Africa are not to be lost to us. Messrs. Lionel Phillips and Raymond W. Schumacher will remain as managing directors of the Central Mining & Investment Corporation in Johannesburg, with Messrs. H. C. Boyd and E. A. Wallers as managers. L. Reyersbach, who was for long the able chairman of Rand Mines Ltd., is, I understand, to direct the affairs of the organization in London. Other motives have prompted the Randfontein directors to urge on shareholders the advisability of amalgamating the two great subsidiary companies controlled by Sir Joseph Robinson. The prime reasons for amalgamating the Randfontein Central and Randfontein South mines are given as follows: (1) less capital outlay necessary for increasing the crushing capacity of the plant; (2) increase of ore reserves; (3) additional security against shortage of native labor. The ore reserves in the two mines are given at 6,055,076 tons of an average assay value of 6.9 dwt. per ton, of which 5,325,130 tons average 7.45 dwt. The South Randfontein mills have been at work for years past, but the new 600-stamp battery of the Randfontein Central has not yet been started. The combined capacity of the two plants as at present constituted is 3,100,000 tons per annum. The general opinion here is that the admittedly unsatisfactory state of the situation with regard to unskilled labor has been the primary reason that has induced the directors to advise amalgamation of the two vast properties.

Hitherto alluvial mining in South Africa has proved a distinct failure. It is true that in the 'early days' of Transvaal gold mining several decent sized fortunes were made at Mac-Mac and Pilgrim's Rest in the northeastern portion of the province, but of recent years work of this nature has given poor results. It is interesting and gratifying therefore to learn that in the Kaap Valley (Barberton district of the eastern Transvaal) experiments have recently been carried out which point to the probability of alluvial gold in this valley being worked at a profit if scientific and up-to-date methods are introduced and a certain amount of assistance is afforded the scheme by the State. Up to date a matter of £350 only has been expended on the scheme and already valuable experience has been gained. The Government cannot be charged with extravagance in the matter, and one or two of the South African papers are agitating for the continuance of the experiments on a larger scale, with a view to finding a solution, or at any rate partial solution, for the distressing problems connected with the 'poor whites' in South Africa. This evil is an ever present one, in fact an increasing element in the affairs of the Union States, and any experiments which appear to point to a remedy, whole or partial, should be followed up to the best of the State's ability. For these reasons the preliminary results secured in the Kaap Valley are of much importance.

GOLDFIELD, NEVADA

Bullion From Consolidated Mines Co.—Efficiency of Refinery.— Estimate of January Output. — Florence Goldfield Operations for 1910.

A recent shipment of gold bullion to the Selby Smelting & Lead Co. by the Consolidated Mines Co., weighing 23,660 oz. avoirdupois, was 0.900 fine and is worth about $18 per oz. Heretofore the bullion shipped by this company graded about 0.350 fine, and the higher degree of fineness of that now produced has been rendered possible by the completion of the new refinery. Four years ago a shipment of ore was made from this mine which still holds the record for highest value of a single consignment. This was a carload of 48 tons from the Hayes-Monnette lease on the Mohawk, in payment for which the lessees received from the Selby company a check for $574,958. The report of January operations has been delayed owing to the absence of the secretary and treasurer of the company, but it is reported on apparently good authority that the production will be greatly in excess of that in December, and may not fall short of $1,000,000 gross. In the mines, development continues with satisfactory results on the deeper levels and in new territory, and the new work from the Grizzly Bear shaft, south of the Clermont, is getting close to the Clermont vein and in the vicinity of the Clermont ore-shoot on the 1160-ft. level. According to present plans the ore, when opened on the deepest level from the Grizzly Bear, will be taken out through the Clermont shaft, which is connected with the Grizzly Bear shaft on two levels. On the 600-ft. level the Red Top vein is being explored from the Laguna shaft, and drifts from the Clermont at this depth are now in unexplored ground. The official report for December operations shows net profits of $447,294.67 from 25,500 tons of ore treated, the gross value of which is given at $752,409, with total costs of $10.25 per ton. The sum of $65,044.63 is charged off for construction, and a footnote explains that this item includes all amounts expended for construction to date.

The Florence Goldfield Mining Co., in its annual statement gives the following figures for the year ended December 31, 1910: Cash on hand December 31, 1910, $92,318; revenue from bullion and concentrate, $586,539; interest and rentals received, $3306; miscellaneous income, $1820; total debit, $683,983. Operating expenses, $320,799; marketing expenses, $47,053; general expenses, $22,130; taxes, $6650; materials and supplies, $1860; dividends paid, $105,000; total credit, $503,492. Less deductions from capital

accounts, $3215, leaving $500,277. Balance on hand December 31, 1910, $183,707. The annual meeting of stockholders of the Florence company will be held at Goldfield March 1, and will be immediately followed by a meeting of the directors. It is not probable that a dividend will be declared, as the payment of 10c., the established rate, would leave too small a fund in the treasury. The Florence main shaft has reached a depth of nearly 700 ft., where another station will be cut; and development is in progress on the 600-ft. level, where an ore-shoot was opened by a cross-cut driven 40 ft. from the shaft, the ore assaying about $70 per ton. The mill is treating from 130 to 150 tons per day, with a reported improvement in the mill-heads.

NEW YORK

Condition of Metal Market.—Congressional Inquiry.—The Calumet & Hecla. — Merger of Bisbee Mines to be Effected. — Davis-Daly, Porcupine, and Ohio.—Ray Central.—San Toy. — Zinc Smelters.

Those who are the chief factors in the metal market realize the necessity for such an organization as will be able to outline and carry through a program of curtailment that will check overproduction of copper, conserve resources, and stabilize the metal market. On the other hand, the necessity for careful action is shown by the introduction of a resolution in the lower House of Congress providing for an immediate investigation of the relations now existing between the Anaconda Copper Mining Co., the Amalgamated Copper Co., and the United Metals Co. If the resolution be adopted, the Attorney General will be directed to make an investigation to determine whether the companies named are doing business in violation of the Sherman Act. While the intimate relations existing between these concerns are known to all who are at all conversant with affairs in copper mining, it will probably be found eventually that instead of there being any violation of law the three are in fact one, in point of ownership. The resolution is not important, except to make it plain that any copper merger, or any effective working organization must be first approved by the Washington authorities, or it will be branded as an outlaw and robbed of any usefulness it might possess for correcting present conditions. The present move probably is due to the rumor that the United Metals Selling Co. is to be eliminated and its copper selling contracts turned over to the Anaconda. The truth is that the Federal authorities are perturbed by the drift of affairs in copper, the centralization of interests which has come about largely as a matter of self-preservation. The recent investigation into the timber situation has revealed a state of affairs of much the same nature. Conservation of natural resources has been made a political issue, and, as it means the railroad, banking, and financial interests on the one side, and the reformers and champions of popular rights on the other, the issues so raised are not, frankly, welcome ones. As to the most important one of the copper consolidations now forming, that of the Calumet & Hecla, there may be some obstacle to overcome before it is allowed to go through. The opposition of the Boston interests seems to have been overcome. The report of the Boston Stock Exchange committee says: "We believe that the directors of the various companies have made an exceedingly thorough and honest effort to find a just basis of consolidation, that the principles of arriving at these valuations are correct, and that whereas many of the factors can not be exactly determined, we believe on the whole, that the valuations reached are equitable and that each and every detail has been given due consideration. In conclusion, your committee has come to the unanimous conclusion that the plan is conceived with absolute intent toward fairness and is as fair a plan as could be produced under existing conditions." In a letter to Quincy A. Shaw, the president of the Calumet & Hecla, the committee recommends that the new holding company be given a larger capitalization than has been contemplated. On the present basis of market value that new stock would sell for something like two hundred dollars per share, which would make a unit rather unwieldy for any shareholders who might care to go in and out of the market speculatively. The copper country people know the mines and the markets thoroughly, and the Boston houses that command this patronage value it highly. As against the smoothing away of objections in Boston, the Calumet & Hecla merger has met with a serious setback in Michigan. Thomas L. Chadbourne, of Houghton, was for many years general counsel for the Calumet & Hecla, and is an Ahmeek holder, owning about 3000 shares of stock, which he does not want to exchange on the basis proposed, as he says he can only do so at what he believes will be a heavy loss to him. Mr. Chadbourne has addressed a circular to all of the shareholders of the various companies asking them to refrain from voting, "which," he says, "is as effectual as voting against the merger." He charges that the Ahmeek property was undervalued and also says that he will immediately have introduced into the Michigan legislature a bill providing, as is now the law in several other States, that shareholders must be paid in cash, if they prefer, instead of being forced to take stock in a new company. While the local authorities say that the proposed tonnage tax bill will not become a law in Michigan, Mr. Chadbourne can undoubtedly succeed in having the law he proposes passed, if he desires.

The consolidation of the Calumet & Arizona and the Superior & Pittsburg is assured by the receipt of proxies, covering 130,000 shares out of 200,000 total of the Calumet

Butte, Montana.

& Arizona, to be voted in favor of increasing the capital to $650,000 and absorbing the Superior & Pittsburg. The latter company's shareholders have until April 1 to turn in their stock and render effective the plan to declare a dividend of 87c. per share. The Davis-Daly stockholders are still after F. A. Heinze, and are trying to learn by what right he used Davis-Daly assessment money in purchasing claims in Porcupine. The protective committee, consisting of three members of the Boston Stock Exchange, has been provided with a treasury fund with which to make a fight, and when Mr. Heinze returns from Porcupine he will have a chance to make good on his promise to give the New England holders a majority of the Davis-Daly board and the executive committee. The Davis-Daly assessment money has been loaned to the Ohio Copper Co.; $50,000 said to be secured by $80,000 of Ohio Copper bonds, which, by the way, are almost unsalable in the open market. Twenty thousand dollars has been expended in Alaska, one-half of this sum for options on properties and one-half for examinations and reports by engineers. The Foster property in Porcupine, supposed to have been purchased by Heinze, now appears to have been acquired for the Davis-Daly company, or at least with Davis-Daly money; $25,000 having been paid upon the option and the company bound to pay a total of $200,000. Mr. Heinze is reported as intending to make a public flotation of the Porcupine property, which, if successful, would probably result in the money being returned to the Davis-Daly treasury, less one-third of the profits derived from the transaction, to accrue to Mr. Heinze personally. The Alice Gold & Silver, one of the oldest

of the Butte mining companies, is to be dissolved and its assets distributed among the shareholders. The meeting of the directors of the Ray Central Copper Co. was to have been held this week, but was postponed on account of the absence of some of the members of the board. The long expected report of Frank H. Probert, of the firm of Weed & Probert, is now promised definitely within a week or two.

The advance sheets of the report of the San Toy Mining Co. for the past year has been mailed to the shareholders. The net profits for the year were $157,566. The report is not so favorable as was that of a year ago. The value of the ore was considerably lower and operating costs proportionately higher. San Toy is supposed to be controlled by Charles M. Schwab, and the public has always been inclined to favor the issue, but the showing has not been good enough to keep up the enthusiasm. The situation in the zinc-smelting industry is said to have determined the American Smelting & Refining Co. to erect a zinc smelter at Nuevo Laredo, on the Rio Grande, opposite Laredo, Texas. The anticipated early exhaustion of the gasfields in and about Chanute and Iola, Kansas, has rendered it imperative that new smelters be erected elsewhere in some district where cheap natural gas can be made available. In the present plans there is included the laying of a pipeline from Reiser, Texas, where a new gasfield has been developed, to Laredo, some 28 miles, and thence across the Rio Grande to the new smelter, and possibly later to be extended to Monterey. The erection of a zinc smelter is expected to prove a great impetus in the development of the zinc ore deposits of northern Mexico.

DENVER, COLORADO

Proposed Legislation.—Progress in Cripple Creek.—The Motter Process.—Cokedale Disaster.—Curtailment at Leadville.

Four years ago there was a law proposed which would establish drainage districts in all the mining camps of the State. The same proposition is again before the legislature. The object of this proposed law is to make it possible to collect the necessary funds from all the companies benefited by a drainage tunnel. The experience of those who backed the Newhouse tunnel at Idaho Springs, and of those who financed the Roosevelt tunnel at Cripple Creek, shows how grudgingly some companies and some individual owners will contribute money only when public sentiment can be invoked against them. Surely it is not right for a few generous companies or individuals to be forced to pay entirely for a tunnel which will benefit others who are simply a drag on the industry. On the other hand, if the bill should be passed without careful consideration and provision for the financially weak operators in a district it may act as the proverbial last straw. Another bill before the legislature is one to authorize the State to tunnel the continental divide, between Tolland and Arrow, at a cost not to exceed $500,000. Those most interested in this measure are showing commendable energy in suggesting the numerous ways in which such an enterprise might prove a paying investment for the State. There is some doubt, however, about the rich veins of ore to be cut by the proposed tunnel, and of the millions of acre-feet of water that would be a yearly source of revenue.

The rumor that the Golden Cycle mine at Victor and the mill at Colorado City have been sold is at last officially dead, and now there is much speculating as to whether the 18-mile aerial tram from the mine to the mill will be built. Estimates have been received by the Cripple Creek Deep Drainage Co. on the length and cost of another tunnel to drain the camp 500 ft. deeper. The directors of the company are awaiting developments from the cross-cut from the present tunnel to the C. K. & N. vein. Should ore be found in this vein at the tunnel level, everybody will be much encouraged. It would seem to be the part of wisdom to prospect rather extensively from the present tunnel level before starting on a project which will cost upward of $1,000,000. The management of the El Paso mine has issued a statement that all leases will be renewed at their expiration on May 1. The company will insist that all assaying be done at the mine and that insurance be carried by all men underground. A change room is to be established by the company for the use of the lessees and their employees. This is in line with the action of the Golden Cycle company some time ago.

If the monthly report of the samplers is an index of conditions, the mines in the Clear Creek district are more active than last year at this time. The Malm dry chlorination process, which promised so much for the district a year ago, is still only a hope. To add to its troubles a competitor has entered the field. The Colorado Metals Extraction Co. has secured a long-time lease on the Lowell mill at Idaho Springs, where it intends to establish the Motter process. As far as can be learned this process does not embody any new features. It is adapted to the treatment of mixed sulphide ores. The finely ground ore is subjected to a roast at a low temperature for the purpose of converting all the silver and copper and some of the iron to sulphates. These are recovered from the solution as silver chloride, metallic copper, and iron sulphate, by the ordinary methods. The residue is re-ground, and after passing over the amalgamating plates is concentrated. The lead, zinc, and iron are separated from each other by magnetic separators.

Students at Colorado School of Mines Ready for Training in Rescue Work Under J. C. Roberts of U. S. Bureau of Mines.

On February 9 an unusual accident happened at the Cokedale mine of the Carbon Coal & Coke Co., near Trinidad. In some manner the car of powder in charge of the shotfirers became ignited. Fifteen miners and two rescuers were overcome by the after-damp. This is one of the model mines of the State, and the accident illustrates the fact that mining, even with the best preventive equipment, is extra hazardous. The Leyden mine, a short distance northwest of Denver, is to be reopened. This mine was wrecked by an explosion and fire which caused the shaft to cave in last December. The new shafts are to be lined with concrete so that they will remain open, whatever happens. This is a very sensible construction and should be made a necessary requirement for all coal mine openings in the State.

Leadville has passed quickly from the height of joyous celebration to the depths of despair. The Western Mining Co., a subsidiary of the A. S. & R. Co., has closed all its zinc-producing mines in the camp indefinitely. This has thrown about 200 men out of employment. It must be admitted as good business on the part of these large holding companies to let the lessees and small operators supply the market as long as they will at a figure that admits of no profit and to market their own ores on a rising market. The rich placer ground in French gulch near Breckenridge is now involved in litigation. Englishmen interested in placer properties with B. S. Revett are now demanding a settlement. The present hearing will last at least sixty days.

General Mining News

ALASKA

JUNEAU DISTRICT

The report of the Alaska Treadwell Gold M. Co. for the month ended January 15, 1911, is as follows: Mill time, 31 days. The 240-stamp mill ran 29 days, 11 hr., 43 min.; water-power, 6 days, 2 hr.; steam-power, 23 days, 9 hr., 43 min. The 300-stamp mill, water-power, ran 9 days, 15 hr., 50 min. The former crushed 32,732 tons, and the latter crushed 16,296 tons; total, 49,028 tons of ore. Concentrates saved by 240-stamp mill, 635 tons; saved by 300-stamp mill, 330 tons; total, 965 tons of concentrate. Estimated gross value of free gold, $78,381.44; estimated gross value of concentrate, $49,818.93; total, $128,200.37. Estimated total realizable value, $122,275.27. Operating expenses, $82,059.16. Net operating profit, $40,216.11; construction expense, $18,248.11. Yield per ton of ore milled, $2.61; stock of ore broken, 20,865 tons. Development work, 1023 ft.—228 ft. in ore, 795 ft. in waste. Assay-value of ore in new work, $0.66 to $4.96 per ton.

The report of the Alaska Mexican Gold M. Co. for the month ended January 15, 1911, is as follows: Mill time, 31 days. Mill of 120 stamps ran 29 days, 17 hr., 34 min.; water-power, 4 days, 1 hr., 56 min.; steam-power, 25 days, 15 hr., 28 min. Ore crushed, 18,129 tons; concentrate saved, 390 tons. Estimated gross value of free gold, $33,704.82; estimated gross value of concentrate, $34,660.87; total, $68,365.69. Estimated total realizable value, $65,746.77; operating expense, $33,209.33; net operating profit, $32,537.44; construction expense, $4072.05; yield per ton of ore milled, $3.77. Stock of ore broken, 8929 tons; development work, 506 ft.—235 ft. in ore, 271 ft. in waste. Assay-value of ore in new work, $2.13 to $3.16.

Report of the Alaska United Gold M. Co. for the month ended January 15, 1911, is as follows: Mill time, 31 days. Ready Bullion 120-stamp mill ran 29 days, 17 hr., 36 min., by steam-power. The 700 Ft. Claim 100-stamp mill ran 29 days, 17 hr., 27½ min.; water-power, 2 days, 7 hr., 19 min.; steam-power, 27 days, 10 hr., 8¼ min. The former crushed 19,628 tons of ore, and saved 365 tons of concentrate; the latter crushed 15,471 tons of ore, and saved 295 tons of concentrate. Estimated gross value of free gold, $20,947.91 in Ready Bullion, $16,348.99 in 700 Ft. Claim mill; estimated gross value of concentrate, $15,957.80 in former, $14,071.24 in latter mill. Estimated total production, $36,905.71 in Ready Bullion, $30,420.23 in 700 Ft. Claim; total realizable value, $34,767.46 in former, $28,702.72 in latter. Operating expenses, $27,652.89 in former, $24,683.07 in latter. Ready Bullion net operating profit, $7114.57; 700 Ft. Claim profit, $4019.65. Construction expense, $1971.84 and $2238.99, respectively; yield per ton of ore milled, $1.88 in former, $1.96 in latter. Development on Ready Bullion, 432 ft.—272 ft. in ore, 160 ft. in waste; assay-value of ore, $2.64 to $3.22; development on 700 Ft. Claim, 291 ft.—232 ft. in ore, 59 ft. in waste; assay-value of ore, $0.27 to $2.72. Stock of ore broken, 2875 tons in former, 13,139 tons in latter.

ARIZONA

GILA COUNTY

The Montgomery mine, situated in Globe district, and operated by the Warrior Development Co., mined and shipped 39,042 tons of ore between October 14, 1909, and December 31, 1910.

GREENLEE COUNTY

The Twin Peaks M. Co. is employing 60 men at its gold mine, situated 13 miles from York station, on the A. & N. M. railroad. The Clear Lake mine is being developed with a force of 15 to 20 miners, under direction of C. M. Fairham. A considerable tonnage of ore has been hoisted, which is to be hauled to Sheldon and shipped to the smelter.

PINAL COUNTY

(Special Correspondence.)—The directors of the Ray Central were at Ray last week, and will recommend in their report to the stockholders that several churn-drills be installed to prospect the hitherto unexplored portion of the property. That section already developed contains, according to the estimate of Weed and Probert, 6,500,000 tons of ore.

Ray, February 14.

CALIFORNIA

CALAVERAS COUNTY

The new 3-compartment shaft being sunk at the Lightner mine, Angels Camp, has reached a depth of 345 ft., and cross-cuts have been started at the 200 and 300-ft. stations to connect with other cross-cuts leading to the principal orebody. A tramway is being built from the new shaft to the mill. The stamp batteries are being overhauled, and it is intended to have 20 stamps operating by March 1, and 20 more a few weeks later.

INYO COUNTY

The interest aroused in the Villareal camp by the operations of the Domingo M. Co. has been increased by recent discoveries of lead-silver ore in that district by John Beauregard of Laws. He made the find by sinking through a lava capping into lime-shale and quartzite in which the ore occurs. He is mining ore of a grade that will stand shipping. In this vicinity are the claims recently located by Massey and Sheehan for George S. Nixon of Nevada. The Domingo company keeps up ore-shipments from its Villareal mine, but is letting no leases. The camp is about 12 miles from Keeler.

NEVADA COUNTY

(Special Correspondence.)—The winze from the 700-ft. level of the Pennsylvania is being sunk. Shaft-sinking continues and the orebody is showing up well; 15 stamps are in action. The San Francisco owners of the Union Hill have decided to replace the old mill with a modern 20-stamp plant. The unwatering of the property will soon be commenced, and a small force of men put to work. The North Star Mines Co. has a small force of men at work in the Champion mines, completing the drift from the Champion to the Nevada City workings. Meanwhile the Champion company continues to operate the property along normal lines, with usual developments progressing. At the Delhi the sinking of the shaft is progressing steadily. The recent break in the flumes, caused by the heavy snow, has been repaired. The Gaston mine has partly recovered from the effects of the recent storm, and a portion of the stamps are again in action. It is reported that development will be resumed at the Murchie mine. The Sacramento people, who recently became interested, are keeping the pumps in action, and expect to commence activities as soon as certain claims against the property have been adjusted. A small crew is employed at the Golden Gate, and some good ore is reported. W. P. Martin is superintendent. The North Star Mines Co. is having work done at the Cincinnati Flat group. The recently installed hoist is greatly facilitating developments. The Tidal Wave gravel mine near North Bloomfield has been leased to A. M. Hotchkiss and associates. The bedrock adit is being re-opened to tap the extension of the noted Derbec gravel-channel.

Grass Valley, February 13.

SAN BERNARDINO COUNTY

The Mohave Mines Incorporated, controlled by people in the East, has purchased the Mohave mine, situated near Silver mountain. The property embraces five claims, on which are veins of low-grade, free-milling gold ore. The purchasers, it is said, are to erect a 40-stamp mill and lay a 3-mile pipe-line to conduct water to the property from the Mojave river.

SIERRA COUNTY

(Special Correspondence.)—Despite the heavy snow in this district, which has caused damage to flumes and ditches, as well as to mine-buildings, several companies are keeping up operations to the normal. The Croesus Mining Co. is developing the Plumbago mines, and extract-

ing good ore from the main adit workings. Charles W. McMeken is superintendent. At the Gold Canyon a small crew is employed and good ore is being opened. Operations have been resumed at the German Bar group by the Buck brothers of Moore's Flat. The adit is being extended to pick up the vein lost by the old company. The upper workings of the Tightner will soon be re-opened and the shaft sunk deeper. It is stated that the last shipment of bullion by the Tightner company amounted to $33,000. A 3-ft. vein of gold-bearing quartz is being opened in the Nonpareil. Reno capitalists are interested. The Andy Fitz Mining Co. has placed a contract with a San Francisco firm for a 10-stamp mill for the Fruitvale mine. Concentrators will also be installed. Reserves of good ore have been opened. At the Sixteen-to-One driving is progressing on the lode. A second pay-shoot is being sought. The Alleghany Channel Mining Co., of Pennsylvania, has a rich gravel deposit in the Gold Star. L. W. Jennings is superintendent. The recent snowslide at the Telegraph failed to do as much damage as reported. No sheds were destroyed, and only a part of the power-line was damaged.

Alleghany, California.

Operations are again in progress. There is no truth in the report that the Keystone mill has been destroyed by a snowslide. At the Sierra Buttes, operations have been resumed. A lower adit is being driven at the Columbo to open the vein 150 ft. deeper.

Alleghany, February 10.

The Oriflamme, on Lafayette ridge, Alleghany district, is being developed under direction of C. C. Ward, who is having a cross-cut driven to intersect three veins. This cross-cut is now in 540 ft.; at 414 ft. from the portal a vein was opened, and by drifting north thereon a shoot of ore was found containing free gold and gold in sulphide. The cross-cut is being extended farther, with the expectation of cutting another lode. Later in the year, it is thought, a sufficient tonnage of ore will be available to justify the building of a mill to treat it. A 6-ft. channel of gold-bearing gravel was opened lately on the property of the Deadwood Consolidated, situated in Poker Flat district. This company, composed of San Francisco and Los Angeles men, has the Deadwood, Reese Ravine, and Sebastopol under bond and lease. Development has been in progress for nearly a year under direction of A. B. Call.

TUOLUMNE COUNTY

(Special Correspondence.)—Los Angeles investors have become interested in the Mastodon aud California mines, on the Mother Lode, and preparations are under way for commencing operations. A pump is being installed on the Mastodon, and an engine, boiler, and hoist have been leased from the Longfellow mine. The shaft is 115 ft. deep, at the bottom of which the ore is of good grade. It is reported that Lester R. Wiley and others are to take a bond on the Nonpareil mine, in the Groveland district, and will begin operations at an early date. A promising new vein has been discovered on the Santa Ysabel, to the west of the shaft, and the ore at the surface is said to be richer than any yet worked at that mine. The vein can be tapped at depth by driving a cross-cut from the shaft, and this will probably be done. A residence that will cost approximately $10,000 is to be erected at the Tarantula mine for J. G. Crawford, manager for the United Gold M. & M. Co., which operates the property. The lumber, which comes from Oregon, has been delivered at the mine. It is reported that operations were resumed at the Draper mine, near Soulsbyville, on the 20th inst. The Springfield Tunnel & Development Co. is installing three new transformers on its property at Springfield. The owners of the Snell mine, situated near American Camp, have entered into an agreement with Edward H. Scott for the sale of the property. The early resumption of operations at the Mazeppa mine is said to be assured.

Tuolumne, February 22.

COLORADO

CLEAR CREEK COUNTY

(Special Correspondence.)—A 3-in. streak of ore has been opened in the east drift on the Unicorn vein that assays 600 to 700 oz. silver per ton. Hurley & Co. have leased a block of ground on the Aetna, and they have a 5-in. streak of ore that assays 3 oz. gold and 15 oz. silver per ton. The east drift on the Aetna vein, intersected by the Capital adit 4600 ft. from the portal, will be driven 700 ft. farther. Holcombe & Co., leasing on the Aetna vein at the bottom of the 50-ft. shaft, have purchased an electric hoist, and shipments will be started next week. The Hite M. Co. is developing the White claims on Columbia mountain. The adit is to be driven to intersect the lodes. The output from the Santiago mine, East Argentine, now averages one carload per day, the average value of the ore being $40 per ton in gold, silver, and lead. The Central Capital mine on Griffith mountain is receiving attention. Shipments of lead-zinc ore will be started next spring. A body of ore, 12 to 18 in. wide, has been found on the Mint property, on Covode mountain. The stuff mills from $40 to $45 per ton in gold. The Conqueror M. & M. Co. is increasing its working force and will start its 50-ton concentrating plant as soon as sufficient water is available. Ore-shipments are being sent out from the Gold Fissure mine to the Golden smelter. It samples from $25 to $30 per ton. Willis Bristol is manager.

Georgetown, February 13.

(Special Correspondence.)—The Lowell mill at Idaho Springs is to be equipped with the Motter process of ore extraction. It is claimed by those interested that all of the metals can be separated, thus doing away with the smelting cost. O. W. Lowell is manager. Ore has been opened on the Bride vein, on Seaton mountain, which assays from $60 to $65 per ton in gold and silver. Hoban & Oxley are operating under lease. Work was resumed last week on the Gold King claims, on Saxon mountain. Operations, carried on through the Eclipse adit, are in charge of W. O. Robinson. Work has been started at the Scepter adit on Democrat mountain. This property was recently taken under bond and lease by M. D. Draper, the bond calling for a payment of $125,000. If the result of development prove satisfactory, it is probable that a milling plant will be constructed.

Idaho Springs, February 12.

GILPIN COUNTY

(Special Correspondence.)—The Coaley M. Co. has been organized to take over the Coaley group, in the Enterprise district. The 200-ft. shaft is to be sunk 200 ft. deeper. Ore was mined years ago that ran as high as $1000 per ton in gold and silver. Six tons of ore sent out last week from the Perigo mine sampled 2.52 oz. gold and 2 oz. silver per ton. The shaft on the Topeka mine has reached a depth of 1400 ft., the last 100 ft. having just been completed. A station is being cut at this depth, and driving will be started on a 3-ft. vein. An orebody 3 ft. wide, averaging $9 per ton, is opened on the 900-ft. level, and ore is being shipped to the Iron City mill.

Emmett Tuck is operating as lessee. The Gilpin-Eureka M. Co. installed a heating plant and is again operating. Simpson & Co., leasing on the Old Town, last week shipped 23,480 lb. of ore that sampled 5.41 oz. gold, 7.2 oz. silver, and 3.5% copper. Pike & Co. sent out 33,400 lb. that milled 2.90 oz. gold, 6 oz. silver, and 2.4% copper. The 500-ft. shaft on the Chase mine is to be sunk to 700 ft., as was announced by Forbes Rickard, consulting engineer for the operating company. The shaft on the Cashier is nearing the 100-ft. point. Machine-drills are in use, and sinking is progressing at the rate of 2¼ ft. per day. A level is to be driven from the 100-ft. station, after which sinking will be resumed. W. Auger is manager. The Gilpin-Valdez M. & R. Co. will erect a 10-stamp mill in the Alaska district. The plant will do custom work. W. H. Bishop is manager.

Central City, February 14.

LAKE COUNTY

The Mount Champion M. Co. owns what was formerly the Theodolite group of mineral ground on the eastern slope of Mt. Champion, just above the Half Moon amphitheatre. It is claimed that the development of the last year has exposed 30,000 tons of ore, grading $12 to $50 per ton, its principal value being in gold, which may be recovered mostly by amalgamation. The plans of the company contemplate the construction of a gravity tramway 6500 ft. in length over which to convey the ore to the base of the mountain, where a stamp-mill and hydro-electric power plant are to be built. The Miller Gold M. & T. Co. owns property on the west slope of this mountain, which is being developed; a mill and tramway, previously commenced, are to be finished this season. The zinc buyers, who bid for Leadville zinc-carbonate, have made up a new schedule for treatment charges, under which it is claimed the zinc producer receives only $8.80 per ton for ore containing 30% zinc, whereas under the old schedule they received $11.30 per ton for ore of that grade. The change has aroused the mine operators, who are to meet and consider their interests.

PITKIN COUNTY

The shaft of the Free Silver mine, at Aspen, has been unwatered, and mining on the lower levels of the Mollie Gibson and Smuggler mines is to be resumed. Three high-capacity electric pumps, installed at the 1200-ft. station of the Free Silver, are expected to keep the lower workings of these properties practically free of water, and driving from that station toward the orebodies has been commenced.

SUMMIT COUNTY

The Wellington Mines Co., operating a zinc mine and mill, announced from its Kansas City office a dividend of $50,000, payable February 20.

IDAHO

SHOSHONE COUNTY

(Special Correspondence.)—Bunker Hill & Sullivan Mining & Concentrating Co. brought its total dividends up to $12,456,000 by the payment of dividend No. 161, amounting to $81,750, a few days ago. In the Hecla mine, at Burke, the discovery of a 14-ft. vein of profitable ore was made on the 1200-ft. level, a fact that removes all doubt as to the wisdom of deep development on this property. Jas. F. McCarthey is manager for the Hecla M. Co., which owns the mine.

Kellogg, February 10.

MONTANA

BROADWATER COUNTY

(Special Correspondence.)—A meeting of the Ohio-Keating Gold Mining Co. is to be held March 21 to consider leasing the property to a number of miners until December 31 on a 25% royalty basis. The board of directors has already approved of the plan. The mine is situated in the Radersburg district and has been closed down for some time; electric power is being substituted for steam. Under the terms of the proposed lease the company and lessees are to use the shaft jointly. A bond issue of $50,000 was authorized recently, and the capital stock was increased from 500,000 to 800,000 shares. The ore exposed in the shaft is identical with that now being mined in the property of the Keating Gold Mining Co., which has been shipping about 2100 tons of ore per month, of an average value of $24 per ton.

Radersburg, February 17.

SILVER BOW COUNTY

The quarterly report of the North Butte company shows that extensive development has been carried on. The Speculator shaft is now down below the 2600-ft. level, and it is to be continued to a depth of 2800 ft. A pump is being placed on the 2600-ft. level. The raises under the Granite Mountain shaft have been completed and these connections have greatly improved the ventilation in the stopes of the Edith May vein. A large amount of work has also been done in the Edith May, Jessie, South Gem, South Croesus, and North Croesus veins. A portion of the report is devoted to an explanation of the settlement of the dispute between the company and the Tuolumne, it being explained that such a course was necessary owing to a wrong impression having been printed, to the effect that the company conceded to the Tuolumne all of the Jessie vein except about 400 ft. at the west end of its property. Mr. Pope, the general manager, then explains the agreement and says that the settlement establishes ownership by the North Butte company to all the ore which has been developed or worked in the Jessie claim for a full length of close to 1100 ft. and does not affect the orebodies of the company or the mining operations in the least. Mr. Pope concludes with the statement that the compromise is a substantial recognition of the rights of both companies and is of mutual advantage. The East Butte company is gradually increasing its smelter business, and each month finds an addition to the amount of custom ore being received. It has been found necessary to start a second furnace to handle all the ore and at the same time treat the ore received from the company mines, although the output from the latter has not been increased. In the old Pittsmont mine development work is being done on an extensive scale, and bodies of ore are being blocked out. The management believes the ore will continue to run from 6 to 8% copper.

NEVADA

ESMERALDA COUNTY

The Columbus Florence American Leasing Co. has a 15-months lease on the Florence Extension in Goldfield, belonging to the Florence American M. Co. The leasing company was incorporated by Clyde Hill and Corrin Barnes, whose financial backers are at Columbus, Ohio. The Combination Fraction Mines Co., operating in Goldfield, had a gross income of $96,314.82 during 1910, principally from ore mined and milled. It had $44,744.44 on hand at the beginning of that year. Expenses, equipment, development, mining, and milling for the year amounted to $145,371.53. The Sandstorm-Kendall Con. Mines Co. has been organized to further develop and operate the Sandstorm-Kendall mines at Goldfield. C. D. Wilkinson and William Campbell are manager and superintendent, respectively. Those having the Precious Metals lease on Atlanta ground, Goldfield district, are developing at a depth of 730 ft., expecting to cut into the Florence vein. The Queen Con. lease, also on the Atlanta group, is active again, the plan being to explore from the 705-ft. level. Sinking is to be continued till a depth of 1500 ft. is reached.

HUMBOLDT COUNTY

W. G. Adamson and associates, in developing a property on the north slope of Winnemucca mountain, five miles from the town of Winnemucca, have opened a mineralized dike, 50 ft. wide, through which gold ore of milling grade is disseminated. Within the dike was found a 10-in. streak of ore said to assay $1000 per ton.

LYON COUNTY

S. S. Arentz, superintendent for the Nevada-Douglas Copper Co., operating the Nevada-Douglas and Ludwig mines in Yerington district, is reported as stating that

all stations have been completed to water-level in the Ludwig shaft, and that pumps are to be installed at the lowest station; that 59 mine-cars have been ordered and a new 150-hp. electric hoist has been shipped, and that a 150-ft. tramway is to be built from the top of Douglas hill to the railroad track. The Mason Valley Mines Co., owner of the copper mine near Mason, has a force of 125 men at work constructing the smelting plant at Wabuska. The concrete work is about completed, and the steel construction will soon be commenced.

MINERAL COUNTY

By enactment of the State legislature, the county of Mineral has been created. The new county embraces what was formerly the northern part of Esmeralda, and the principal towns are Rawhide, Hawthorne, and Mina. It is announced that the Black Eagle company has purchased the King-Heisner mill, at Rawhide, the Huntington mills in which are to be replaced by stamps. Cyaniding equipment is to be provided, and an air-compressor is to be installed.

NYE COUNTY

Loftus and Davis, who control the Gold Bar property, 10 miles from Rhyolite, are reported as having decided to spend no more money on it, and they may move the 10-stamp mill to Round Mountain, and add the equipment to their mill at that place. Lessees on the Big Four mine brought gold and silver bullion of the value of $40,000 into Tonopah last week. This was recovered from ore taken from the 225-ft. level. It is said to have averaged $100 per ton. The property is on Gold hill, Manhattan district.

NEW MEXICO

GRANT COUNTY

(Special Correspondence.)—The Savanna Copper Co., operating in the Burro mountain district, 13 miles southeast of Silver City, has a copper property which is developed by seven shafts having an average depth of 300 ft. There are four miles of underground workings. Of

Map of New Mexico.

the 7 hoists in use, 3 are operated by steam, and 4 by gasoline engines. Present work is confined to exploration with two Star churn-drills on the northeast portion of the property. Drilling for the last 11 months has been continuous, and the result has been satisfactory. There are 43 drill-holes, averaging 664 ft. in depth, mostly in porphyry through which copper is disseminated. Drilling is to be continued to determine the limits of the ore zone. Within the next month the company intends to resume underground development. I. J. Stauber is the company's manager. The Comanche mill and smelter, formerly operated by the Comanche M. & S. Co., are in good condition, and the mill, especially, may be of use in concentrating. Chloride Flat, adjoining Silver City on the southwest, contains lime and iron deposits, which could be used as flux for the smelter. The iron contains some silver.

Silver City, February 10.

The property of the Hermosa Copper Co., in Santa Rita district, has been taken under bond by the Indian Copper Co., an organization controlled by the Gunn-Thompson company. The Hermosa adjoins the Chino, and has been extensively developed. There is said to be 100,000 tons of ore exposed in the workings.

SOCORRO COUNTY

The Mistletoe M. Co. has erected and set in operation a 50-ton plant for dry concentration at Kelly. Its ore consists of lead carbonate and zinc, containing from 4 to 8% lead. A concentrate is obtained that will sample about 47% lead. The plant cost $20,000. The Lynchburg mine in the same district is under bond to the American Zinc & Lead Co., which has made a payment of $5000 on the purchase price. It is probable that other dry-concentrating mills will be erected in Kelly district. The Tri-Bullion M. & D. Co. is operating its mine and mill, the latter being equipped with tables suitable for separating lead from zinc and iron; also a magnetic separator.

OREGON

BAKER COUNTY

The White Swan, now called the Susan D. mine, situated east of Baker, is under bond to C. F. Sodering and others of Spokane. In driving from the bottom of a 122-ft. shaft a vein was opened containing 2 ft. of high-grade ore. Operations have been resumed on the Virtue mine, situated in the same locality. The Imperial property, in Cable Cove, is being operated again by E. R. Davidson, of Spokane. It is stated that he will soon ship ore to the Sumpter smelter. The Oroville Dredge Co. has acquired a considerable area of placer ground at Sumpter which is adaptable for dredging. Development is going on at the Ben Harrison with a force of 25 miners. A cross-cut is being driven to open the vein 250 ft. lower than the present working level. The property is in the Greenhorn district.

JOSEPHINE COUNTY

The Deep Gravel mines, situated in Waldo district, have been sold to Eastern people who have organized the Waldo Con. Gold M. Co., in which title to the mines is vested. O. A. Turner is president of the company; Frank M. Leland is general manager. The same company has acquired the Osgood, and the Simmons-Cameron-Logan placers. The Deep Gravel is equipped with 6000 ft. of hydraulic pipe, 4 giants, having heads of 150 and 200 ft. A shaft sunk to bedrock on the lower end of the property is 122 ft. deep, the gravel containing gold and some platinum.

The Scandinavian-American Dredging Co., for which P. H. Holdsworth is manager, is moving a dredge to the Argo property, and is expected to be ready to operate in a few weeks. A carload of equipment has been received by the Rogue River Dredging Co. for use in rebuilding its dredge.

TEXAS

(Special Correspondence.)—The mining men of this State are making an effort to get the enactment of a law governing the location and development of claims upon State lands. A bill has been introduced in the legislature with this object in view—in the Senate by Claude B. Hudspeth, of El Paso, and in the House by A. M. Turney, of Alpine. Mr. Hudspeth has also introduced a bill providing for the establishment of a State School of Mines and Metallurgy, which shall be separate from the mining department of the State University, at Austin. The bill provides that the proposed school shall be built at El Paso. In effect the mineral lands measure provides that persons prospecting State or school lands for precious minerals may, within one year after filing affidavit of claim, work the land, and

if mineral is found no more than the amount necessary to pay the prospector's reasonable expenses may be taken away, but the claimant may purchase the land any time within the year, giving his note for the unpaid balance of purchase price, bearing 3% interest annually, and depositing in the State Treasury one-fifth of the purchase price. Thereafter, in addition to the interest on his note, the purchaser must pay annually to the Treasurer one-fifth of the cash price until the sum of $1500 an acre is paid. The nineteen sections of this bill provide for regulations also as to State lands worked for all baser metals; land bearing oil or natural gas being fixed for sale at not more than $25 or less than $10 per acre if within five miles of an operated railroad; otherwise to be sold at $5 per acre. The bill for the School of Mines and Metallurgy provides that its establishment shall be conditioned on the city of El Paso deeding to the State a tract of not less than 20 acres to be selected by the Governor and Superintendent of Public Instruction. The school is to be under the supervision of the regents of the State University and all subjects pertaining to mining and metallurgy will be included in the curriculum. The institution is designed to be self-supporting, all money received from tuition and other sources to be returned to the State annually in repayment of the appropriation of $15,000 that the bill carries with it.

Austin, February 6.

UTAH

JUAB COUNTY

The Chief Consolidated, for 1910, received $177,639.12 for ore sold and expended $63,078 for hoist and equipment; $111,190.77 was the cost of mining and development. During the year 6947 tons of ore was shipped, which yielded 440 oz. gold, 433,850 oz. silver, 525,552 lb. lead. The net value of the ore was $25.57 per ton. The principal part of the development performed was on the 1400-ft. level. The work was divided as follows: Shaft-sinking, 118 ft.; driving, 3044 ft.; raising, 328 ft.; winzes, 526 ft.; a total of 4016 ft. for the year. Ore shipments from the mines of Tintic district run from 140 to 156 carloads per week; for the week ended January 27 they were as follows: Dragon mine, 23 cars; Iron Blossom, 20; Sioux Con., 6; Colorado, 6; Brookiyn, 2; Grand Central, 8; Gold Chain, 4; Centennial Eureka, 46; May Day, 2; Uncle Sam, 6; Ridge & Valley, 3; Iron King, 3; Opohongo, 2; Chief, 2; Gemiui, 3; Scranton, 4; New Bullion, 1; Tintic Smelter, slag, 3; total, 146 cars.

The Yankee Con. M. Co., owning the Yankee mine at the north end of Tintic range, during 1910 raised $89,929.50 by assessments, and received $23,200.62 from other sources. The expenditures for the year amounted to $79,461.56, there being a balance January 1, 1911, of $10,388.96. The mine work accomplished during the year consisted of 485 ft. of shaft-sinking and 4000 ft. of driving for exploration and development purposes. In the meantime, new shaft equipment has been supplied. B. N. Lehman is, and for several years has been, the company's manager. The directors are John E. Du Boise, J. E. Frick, B. N. Lehman, H. C. Edwards, and C. J. North. The Dragon mine produced 4000 tons of ore in January. The mine is in charge of L. E. Riter.

PIUTE COUNTY

The Shamrock Gold M. Co., operating near Marysvale, shipped two cars of ore in January. W. J. Wolstenholme is in charge and employs eight miners. An adit, now in 1000 ft., is being driven on the Gold Bullion, controlled by Springville men.

SALT LAKE COUNTY

It is announced that a 3-compartment interior shaft is to be sunk from the Utah Con. company's No. 7 haulage level, to aid in the more economical development and extraction of ore below that level. There is now a 250-ft. incline which starts on this level at a place 500 ft. from the portal; but the new shaft is to be farther in, near the centre of the mineralized area, and will be sunk to a depth of 300 ft. This work is the beginning of operations in undeveloped ground. A station is being cut out for the collar of the shaft. The heading of the adit which the Bingham Copper Co. is driving in Bingham district has intersected a second fissure-vein containing 18 in. of galena ore of good grade.

Werner Ziegler, having a lease on the old Winnemucca mill in Bingham canyon, has the plant in successful operation on custom copper ores, consisting mostly of low-grade stuff from various mine dumps.

SUMMIT COUNTY

Ontario lessees are mining and marketing ore and developing in new ground. The old Ontario mill is to be so remodeled as to make it a modern plant, when it will be operated on ore mined by the lessees. The new mill at the Little Bell mine, Park City district, has been closed by reason of an insufficient water-supply.

PHILIPPINE ISLANDS

Australian investors, who control the Rio Chico Gold Dredge & Mining Co., have acquired 100 acres of placer ground on Rio Chico and Rio Cahu, in Nueva Ecija district. Tests made by boring in this field indicate 18 to 52c. gold per cubic yard. A dredge is to be built for this work. In the Paracale district, a dredge being built for the Gumaus company is expected to be ready for work by next August. The dredge operating on ground of the Philippine company recovered 73 oz. gold in 11 days operating in November. The Paracale Gold Dredging Co. is operating one dredge and may erect another this year. This company has installed a stamp-mill in which to crush the gold-bearing boulders. Shipments of 135 tons of concentrate and 125 oz. of gold and silver bullion were sent out from the San Mauricio mine at Mambulao in November.

CANADA

BRITISH COLUMBIA

(Special Correspondence.)—The Hercules M. & S. Co., composed principally of Spokane men, has acquired and is to develop the Reco, Trachyte, and Buffalo claims on Copper mountain, situated 15 miles south of Princeton. In the group are said to be three fissure veins, on one of which is a 4-ft. vein of copper ore. Those interested comprise N. S. Pratt, Peter Hoogenbaezem, R. H. Hughes, J. E. McCauley, Andrew Anderson, and R. L. Sheppard. It is claimed considerable money has been spent on development.

Princeton, February 17.

(Special Correspondence.)—A discovery of 6 ft. of steel galena, assaying 170 oz. silver per ton, has just been made on the 1000-ft. level of the Rambler-Cariboo mine. Another find of importance was made in the Standard mine, Silverton. The No. 6 tunnel, the heading of which has been in concentrating ore for some distance, now has 2 ft. of galena ore of shipping grade, though it is more than 100 ft. from a point vertically under the beginning of the ore-shoot opened on No. 5 level. The width of the vein on No. 5 level is 41 ft. at its widest point. Much of this ore is suitable for concentrating, though there is a strip of silver-lead ore near the foot-wall over 4 ft. wide that will assay 65% lead and 90 oz. silver per ton. Two gold bricks were shipped from the Nugget mine last week valued at $8000. This was the result of 26 days run of the 4-stamp mill. Ore is being shipped from the Molly Gibson mine of the Consolidated company over the new tram line, which has a length of over 4½ miles. The shipments of ore and concentrate from the Slocan-Kootenay district for the week ended February 11 amounted to 5114 tons.

Nelson, February 18.

(Special Correspondence.)—The Consolidated company has placed the Phoenix Amalgamated on a producing basis, and shipped 380 tons of ore to the Trail smelter last week. Operations are also continued at the Snowshoe. This concern may build a cyanide plant at Boundary Falls to treat the ore from the No. 7 mine. The ore shipments from the Boundary district for the week ended February 11 aggregated 40,377 tons.

Phoenix, February 15.

Personal

Professional men are invited to send news of their engagements and travels. Such news is interesting to friends.

W. J. Lorino is in London.

E. W. Parker is in San Francisco.

Edmund Juessen has gone to Portland.

Edward J. O'Connell has been in San Francisco.

W. H. Hutchinos is in charge of the Ohio mine, Pearl district, Idaho.

R. B. Lamb, of Toronto, Canada, is in Porcupine, on professional business.

F. K. Boyd is mill superintendent for the Seguranza Mining Co., Zacualpam, Mexico.

G. A. Denny is consulting engineer for the Julieta mine, at Almoloya, Chihuahua.

R. H. Channing and S. A. Lewisohn visited Virginia City, Nevada, on February 12.

Robert N. Bell is again State Inspector of Mines for Idaho, after an interim of two years.

C. B. Lakenan, manager for the Nevada Consolidated Copper Co., was at Salt Lake last week.

A. L. Queneau has opened an engineering office at 929 Chestnut street, Philadelphia, Pennsylvania.

Lee Mantle, of Butte, Montana, has purchased the Jack Waite lead mine, situated near Murray, Idaho.

Kirby Thomas, who spent several weeks in Alamos district, Sonora, Mexico, has returned to New York.

R. B. McGinnis left San Francisco for Brazil, by way of New York, on February 18. He expects to return in August.

Emerson Gee is at the Minas Del Carmen, in the district of Juquila, Oaxaca, Mexico. He will return to Los Angeles March 1.

M. J. Heller, consulting engineer for the Consolidated Arizona Smelting Co., Humboldt, Arizona, was at Pioche, Nevada, last week.

W. H. Landers, superintendent for the Standard Con. Mg. Co., at Bodie, California, is in San Francisco to attend a meeting of the company.

W. J. Thomas has resigned as superintendent for the Seven Troughs Coalition Mining Co., which office he has held for the last three years.

Frederick J. H. Merrill has opened offices at 624 Citizens National Bank Bdg., Los Angeles, for consulting practice in geology and mining engineering.

C. H. Repath, who designed the International smelter at Tooele, Utah, is at Douglas, Arizona, designing some construction work for the Calumet & Arizona company.

F. W. Solomon, assistant superintendent of the concentrator of the Steptoe Valley Smelting & Mining Co., has been appointed superintendent of the concentrator of the Miami Copper Company.

Chester W. Washburn, having finished the examination of Mexican oilfields for S. Pearson & Sons, Ltd., has gone to London. From there he will go to Buenos Ayres to investigate the possibilities of finding oil and artesian water in the western Argentine States.

George Q. Palmer, formerly vice-president, has been made president of the Alberger Condenser Co. and the Alberger Pump Co. Mr. Palmer is succeeded as vice-president in the Alberger Condenser Co. by D. H. Chester, and in the Alberger Pump Co. by W. S. Doran.

The Geological Society of London will this year award its medals and funds as follows: The Wollaston medal to Prof. Waldemar C. Brögger, Sc.D.; the Murchison medal to Mr. Richard H. Tiddeman, M.A.; the Lyell medal to Dr. Francis A. Bather, M.A., and Dr. Arthur W. Rowe; the Bigsby medal to Dr. O. Abel; the Wollaston fund to Prof. O. T. Jones, M.A.; the Murchison fund to Mr. Edgar S. Cobbold; the Lyell fund to Prof. Charles G. Cullis, D.Sc., and Mr. John F. N. Green.

Market Reports

LOCAL METAL PRICES.

San Francisco, February 23.

Antimony	12—12¾c	Quicksilver (flask)	$51—51½
Electrolytic Copper	14½—15¼c	Tin	45—46¼c
Pig Lead	4.75—5.70c	Spelter	7—7¾c

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

METAL PRICES.

By wire from New York.

Average daily prices in cents per pound.

Date.	Electrolytic Copper.	Lead.	Spelter.	Silver, per oz.
Feb. 16	12.25	4.42	5.53	51⅞
" 17	12.22	4.42	5.57	52⅛
" 18	12.22	4.42	5.57	52⅛
" 19	Sunday.		No market.	
" 20	12.22	4.41	5.60	52¾
" 21	12.25	4.41	5.60	52⅛
" 22	Holiday.		No Market.	

ANGLO-AMERICAN SHARES.

Cabled from London.

	Feb. 16. £ s. d.	Feb. 23. £ s. d.
Camp Bird	1 14 7½	1 13 6
El Oro	1 5 7½	1 5 6
Esperanza	1 12 6	1 12 7½
Dolores	1 5 0	1 5 0
Oroville Dredging	0 7 0	0 7 0
Mexico Mines	7 8 9	7 5 0
Tomboy	0 15 6	0 15 0

(By courtesy of W. P. Bonbright & Co., 24 Broad St., N. Y.)

COPPER SHARES—BOSTON.

	Closing prices, Feb. 23.		Closing prices. Feb. 23.
Adventure	$ 5¼	Mohawk	$ 43
Allouez	34	North Butte	28¾
Atlantic	3⅞	Old Dominion	39⅛
Calumet & Arizona	51⅝	Osceola	107
Calumet & Hecla	500	Parrot	12½
Centennial	12	Santa Fe	1¼
Copper Range	67¾	Shannon	11¼
Daly West	3	Superior & Pittsburg	14¾
Franklin	10	Tamarack	45
Granby	34	Trinity	4½
Greene Cananea, ctf	6⅛	Utah Con	13
Isle-Royale	13	Victoria	2
La Salle	4¾	Winona	3½
Mass Copper	7	Wolverine	120

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

MINING STOCK QUOTATIONS—NEW YORK.

(By wire from Catlin & Powell Co., New York.)

	Closing prices, Feb. 23.		Closing prices, Feb. 23.
Amalgamated Copper	$ 64¾	Miami Copper	$ 20⅛
Arizona-Cananea	3¼	Mines Co. of America	5⅛
A. S. & R. Co.	79	Montgomery-Shoshone	⅛
Braden Copper	3⅞	Nevada Con	19¼
B. C. Copper Co.	6⅜	Nevada Utah	1
Butte Coalition	18⅜	Nipissing	11⅛
Chino	21⅞	Ohio Copper	1⅝
Davis Daly	1⅜	Ray Central	1½
Dolores	5⅛	Ray Con	17⅝
First National	2¼	South Utah	⅞
Giroux	6⅝	Superior & Pittsburg	14¾
Greene-Cananea	6¼	Tenn. Copper	38⅝
Guanajuato Con	⅛	Trinity	4⅛
Inspiration	8⅜	Tuolumne Copper	4¾
Kerr Lake	6⅞	United Copper	4¼
La Rose	4⅞	Utah Copper	45⅞
Mason Valley	9⅛	Yukon Gold	4

SOUTHERN NEVADA STOCKS.

San Francisco, February 23.

Atlanta	$ 12	Mayflower	$ 5
Belmont	6.00	Midway	14
Booth	6	Montana Tonopah	94
Columbia Mtn	2	Nevada Hills	2.40
Combination Fraction	13	Pittsburg Silver Peak	75
Fairview Eagle	35	Rawhide Coalition	3
Florence	1.90	Round Mountain	41
Goldfield Con	6.70	Sandstorm Kendall	10
Gold Kewenas	6	Silver Pick	5
Great Bend	1	St. Ives	16
Jim Butler	28	Tonopah Extension	1.15
Jumbo Extension	37	Tonopah of Nevada	8.37
MacNamara	15	West End	54

(By courtesy of San Francisco Stock Exchange.)

Decisions Relating to Mining

Specially reported for the MINING AND SCIENTIFIC PRESS.

MINING—LIENS FOR LABOR AND MATERIAL

The procurement of the carbonaceous mineral commonly known as mineral coal, by digging in the earth is termed 'mining'; and the term 'mine' or 'deposit yielding metals or minerals of any kind,' used in the statute of Oregon giving laborers and material-men a lien for the working or development of any mine, lode, mining claim, or deposit yielding metals or minerals of any kind, has been held to include a coal mine, although the term 'mining claim' as used in such statute may not do so.

Escott *v.* Crescent Coal & Navigation Co., (Ore.) 106 Pac. 432. Jan. 1910.

STATE REGULATION OF MINING LOCATIONS

A State may add to the regulations made by Congress for the location of mining claims; but such State regulations must not be inconsistent with those adopted by Congress. And a failure to comply with the State laws and rules will work a forfeiture whether such laws and rules provide for forfeiture for noncompliance or not, and the mining claim becomes subject to re-location by any qualified locator. Such statutes are said to be mandatory and substantial compliance with their provisions are necessary to perfect a valid location.

Knutson *v.* Fredlund, (Wash.) 106 Pac. 200. Jan. 1910.

LOCATION OF MINE—SUFFICIENCY OF NOTICE

The statute of Washington requires a lode discoverer to record in the county auditor's office within a certain time a notice containing the name of the locator, the date of the location, the number of feet in length claimed on each side of the discovery, the general course of the lode, and such a description of the claim by reference to some permanent monument as will sufficiently identify it. In a controversy arising under a notice of a lode location under these statutes, it was held that location notices which did not designate the point of discovery, or state the number of feet in length claimed on each side of the location, or the general course of the lode, or identify the claim by reference to some natural monument, were insufficient; and in an action to recover possession of such a claim it was also held that an amended notice of location which did not cure the defects in the original notice was not proper evidence.

Knutson *v.* Fredlund, (Wash.) 106 Pac. 200. Jan. 1910.

LOCATION OF MINING CLAIM—EFFECT OF FAILURE TO WORK

The statute of Montana requires performance of the following acts in order to constitute a valid quartz lode mining location: (1) discovery of a vein or lode; (2) the posting of a notice of location at the point of discovery containing certain designated matters; (3) the marking of the boundaries on the ground, and the doing of certain development work; (4) the filing for record of a declaratory statement containing the matters mentioned in the statute. Under this statute the failure, among other things, to perform the designated work will forfeit the location. But no one but the Government, or a subsequent locator, can complain of a failure on the part of the original locator to do the necessary annual work, and a subsequent locator is not in a position to make complaint until he himself has completed a valid location; and if prior to the completion of such valid subsequent location, the original locator has resumed work upon his claim in good faith, he thereby saves his claim from such forfeiture and such subsequent locator can take no advantage of such delinquency. And in all actions or controversies for the forfeiture of mining claims the rule is that every reasonable doubt will be resolved in favor of the validity of a mining claim as against any effort or action of forfeiture.

Thornton *v.* Kaufman, (Mont.) 106 Pac. 361. Jan. 1910.

Book Reviews

Any of the books noticed in this column are for sale by, or can be procured from, the MINING AND SCIENTIFIC PRESS.

COMMERCIAL HANDBOOK OF CANADA FOR 1911. By Ernest Heaton and J. B. Robinson. Pp. 540. Index. Seventh edition. Toronto, 1911.

This annual has become a necessity to those having commercial interests in or with Canada. It contains a vast amount of information conveniently arranged in concise form. It also gives much needed information relative to the development of the natural resources of the Dominion, such as mining, lumbering, farming, manufactures, transportation, commerce, and a great many other things, including various tables which are always useful for reference. Price $1. Postage 10c. Heaton's Agency, Toronto, Canada.

DESCRIPTIVE MINERALOGY. By E. H. Kraus. Pp. 332. Ill. George Wahr, Ann Arbor, Michigan, 1911. For sale by the *Mining and Scientific Press*. Price $2.75.

This is a complete and well prepared volume on descriptive mineralogy, the usual sections on the determination of minerals by means of the blow-pipe and on the optical properties of minerals having been omitted. Blank pages for notes are interleaved, making a rather bulky volume. Of the making of books there is no end, and authors do not always feel the necessity of presenting a reason for adding to the already bulky literature of the subject. Presumably in this case it is the presentation of mineralogy in a form better adapted to student needs than the 'big Dana,' while retaining the Groth classification. The less scientific classification by bases seems better adapted to the teaching of mineralogy to mining and civil engineering students. Presumably this volume is intended as a textbook for such students, but it is difficult to understand how time can be spared in an engineering course for so extended a treatment of only a portion of the subject of mineralogy. The illustrations in the book are confined to diagrams in the text, so that it is somewhat lacking in this regard, but the paper and press work are good.

T. T. R.

METALLURGY OF LEAD. By H. F. Collins. Second edition, revised and enlarged. Pp. 538. Ill., Index. Chas. Griffin & Co., London, 1910. For sale by the *Mining and Scientific Press*. Price $6.

This is a revised and enlarged edition of the valuable work which first appeared in 1899. So much new material has been added in bringing it up to date that, in addition to increasing the page size, the present volume contains 170 more pages than the first edition. Advantage has been taken of the opportunity to rearrange the chapters so that the presentation of the subject is more logical. The author calls attention to the fact that the two best known texts on the metallurgy of lead are national in character and expresses a desire to make his own cosmopolitan. This, the second edition, may fairly claim to be, though the first scarcely attained the desired ideal. The excellences of the work are so many that their enumeration would require much space, so that a commendation of the description of blast-roasting, of the more advanced discussion of the principles of smelting, and the more complete description of a modern plant and of present-day practice, and especially of the much more complete and better chosen list of examples of lead smelting practice throughout the world, must suffice. There are new chapters on electrolytic refining and flotation processes and recent improvements in the collection of flue-dust are described. By omitting matter that is of little present importance Mr. Collins has made the first step toward the production of an ideal text on metallurgy, one where lengthy descriptions of archaic methods are omitted and a full description of the uses and applications of the metal in question is given. It is quite the best presentation of the metallurgy of lead which we have as yet.

T. T. R.

COMMERCIAL PARAGRAPHS

The Edgar Allen American Manganese Steel Co., has moved its general Eastern sales office to New Castle, Del., one of the manufacturing plants of the company.

The Joshua Henuy Iron Works of San Francisco was the first concern to reserve space for an exhibit at the Panama-Pacific International Exposition, to be held in San Francisco in 1915.

The General Engineering Co., Salt Lake, has added a second story to its building, moved its offices and drafting-room to the second floor, giving double its former floor-space for the ore-testing plant. A cement-testing department has been added to the business of the company.

The Sullivan Machinery Co. announces the opening of a branch office at Spokane, Washington. Austin Y. Hoy will be in charge. Announcement is also made that Howard T. Walsh has been appointed manager of the London office and that J. C. West comes to the Pacific Coast as manager of that branch.

Herman Nieter, who was formerly New York agent for the Hammond Iron Works and later sales manager for the Canton Boiler & Engineering Works of Canton, Ohio, has recently been appointed general sales manager of The Kennicott Co. of Chicago. The Kennicott Co. is prepared to handle all kinds of steel-tank work as applied to mining plants, oil refineries, and water-works. It also manufactures water softeners.

The Wedge Mechanical Furnace Co. has been organized to take over the furnace business of the Pennsylvania Salt Manufacturing Co. The officers of the new company are the same as the old, with the exception of Utley Wedge and Leslie H. Webb, who have been added to the furnace company's staff. The sales of the Wedge furnace have been increasing very rapidly during the last year, and it is a significant fact that the first sale has almost always led to further orders.

Among the growing industries on the Pacific Coast are those represented by the Leona Chemical Co., with offices in the Albany building, Oakland, California. The Leona Chemical factory in Oakland started several years ago the manufacture of sulphuric acid, and the raw material from which it is made is procured from mines which this company owns and operates at Leona Heights. With sulphuric acid as a base, the manufacture of other commercial acids, such as nitric, muriatic, etc., was soon taken up, and then followed the production, one by one, of such industrial chemicals as are used in the arts and manufactures about the bay cities. Alum and aluminum sulphates are being made for use in the manufacture of paper and paints, also in the preparation of leather and as a mordant for dyeing. It is used in large quantities in winter, for purifying and clarifying water. It is made from bauxite with sulphuric acid. Barytes and other salts of barium are produced in large quantities for use in the manufacture of mineral paints, pottery, glass, and sugar refining. The crude baryte ore comes from large deposits which this company owns at El Portal, the entrance to the Yosemite valley, whence it is shipped to Oakland for grinding and refining. The finished product is a fine, impalpable white powder, and has become in such demand that the Leona company plans to erect a large mill in the future, for grinding the ore and manufacturing other salts of barium. Electrolyte is another of this company's prominent products used entirely for storage-battery purposes. This is an especially pure sulphuric acid. The Leona quarry, situated in the hills of Oakland, at Leona Heights, was opened 20 years ago and has been in continual operation since that time. The rock quarried is a hard, clean, blue trap rock, particularly well adapted for both concrete and macadam purposes. During the past year and a half, the operating machinery has been completely changed, the old plant having been torn down and new and large equipment installed, having a daily crushing capacity of over 1500 tons. The rock is quarried by glory-holes, from the base of which it is fed directly into cars hauled by electric locomotives out of a tunnel to the crushers. The rock is automatically dumped from the cars into the crushers and is conveyed down the hill by means of a 24-in. rubber belt-conveyor over 1800 ft. to screens on the bunkers at the foot of the hill. The company has its own power-plant, consisting of three double-cylinder Doak gas-engines which were manufactured in Oakland. These develop 450 hp. to drive the generators, compressors, machine-drills, crushers, conveyors, and screens. The crushed rock is delivered at the bunkers to the California railway, which has direct shipping connections with the Southern Pacific, Western Pacific, and Santa Fé railroads and also with the Oakland Traction and Key Route systems, thus giving varied and far-reaching outlets for the products. The officers of the Leona Chemical Co. are F. M. Smith, president; Wm. L. Locke, vice-president; Dennis Searles, secretary; Roland L. Oliver, general manager, and Harry P. Stow, general superintendent.

Lap-welded pipe may now be obtained in sizes larger than 30 in. The American Spiral Pipe Works of Chicago is now making lap-welded pipe from open-hearth flange-steel from 55,000 to 65,000 lb. tensile strength, in sizes from 12 to 72 in. diam. After the pipe is welded, it is again heated in a large annealing-furnace and thoroughly annealed, thus removing any strains that may have occurred during the process of making. Test-bars cut from the welded seam show the weld possesses remarkable strength, and in many tests the strength was in excess of 60,000 lb. per square inch. In a test-bar cut from the welded portion of 20-in. pipe, ¼ in. thick, the metal broke under a strain of 62,520 lb. per square inch at a short distance outside of the weld, while a bar cut from the same pipe away from the welded seam stood 60,370 lb. per square inch. However, the makers do not claim the welded seam to be stronger than the material from which the pipe is made, but do claim to be making a weld which will average close to the maximum strength of the plate from which the pipe is made, and a weld which enables them to use the best grade of flange-steel of 60,000 lb. tensile strength. A length of 24-in. inside diameter pipe, ¼ in. thick, was tested for fatigue of the metal, to see if the weld would weaken under repeated strains. The pressure was brought up to between 900 and 1100 lb., nine different times, the pipe showing no signs of fracture, although it had bulged out 1¼ in. diam., stretching the metal about 4 in. Finally on the tenth test, a small fracture occurred near the weld. As the internal diameter of this pipe was then 25¼ in., the strain on the metal was in excess of 55,000 lb. per square inch. A length of 20-in. inside diameter pipe, ¼ in. thick, was crushed in a hydraulic press for the purpose of testing the welded seam. Although the seam was badly folded together, it remained perfectly tight under water-pressure. It may be of interest to note that the total end-pressure required to crush this pipe was 565,000 lb. The pipe is used for high-pressure hydraulic lines, condenser piping, compressed air, and in places where severe duty is required.

CATALOGUES RECEIVED

The J. Geo. Leyner Engineering Co., Littleton, Colo. Bulletin 1026. 'Tunneling on the Los Angeles Aqueduct,' Illustrated. 16 pages. 6 by 9 inches. Bulletin 1027, 'Reprints Advertisements.' Illustrated. 12 pages. 6 by 9 inches.

Allis-Chalmers Co., Milwaukee, Wis. Bulletin No. 1432. 'Stamp Mills, and Accessory Machinery for Free-Milling Gold Ores.' Illustrated. 60 pages. 8 by 10½ inches. No. 1445. 'Electric Hoists.' Illustrated. 28 pages. 8 by 10½ inches.

Earle C. Bacon, Engineer, New York. 'Hoisting Engines, Mining Machinery, Etc.' Illustrated. 134 pages. 7½ by 10 inches. Catalogue A, Fifth Edition. 'Ore and Rock Crushing Machinery.' Illustrated. 80 pages. 8 by 10¾ inches.

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EDITORIAL

JAPANESE laborers continue to return to their home country, figures for 1910 just made public, showing an excess of 3899 in the arrivals in Japan, over America.

OIL MEN in California are rejoicing over the passage by the Senate at Washington of the remedial legislation already passed by the House and designed to allow perfecting of title to lands under dispute.

GOLDFIELD CONSOLIDATED in January earned $552,627, according to the report issued last week. The gross output, from 27,192 tons milled, was $798,177; the tailing ran $2.03; net recovery $27.32. Development amounted to 4004 feet and is said to have yielded satisfactory results.

PHOSPHATE deposits have been entered under both the lode and placer laws and there has been no final decision as to which form of entry is correct. The House at Washington passed last week a bill providing that in case of conflict between locators under placer laws and the lode laws, the respective rights of the claimants should be determined as though location under either law was valid at the time the entry was made. This will clear away some existing conflicts but the main matter remains undetermined.

SPELTER production of the United States in 1910 amounted to 269,184 short tons, while consumption was 245,884, according to figures prepared by Mr. C. E. Siebenthal of the U. S. Geological Survey. Apportioned according to the source of the ore, 140,651 tons came from Missouri; 23,238 from Colorado; 20,952 from Wisconsin; 20,217 from New Jersey; and smaller amounts from other States. Kansas led in smelting, with 105,697 tons, while Illinois produced 73,038, and Oklahoma 34,760. The year was one of increased production and decreased consumption.

INDUSTRIAL safety is to be promoted by a new society which has taken the name of 'The Industrial Safety Association.' The mining industry is appropriately represented in its control with Mr. Philip T. Dodge on the board of managers and Mr. Charles Kirchhoff among the vice presidents. The object of the society is to prevent accidents to life, limb, and body of persons engaged in productive industry, and to promote health and well being of wage earners by disseminating knowledge of sanitation and hygiene. There is evidently a large and useful field

open to the society. It is proposed to hold exhibitions of safety appliances, to furnish lectures in industrial centres, and to distribute reports, pictures, and leaflets designed to inculcate sound notions of sanitation and hygiene. The Association will depend on membership dues for funds. It deserves hearty support from mine and works managers.

STEAM-SHOVEL mining has long been in vogue in the Lake Superior district where the cheapest iron mining is done by means of steam-shovels in open pits. When the porphyry copper mines came to be opened in the West the same method was applied. Small shovels are employed underground in the Joplin zinc mines, and at Blair, Nevada, a shovel is used in mining gold ore. Generally, gold ore does not exist in large enough bodies to warrant introduction of steam-shovels, but none the less mining engineers evidently need to know more about these powerful machines. They have too long allowed civil engineers their exclusive use. Whether or not steam-shovels can be introduced to advantage is not always easily determined. Their field is limited. If the scale of work is such that only one shovel can be used, there is doubt as to their adaptability, though in the Lake Superior region they are used individually in 'milling' pits where the ore is handled underground. In large work they permit selection of material. In crowded quarters the rule works the other way. Steam-shovel mining involves more than ordering a shovel by telegraph. There are problems of trackage, of grades, of blasting, and of handling material, that are peculiar to this form of work. Some of these are discussed in this issue by Mr. E. E. Barker on the basis of experience at the Ely copper mines.

STATE CHAPTERS of the American Mining Congress are being organized. The usefulness of such chapters will depend on the character of the men who go into them, and particularly on the executive officer. The Colorado chapter is conspicuously fortunate in the men who are active in its affairs, and in its secretary, Mr. A. W. Warwick. Regular and special meetings have been held for discussion of bills introduced into the State Legislature and affecting mining. Active campaigns have been inaugurated for and against a number of bills, and there can be no doubt that much good is being accomplished. The best way to fight a bad bill is by well-directed publicity; and there are always bad bills. The best way to secure enactment of good laws is by intelligent attention to the bills introduced. Many a good cause has been lost by poor presentation, and successful campaigns can only be waged after thorough preparation. The man who sits back and does nothing but criticize deserves little sympathy if there remain a large field for his activities in that direction. Organized effort is essential to success. In California, since the practical demise of the California Miners' Association, there is no organization that can speak directly and authoritatively for the mining industry. When any law is proposed in which mining men are interested they must work for or against it as individuals. The bill that we discussed last week, proposing regulation of smelters, is one of first importance to the whole mining and chemical industry, and yet the miners' side is being presented by a few men representing corporations directly interested. However fair and able a presentation of the case these men may make, their work will be discounted in advance by their direct self-interest and the present anti-corporation sentiment. The matter is, however, one of vital import to many more than the managers of smelters and acid works, and this instance is typical of what comes up in every American State from time to time. Mining men should be fair about such things. Don't leave the corporations to fight your legislative battles and then object to 'big business' in politics.

Mineral Resources of Japan

In one of our recent issues Mr. T. Haga described some of the difficulties which have been encountered in the operation of the Imperial Japanese Iron Works at Wakamatsu, in the northwestern part of the island of Kiushu. Iron and steel constitute almost exactly one-half of the import trade of Japan in mineral products, kerosene forming about one-half of the remainder. In 1909 of a total mineral import trade of 53,328,897 yen, iron and steel amounted to 26,878,724 and kerosene 11,657,300 yen. To offset this there was a total mineral export of 43,221,316 yen, of which copper constituted 21,071,383 and coal 17,297,139 yen. This situation presents certain features of broad significance from a strategic standpoint. Iron, steel, and kerosene are so essential to the daily life of the Japanese nation that in the event of a war the greatest inconvenience would result from a blockade of commerce. The Japanese Government judged it wise to expend considerable sums in an attempt to develop domestic sources of supply. But the results attained have been most discouraging. Extensive exploration failed to discover either petroleum or iron in large enough quantities to become the basis of an extensive industry, and the iron works, which were constructed on an elaborate scale, exhibit yearly losses of discouraging magnitude, which the Government Board in charge, pressed for funds to carry out the plans for extensive development of all lines of industry, found an oppressive burden. More recently there have been signs of relief. Exploration work in Saghalien has shown the existence of petroleum deposits that promise to become important. Transport from Saghalien to Japan in tank steamers would be easy, and both Saghalien and Japan would profit if the crude oil were refined in Japan. It is hoped by the expenditure of 13,000,000 yen at the Iron Works to reorganize the business in such a manner as to compete with imported iron and steel. The ore supply is secured by a contract for a supply of ore of bessemer grade, at a low price, with the mines at Tayeh, China, and is buttressed by the recent discoveries of iron ore in Korea, which has already become a producer in a small way. From a strategic standpoint the difference between importing refined products and raw materials would seem to be exactly the same as that between tweedle-

dum and tweedledee. How adequate returns are to be derived from the sums expended on the attempts to develop these two industries in the decade past, is not clear. Nor is the export of coal to be regarded as an unalloyed benefit. The coal supply of Japan is far from inexhaustible, and the Government looked forward to the possibility of its exhaustion with grave apprehension. With the acquisition of Korea and southern Manchuria this problem has been solved, since the Fu-shun mines now produce nearly a million tons yearly, the Pen-hsi-hu are beginning to produce, and Korea has already developed a small output of good coal. These mines have been developed with capital furnished jointly by the Government and the principal colliery owners of Japan, so that the important part which these new coalfields are already taking in supplying the export trade is not a source of loss to the coal producers of Japan, the profits from the Manchurian and Korean mines more than repaying any slight decrease of profit in the operation of the mines in Japan, while the great object of conserving her resources is firmly secured.

The Belmont Mine Fire

The fire at the Belmont mine at Tonopah, Nevada, has spread a feeling of sadness throughout the world of metal mining. The story is the usual one of unpreparedness, of underestimation of danger, of prompt response to the call for volunteers, and of heroic efforts to rescue the men who were trapped. Both officers and men did their full duty to the best of their ability when once the danger was apprehended; still seventeen men are dead. 'Big Bill' Murphy made two trips with the cage through the smoke, bringing men to the surface. He went down a third time never to return. His story is the same as that of the twelve volunteers who at Cherry, Illinois, under similar conditions, lost their lives in attempting to rescue their fellows. With all its faults, human nature is a fine and noble thing; heroes are found in every emergency. The pity is that the same sacrifice must be made over and over.

In the great coal mine disaster in northern Illinois, November 13, 1909, 259 men lost their lives because of a small fire not promptly attended to, because there were no adequate means of fighting a large fire, because the men were not promptly notified, and because there was no crew trained to fight fire underground. The disaster startled the world, and in Illinois coal mines are now thoroughly equipped with fire-fighting apparatus. Metal miners have been wont to think of the great disasters as confined to the collieries. The experience at the Belmont indicates the contrary, and the accident there does not stand alone. In the nearby Comstock district stories are still told of the great and disastrous fire that once raged underground for days and cost much in life and property. At Butte, Montana, and at Jerome, Arizona, fire underground is a constant menace. Only by unceasing vigilance and excellent supervision have great disasters been avoided. But they have been avoided; and the lesson should sink deep.

The Belmont is an excellent mine, well run and well managed in every particular. At the time of the fire the men in control had taken all the usual precautions, and before criticizing them it would be well to ask how many mines are better prepared for such an emergency. The fundamental trouble is that the customary precautions are too few. It is entirely too common to extend workings from a shaft, winze, or raise, with only one outlet; to provide no control, and especially no emergency control, for ventilation; to use open lights carelessly while handling combustible material; to have no adequate water-supply or fire-fighting apparatus; and more important still, to have no trained men or predetermined system for fighting a fire. We have been in and around mines for years, but we have never seen a fire drill at any metal mine, and at but few have we learned of rules and regulations with regard to fighting fire and rescuing men. Apparatus is important, but training and plans count for more. At none of the mines at Tonopah were there helmets that the men might wear while working in the smoke, and the two sent from Goldfield were incomplete. It is probably just as well that they were, for a helmet is an element of danger rather than safety when worn by a man unskilled in its use. Mr. J. R. Williams has shown that the new apparatus requires new tactics, and the whole plan must be thought out in advance. With such a plan, with proper equipment, and with a corps of trained men, few if any lives would have been lost at the Belmont. Each mine, or at least each district, should have a volunteer crew of rescue-men, another of first-aid men, and an adequate outfit for fighting fires. Methods of handling such situations as that at the Belmont should be thought out and discussed; and a thorough system of promptly notifying the men throughout a mine in case of any accident, should be worked out at every property. The United States Bureau of Mines is doing excellent work in demonstrations and instruction along just these lines. So far its work has been confined largely to the coal mines. When the fire was discovered at Tonopah the nearest mine-rescue car was at Alma, Wyoming. Though the engineer in charge, Mr. Sumner S. Smith, made every effort, delays at junction points and elsewhere prevented his reaching the scene until Sunday afternoon. In some such case, waiting for a delayed connection may cost a score or more of lives. While he arrived too late to be of immediate service, Mr. Smith will remain and instruct a corps of men at both Tonopah and Goldfield with a view to the next contingency that may arise. This is fundamental work and should be rapidly extended. If the present Congress does not provide money for expanding this work so as to cover all mines, its leaders will be derelict in their duty.

The past is gone. For those that are dead we can do nothing, though to their relatives and friends we extend a comrade's sympathy. The future, however, remains to us, and Mr. W. H. Murphy and the others who were killed, will have died in vain if better fire protection be not provided at the mines not only at Tonopah, but throughout the West.

Stopes in Steam-Shovel Mining

By E. E. Barker

How steep a slope may be carried in the bench system of steam-shovel mining, has been the subject of much discussion. Possibly the following details of work in Nevada may be of interest to engineers having similar problems to face.

The slope of the standing bank depends upon the depth to be excavated, as well as the structure and formation of the material, so that a rule can not be formed to fit all conditions, but a general slope may be determined on which to base calculations. In the case of steam-shovel mining of the large low-grade copper deposits, the material mined is usually a variety of the so-called porphyry, which has been subjected to a leaching action, leaving the material in a very porous condition, as for example, the monzonite-porphyry of the Ely district of Nevada. In some cases, as, for example, the altered schist of the Miami district, Arizona, the material was originally much fractured, thousands of veinlets crossing and re-crossing in all directions, giving ready access to percolating waters. In both cases the porphyry when mined, especially in the sulphide zone, breaks into pieces rarely larger than six inches in diameter and more often of a size of which 50% will pass a half-inch screen, or else it crumbles directly on exposure, making the holding of a bank steeper than a slope of 1 to 1 almost impossible. In speaking of the slope ratio in this article, the horizontal will be given first, as 1½ to 1, meaning 1½ horizontal to 1, the vertical. In every case the vertical is taken as the unit. Even if the formation should be of more durable material, as would be the case in granite or limestone, the necessity for heavy blasting to loosen the banks in order that steam-shovel operations could be carried on would so shatter the walls as to prevent the standing of a bank steeper than 0.66 to 1, at most. The recent failure of some slopes of this ratio in the Culebra cut at Panama only tends to prove that, generally speaking, a slope of smaller angle is more reliable in the end. Various reasons have been given for these failures, such as surface flows, surface disintegration, or structural breaks. Since any of these may occur in any formation, the greater the reason for a slope that approaches the 1 to 1 ratio. Since the height of a standing bank is a factor in determining the slope, in the following discussion a height of 50 ft. will be taken for the vertical distance between benches. This distance has been found to be the most advisable for all purposes, including the nearness to which one shovel-cut can follow the one above, and safety in operating the machines. The blasting of this bank is usually accomplished by the springing and firing of churn-drill holes, from 8 to 12 inches in diameter, drilled on each bench by the ordinary portable churn-drill rig. With this height the shovel is seldom in danger of being buried by a slide, and with a horizontal bench

Fig. 1. Steam-Shovels at Ely, Nevada.

of 50 ft. the loading track is not so likely to be buried by the blast, thus avoiding serious and costly delays. Of course, higher banks can be carried, a height of 200 ft. or more being possible, but this would necessitate tunnel-blasting, requiring a heavy tonnage of explosives and naturally a much wider bench, so that in working by benches or terraces the reason for the rejection of this method is obvious, to say nothing of the care necessary to avoid exposing the shovel and crew to danger from a treacherous bank.

The accompanying photograph, Fig. 1, shows the shovels in operation on their respective benches with the higher one slightly in advance of the one below, thus insuring an ample width of bench for the bank when blasted. A churn-drill may be seen above the lower shovel, and the waste and ore trains are in position for loading. The cars in the right fore-

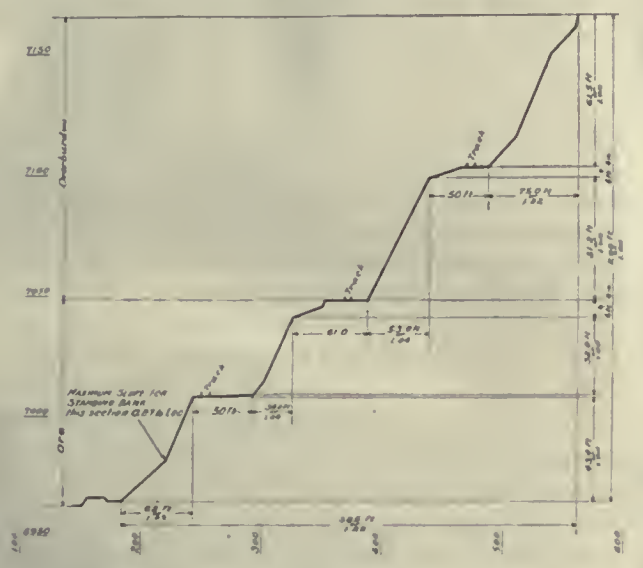


Fig. 2.

ground are loaded with ore, ready for shipment to the mill.

A study of an actual section (Fig. 2) through a bank of the steam-shovel ore-pit of the Nevada Consolidated Copper Co. at Ely, Nevada (the material being, as mentioned before, a monozite-porphyry) shows that the slope between the benches from the upper edge to the toe of the talus below, is a little greater than 1 to 1, varying between 1.04 and 1.43, or an average of 1.18 to 1. The talus, or broken material, that has become loose and has fallen to the bench below, as shown in the diagram, will always be found at the foot of a bank, the quantity varying in amount according to the condition of the standing ground. In the analysis of a steeper section, as shown in Fig. 3, the ratios of the corresponding banks are somewhat less, varying between 0.8 and 1.18, or an average for the four banks of 0.99 to 1. The steepest bank in the shovel-pit is one in the zone of sulphide ore, shown above in Fig. 3, 52.9 ft. high and standing at a ratio of 0.6 to 1. This bank is freshly cut and will stand at this ratio for only a short time, when disintegration will cause it to crumble. It will be seen, then, that an average slope for this height of bank and material will average closely the ratio of 1 to 1, a little steeper in the zone of sulphides and a little flatter in the oxidized material above.

So far the discussion has dealt with banks between the benches, not considering at all the general slope from the bottom to the upper edge of the excavation, which is the real question of moment. This ratio is, of course, much larger since the added width of the bench on which the shovel operates nearly doubles the horizontal distance. In Fig. 2 this ratio over all from the edge of the top to the toe of the bottom bench, will be seen to be 1.92 to 1, and in Fig. 3, 1.76 to 1 for four benches. With the addition of more benches the ratio will not remain the same, but will grow larger by a decreasing amount. Using the ideal section (Fig. 4), with 1 to 1 slopes, 50-ft.

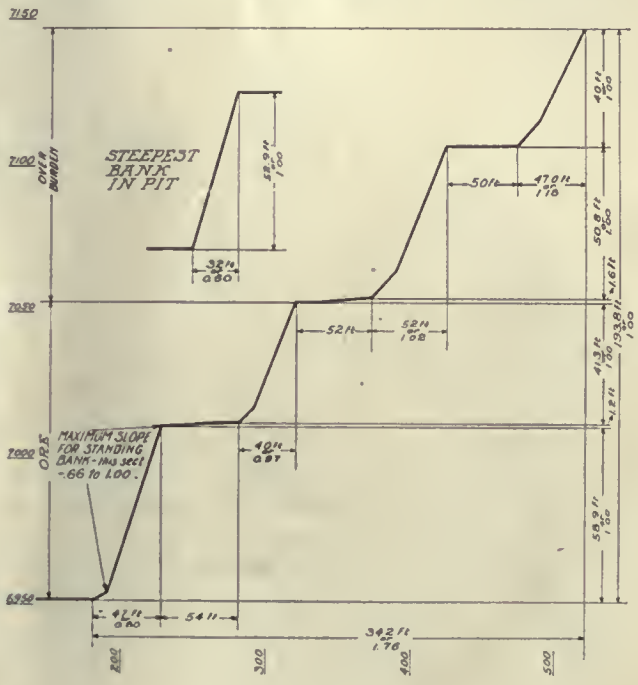


Fig. 3.

benches and 50-ft. heights, the table below will be self-explanatory and tabulates the principle.

Number of benches.	Horizontal distance.	Vertical distance.	Ratio of slope.	Difference.
2	150	100	1.50 to 1	...
3	250	150	1.66 to 1	0.16
4	350	200	1.75 to 1	0.09
5	450	250	1.80 to 1	0.05
6	550	300	1.83 to 1	0.03

From this table the formula below is deduced:

$$S = \frac{na + (n - 1)b}{nc} \text{ or, substituting}$$

$$S = \frac{4 \times 50 + 3 \times 50}{4 \times 50} = \frac{350}{200} = 1.75 \text{ to } 1$$

Let S equal the slope ratio; a equal the base of the individual slope triangle; b equal the width of bench; c equal the vertical height of bank; n equal the number of benches.

Again, with $c = 60$ ft.; $a = 50$ ft.; $b = 60$ ft.; $n = 6$, we have

$$\frac{6 \times 50 + 5 \times 60}{6 \times 60} = \frac{600}{360} = 1.66 \text{ to } 1$$

In the selection of the width of bench, the deciding factor is the slope taken by the blasted bank. Ordinary broken material will repose at a slope of about 1½ to 1, but the impetus given the broken

rock in a blast usually causes the slope to form at approximately the ratio of 2 to 1. Since the drill-holes are placed about 10 ft. from the edge and the blast loosens the ground for about 10 ft. more, the bank, when blasted, lying at a slope of 2 to 1, assumes the position of the dotted line at the top of Fig. 4, still leaving 20 ft. clear on the bench below, which gives ample room to safely accommodate the

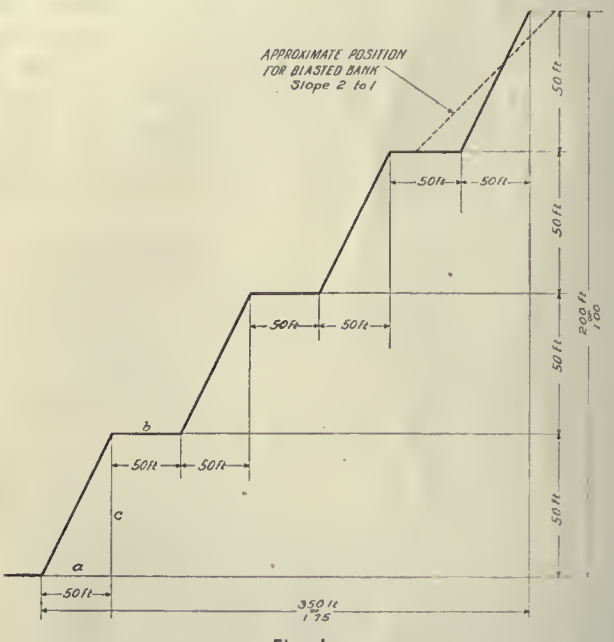


Fig. 4.

loading track without danger of being covered. From the data at hand and with conditions as given above, the section with the minimum bench and the maximum height and slope for economical operation, is the one shown in Fig. 4, with a general slope of 1.75 to 1, or a corresponding ratio for the number of terraces required.

COPPER IN RUSSIA

By S. H. Ball

In a recent interview published in the *Boston News Bureau*, Mr. Ball, who recently returned from Siberia where he investigated copper conditions, discussed conditions as below.

Copper production in Russia for the first six months of 1910 amounted to approximately 25,000,000 lb., an increase of 33%. The yield of this metal has been increasing considerably, the greatest factor being the Ural region. There are four mining regions in Russia, the Ural, Caucasus, Baikal, and Kirghese Steppes. Although the heaviest increase came from the Urals, substantial gains have also been made by the mines of the Caucasus and Kirghese Steppes. The increase in the Ural region has been due primarily to the re-starting of the Demidoffs smelter, which plant, owned by a private estate, has been closed down for two or three years. The Kyshtim Corporation has blown in two furnaces of its new smelter of the Washoe type and is treating 600 tons of ore per day. The ore assays high in sulphur and iron and the first matte carries 20% copper. To obviate further smelting a basic converter is being erected while an electrolytic refinery is already in operation. Best prices obtainable for copper are secured by this company. In all of Russia there is but one other electrolytic refining plant. The Kyshtim estate covers 2000 square miles and a railroad runs into the property. In the Kirghese Steppes there are two important mines. The Spassky mine in southwestern Siberia is one of these. It has a smelter at Spassky, a coal mine at Karagandy, and copper mines at Yuspenssky. A company railroad connects all these points. June production was 224 tons, and by now should have reached 300 tons. The shaft at the copper property is 490 ft. deep; ore runs from 14 to 18% copper. A cost of £29 per ton has been attained, and on November 10 the company paid its first dividend. Its first six months' production amounted to 2,573,172 lb., as compared with 1,760,436 in the same period of last year. The Atbaser Copper Fields Ltd. controls 28½ square miles, the greater portion of which is covered by rock of the ore-bearing series. The mine has been developed by six shafts, and ten drills are now at work. A considerable tonnage has been won and a large amount blocked out either by underground work or drills. The ore occurs either in flat or inclined sheets which are from 18 to over 8 ft. in thickness. The ore is high, averaging from 14 to 17% copper and containing from 45 to 50 oz. silver per ton. The erection of a smelter is now being considered. The company also owns valuable coal claims.

COST OF LITHIUM

The operation of amblygonite mines in South Dakota during the last two years has reduced the price of lithium carbonate from $2.50 to 50c. per pound, and large quantities have been sold at still lower prices. The carbonate is the lithium product most used, and is employed in making storage batteries and fireworks and for medicinal purposes. Lithium, the metal, has no practical use. Lithium bromide is used to some extent in photography and in medicine. In an advance chapter of the U. S. Geological Survey's volume entitled 'Mineral Resources of the United States, Calendar Year 1909,' prepared by Frank L. Hess, the occurrence and extraction of lithium ores are discussed. In 1909 several carloads of amblygonite were taken from the mines at Keystone, S. D., and a few carloads of spodumene were shipped from the same locality by another company. Practically all the lithium compounds prepared in the United States in 1909 were extracted from these ores. The pamphlet can be obtained free by applying to the Director of the Geological Survey at Washington.

Wood may be made acid and chlorine-proof by taking 6 lb. of wood-tar and melting it together with 12 lb. rosin in an iron kettle. Then stir in 8 lb. finely powdered brick-dust. The wood must be perfectly clean and dry before being painted over by the warm preparation. An even better way is to paint the surface with the warm mixture of tar and rosin, allow it to soak in slightly and then dust it over with the powdered brick. The coating must not be took thick or it will soften in hot weather.

Relation of Chemistry to Metallurgy

By Arthur C. Claudet

*Among the large number of processes that might be quoted as illustrating the debt of metallurgy to chemistry, I venture to select the following:

(1) The 'cementation', or precipitation process as applied to cupriferous pyrite at the mines in the south of Spain, and in adjoining districts of Portugal. This group of mines is traversed by a belt of cupriferous pyrite, containing 2% copper, with 46 to 50% sulphur. The processes used on the spot for the extraction of the copper belong both to chemistry and metallurgy. This is a case where chemicals are formed naturally, and in place, for the purpose of rendering the copper soluble. Briefly, the process consists in building up enormous heaps of mineral, so arranged that air can penetrate through them; water is pumped on them, and, aided by the heat of the sun, chemical reactions are set up: the copper sulphides are more easily oxidized than the iron pyrite, and are dissolved by the water. The resulting solution finds its way through the mass of the ore, and, after passing through a filter-bed of small pieces of pyrite, is led by suitable channels to precipitation-vats; where the copper is precipitated by means of pig iron, the precipitate being subsequently collected and sent to the smelting works. The pyrite heaps, after their copper content has been extracted, are sold to sulphuric acid works, whence, after burning out the sulphur, the oxidized residue is sold to iron works to be smelted. The copper precipitate is sold to the copper smelter.

This appears to be a simple process, but it has its complications. The chemist must thoroughly understand the reactions in order to regulate the cost, and to be able to produce a copper precipitate as free as possible from impurities, so that the best prices may be obtained. This requires metallurgical as well as chemical knowledge, that is, information concerning the requirements to which such products must conform at the hands of the smelter and in the market. In this process the main reactions are as follows: Oxidation is promoted by the action of the air, which is naturally warm owing to the climate, penetrating through the heaps, helped by the water percolating through them. When once the oxidation commences, considerable heat is generated; this must be carefully controlled. The copper sulphide becomes copper sulphate, and the iron sulphide becomes converted into ferrous and ferric sulphates. The ferric salt exerts a powerful action on the oxidation of further quantities of copper sulphide, being thereby reduced to the ferrous state, then re-oxidized to ferric sulphate, and so on. The liquor issuing from the heaps contains a large proportion of iron as ferric sulphate, and in order to lessen the consumption of pig iron, this liquor is led through filter-beds of fine ore, so that the ferric sulphate becomes reduced mainly to ferrous. It may here be remarked that much more iron is consumed in precipitating the copper than is required by theory, and this excess consumption is reduced considerably, according to the proportion of the ferric salt present in the liquor, before it enters the precipitation-vats. The number of these vats, which are filled with cast-iron pigs, and the length of the series are determined by the work done by the iron; that is, when the iron consumed costs more than the worth of the copper precipitated, the liquor is run to waste. In the iron precipitation process, the copper precipitate gets contaminated by the impurities present in the iron, and this affects the quality of the precipitate produced during the final stages. The pig iron used varies from 92 to 94% metallic iron, the remainder being carbon and phosphorus. In most descriptions of this leaching process the phosphorus is rarely mentioned. At certain stages of the process the precipitate will therefore contain considerable quantities of these two elements, carbon and phosphorus, and in addition arsenic from the ore itself. The arsenic also is chiefly thrown down in the final stages of the process. It is therefore desirable to collect the copper precipitate in grades of quality, as by doing so the precipitate will command a higher average price. The heaps, after having been denuded of their copper, are sold to sulphuric acid makers all over the world. On the average, the washed pyrite contains 45 to 50% sulphur, and the United States takes a considerably larger tonnage than any other nation.

This is a brief description of an important industry. It requires considerable skill to keep costs down to the lowest limit, and to effect this object it requires well-trained technical men who possess sound knowledge of mineral chemistry and metallurgical requirements. Some years ago the ore was roasted in heaps, but such enormous quantities of sulphurous acid fume were evolved that the agricultural country for miles around the mines was devastated, and the Spanish Government insisted that the mining companies should gradually abandon roasting and adopt the natural weathering process that is now universal—an enlightened policy having regard to the magnitude of the industry locally.

(2) The treatment of Spanish cupriferous pyrite exported direct to Great Britain and other European countries for sulphur and copper extraction. The composition of this ore is much the same as given under No. 1, except that it is richer in copper. This class of ore is first burned by the sulphuric acid manufacturer to extract its sulphur. This reversal of the order of operations as practised in Spain is an example of the influence of economics. In both cases the ore is essentially the same, but one or two per cent more copper permits of its direct shipment to centres where metallurgical facilities are greater, and where consequently a closer recovery can be made, the additional profit outweighing the freight. The burned ore is calcined with salt, and lixiviated with waters containing hydrochloric acid recovered from the furnace-gases by ordinary condensation. The residue, representing the bulk

*Abstract from *Journal of the Society of Chemical Industry*, December 31, 1910.

of the ore, is thereafter sold to the iron smelter. The liquors pass to vats where the silver and gold (present in very small proportions) are separated by means of soluble iodide, and then pass to vats where the copper is precipitated by wrought-iron scrap. The silver and copper precipitates are sold to smelters.

Perhaps I may be allowed to touch upon the Claudet iodide process used in conjunction with the ordinary Longmaid & Henderson wet copper process as practised on this class of ore, more especially as this process is now suffering a lingering death, and I have no interest in it, the patent having expired some years ago. I think I am correct in saying that no other chemical process has ever been able to make a profit out of an ore containing only 1 to 1½ oz. silver per ton and 3 gr. gold, as the Claudet process did some years ago. This was only possible on account of the conditions existing at the time. First, the price of silver was 5s. per oz. when the process was invented by my late father, Frederic Claudet; now the price is under 2s. 6d. per ounce. Second, it was only applicable to copper ores when treated by the Longmaid-Henderson process; these were practically limited to Spanish cupriferous pyrite. The use of this silver process does not interfere with the subsequent precipitation of the copper. In the Longmaid-Henderson process the roasted pyrite, called 'burnt ore', obtained from the sulphuric-acid makers and containing 3 to 4½% copper, is calcined with 10 to 15% rock salt, and the chloridized ore lixiviated with acid water; the resulting solution is then run into vats and the copper precipitated by iron. The strong chloride liquor held the silver chloride in solution, while silver iodide was found to be practically insoluble. The method adopted was to place a series of vats in front of the copper precipitation-vats, and separate the silver therein as insoluble argentic iodide by means of a soluble iodide; the liquor was allowed to settle, decanted, and passed to the copper precipitation-vats. The silver iodide was collected and reduced to spongy metal by means of zinc, the zinc iodide being used for a further precipitation of silver. About 1 oz. of silver and 2 or 3 gr. of gold per ton of original ore were saved, and large profits were made. Under normal conditions, about 10 to 15% of the iodide was lost. The only condition required in the iodide process is that the calcination of the burnt ore with salt needs careful regulation in order to prevent the formation of subchloride of copper, which, if formed in any considerable quantity, militates against the success of the process, cuprous iodide being produced with a loss in iodide. The silver residue, containing 500 to 15,000 oz. silver per ton, was smelted in the usual way.

(3) Pyritic smelting.—In this case it is the metallurgist who comes first. The direct smelting of low-grade pyritic copper ore, perhaps containing silver and gold, which by any other process would be of no value, is now successfully conducted in various parts of the world. The object to be attained is to perform the smelting operation in such a way as by a first smelting to obtain a matte containing 20 to 25% copper, then by a second smelting to obtain a matte containing 45 to 50% copper, the slag from this operation being rich enough to add to the first smelting. This rich matte is then run into converters of the bessemer type, and by blowing air through the mass the combustion of the sulphur is effected, a blister copper containing over 90% of the copper originally present in the ore is obtained, and 95% of the silver and gold is collected. Pyritic smelting has the advantage of avoiding the first roasting operation, as it deals with the metallic sulphides direct, in place of their oxides, and by utilizing the calorific value of a large proportion of both the sulphur and the ferrous iron in the blast-furnace, permits of a great reduction in the consumption of coke, an expensive item in cupola smelting. That portion of the iron which is oxidized forms a base for the silica and thus reduces the consumption of extraneous flux. The portion of ferrous sulphide that remains unoxidized falls as matte, carrying the copper with it.

Pyritic smelting is also practised with pyritic gold and silver ores containing but little copper. Some proportion of the latter is, however, necessary to act as a collector of the precious metals, which the ferrous sulphide matte alone is incapable of doing completely. As small a quantity as ½ to ¼% copper may, in some cases, be sufficient to effect the collection of gold and silver into the matte. Pyritic smelting, in spite of its apparent simplicity, demands constant watchfulness on the part of the metallurgist to secure its maximum advantages. This product is sold to the copper refiner and treated by electro-chemical means, separating copper of 99.9% and over, practically free from impurities, the silver and gold with the impurities remaining in the form of a mud, which is again sold to smelters for re-treatment.

The electrolytic refining of the blister copper is a task belonging to the chemist, but he plays an even more important part in the recovery of sulphur from the furnace-gases evolved in huge quantities during the smelting processes that yield the copper matte. This work has been forced on the chemist on account of the devastating effect of the sulphurous acid gases on vegetation. Agricultural land has suffered so much from their action that unless some method for their elimination from the air were found possible, pyritic smelting in most cases would have to cease, and large smelting works would be compelled to stop. The best way to suppress a nuisance is to turn the cause into a source of profit. During the last few years these deleterious gases have been turned to account, and large quantities of sulphuric acid are now made from them by the 'contact' process, and the intensive chamber process. In dealing with immense quantities of ore, as in pyritic smelting, every endeavor in the way of reducing working costs has to be made, and as the plant must be made and designed for as nearly automatic working as possible, the mechanical engineer takes a prominent part. I may mention here that the sulphuric acid is mainly used

for the manufacture of superphosphates, the raw phosphates being shipped to the works from a long distance. Thus, instead of pyritic smelting being a curse to the agriculturist, it becomes a blessing.

(4) Broken Hill lead-zinc-silver sulphide ores. Here the whole treatment consists in an association of chemical and metallurgical processes gradually evolved during a period of many years. The ore consists of an intimate mixture of galena and zinc-blende, with garnetiferous schist, but the rocky gangue has so high a specific gravity that it can not be separated by ordinary methods from the blende. Hence for many years the zinc tailing (after separation of the bulk of the lead) lay accumulating, in millions of tons, awaiting the advent of a suitable recovery process for zinc. At the present time the ore is crushed and jigged, and a concentrate produced containing 65 to 70% lead, 5 to 10% zinc, and about 20 oz. silver per ton of concentrate. This is smelted to obtain lead containing the silver and a small quantity of gold. The lead is desilverized in the ordinary way, producing almost pure market lead, and silver bullion containing an amount of gold sufficient at least to pay the cost of refining and a possible additional profit. Here you will realize that the metallurgist and the chemist are equally necessary.

The lead concentrate is now more successfully smelted by interposing, before smelting, an agglomeration process such as the 'pot-roasting' process, which consists in roasting concentrate mixed with lime, or carbonate of lime, yielding a product that is in a suitable mechanical condition for smelting, and making sulphurous acid more simply and cheaply. The first to prove the great efficacy and economy of 'pot-roasting' processes were Huntington and Heberlein, these inventors using lime. Carmichael and Bradford modified the method by the employment of gypsum. Savelsburg uses carbonate of lime. In essential features these various methods closely resemble one another. The crushed ore or concentrate, after incomplete roasting to a low sulphur content (say 6 to 7%), is mixed with a suitable amount of reagent, charged into a 'pot' or other receptacle, ignited at the bottom, and 'blown' by a strong air current. The reaction being strongly exothermic, no additional fuel is required, and torrents of sulphurous acid are evolved. After the 'blow' is complete the agglomerate is discharged (broken by the fall into suitably sized lumps), and sent direct to the blast-furnace for reduction to lead-silver bullion. Not only is the necessary agglomeration economically effected in this way, but richer sulphurous acid gases are claimed to result for utilization as acid, while, finally, the lead recovery is increased by some 6 or 7 per cent.

In producing the lead concentrate, the zinc tailing (a product known locally as 'middlings') carries considerably more zinc, weight for weight, than the original ore, considerably less lead, and about the same amount of silver. After years of experiment, physico-chemical processes have at length been devised for the treatment of this product also. It is ground fine, pulped with slightly acid water, and then stirred with a small quantity of oil. The oil coats the particles of sulphides with a thin film. These oiled particles are brought to the water surface and, having once broken through it, they float by virtue of the surface tension of the water. In two or three instances the raising of the oiled sulphides to the surface is effected by causing small gas bubbles to become attached to them while submerged. The scum or film of valuable metals is removed by different mechanical methods, while the gangue or valueless material is left unaffected in the liquor, and after subsidence and separation, is sent to the waste-heap. Over a million tons of accumulated tailing has been treated at great profit by this essentially physical method, and Broken Hill has now become as great a zinc producer as it formerly was famous for its lead and silver. Already one mine alone produces one-tenth of the world's total output of zinc ore. In this way, valuable products are obtained at the present time. Here the physicist, the chemist, and the mechanical engineer help the metallurgist. If, however, this zinc concentrate is smelted for the production of spelter on the spot, then the metallurgist takes a prominent position; but the chemist does also, for in the production of spelter the concentrate must be roasted, and he has to endeavor to turn to account the sulphurous fume from the roasting to form sulphuric acid, to be used, if possible, in the production of superphosphates.

(5) The manufacture of copper sulphate. At first sight this would seem to be a chemical process, pure and simple, but on looking into it, various metallurgical operations are found to play a part in the process. Copper sulphate is produced on a large scale, either by the direct treatment of smelted copper or as a by-product from some other process, such as in the refining of silver and gold bullion, where copper is used as a reagent, and has to be recovered.

As a direct process, the smelter in its operations produces copper bars, which may contain silver and gold; these are granulated and treated with sulphuric acid, and, with the aid of air, the copper is brought into solution, from which the copper sulphate is crystallized out, leaving an insoluble residue which is smelted for its silver and gold. An important factor in this process is that iron sulphate, the enemy of copper sulphate, is nearly absent from the copper sulphate crystals. As a by-product, this salt is obtained in the process of refining silver and gold bullion, a suitable alloy being made up by melting the bullion with silver 2¼ times the weight of gold and copper ¼ the weight. This mixture is granulated and boiled with sulphuric acid in suitable vessels; the gold remains as a mud, which is collected and melted into bars; the silver goes into solution and is precipitated by metallic copper, to be melted into silver bars. The liquor is then subjected to crystallization and yields copper sulphate, thus recovering in a marketable form the original copper added in the refining process to precipitate the silver.

(6) The cyanide process of gold extraction is an

instance of the help that the chemist can give the metallurgist. It is a purely chemical process, which both increases the extraction of gold from ores and enables greater profits to be made than if any other process were adopted. Although apparently simple in application and in the plant required, reactions of great complexity occur, and as the cyanide solutions are used over and over again, they become highly complex in constitution and require careful study, because the compounds produced may accelerate or retard the solution of gold. The zinc-gold mud produced has to be refined by acids, and smelted to produce bars of bullion. One process of refining this mud is cupellation with litharge in a large furnace, involving a purely metallurgical operation. Without the aid of the cyanide process, the gold extraction obtained from the Rand ores would be 20 to 30% less than at present. The application during the last few years of the process to silver ores, especially in Mexico and the United States, must be noted. The large quantity of cyanide required for precious-metal extraction necessitated improvements in its manufacture to reduce its cost of production, and thus the metallurgy of gold has benefited a large chemical industry.

It may be recalled that at the outset of the cyanide process potassium cyanide cost 4s. per pound, and the consumption of this chemical was high. Thanks to the aid of the industrial chemist, potassium cyanide now costs nearer 6d. per pound, while the consumption has been reduced (as regards loss) to but very few ounces per ton of ore. In a recent case brought before the notice of the Institution of Mining and Metallurgy the total cost of extracting gold from one ton of ore, for potassium cyanide, power, and labor, amounted to only 11 pence.

(7) **The Pearce process** of treating auriferous copper was the product of both chemist and metallurgist. The main feature in this process, which has now been replaced by later methods, was the discovery by Richard Pearce that a granulated alloy of copper and gold, when melted with iron pyrite, yielded some of its copper to form a matte, but the gold remained in the unattacked copper; by repeating the process a number of times the whole of the copper is separated from the gold. This method was worked in conjunction with the well known Swansea smelting and the Ziervogel processes, the latter of which is of a purely chemical nature.

(8) **Treatment of the arsenical cobalt and nickel-silver ores** now being mined in Ontario affords an interesting field for research work for the chemist and the metallurgist. These ores are rich in silver, often yielding several thousand ounces per ton. Great difficulties are involved in their satisfactory treatment; arsenic may reach up to 30%, cobalt and nickel 10 to 15%, in each case. Efforts have also been made to save not only the silver, but also the cobalt, nickel, and arsenic. The present treatment is to smelt these ores with lead, thereby extracting a large proportion of the silver; in this operation a speiss is obtained consisting of arsenic, cobalt, and nickel, with several hundred ounces of silver per ton.

DONT'S AND EXPLOSIVES

Miners' Circular No. 1, the first of a series to be written in plain, non-technical language for the benefit of the miner, has just been issued by the Federal Bureau of Mines. It contains the names of the permissible explosives tested by the Bureau at its Pittsburg station up to November 15, 1910, and gives precautions as to their use. Permissible explosives give a short and relatively cool flame that is less likely to ignite inflammable gas or coal-dust than is the longer and hotter flame of dynamite or the longer and much more lasting flame of black powder. Because they can be used with greater safety, permissible explosives have taken the place of other explosives in many coal mines in the United States during the last two years, and their use is increasing rapidly. The following precautions are urged by the Bureau of Mines: Don't store detonators with explosives; don't open packages of explosives in a magazine; don't open packages of explosives with a nail-puller, pick, or chisel; don't store explosives in a hot or damp place; don't store explosives containing nitroglycerin so that the cartridges stand on end; don't repair a magazine until all explosives are removed from it; don't use permissible explosives, or other explosives, that are frozen or partly frozen; don't thaw frozen explosives before an open fire, in a stove, near a boiler, near steam-pipes, or by placing cartridges in hot water; don't put hot water or steam-pipes in a magazine for thawing purposes; don't carry detonators and explosives in the same package; don't handle detonators or explosives near an open flame; don't expose detonators or explosives to the sun for any length of time; don't open a package of explosive until ready to use the explosive, then use it promptly; don't handle explosives carelessly; don't use more than 1½ lb. of any permissible explosive for one shot in a coal mine; don't use a detonator (blasting cap) or electric detonator of less strength than No. 6; don't crimp a detonator (blasting cap) around a fuse with the teeth; don't economize by using a short length of fuse; don't use in a gaseous coal mine any fuse or other device which emits flame or sparks; don't use coal cuttings or 'slack' or any combustible material for stemming; don't use a metal tamping-rod—a copper-tipped rod is not to be recommended, wooden rods being safer; don't use two kinds of explosives in the same drill-hole; don't return to the face until at least five minutes after a shot has been fired; don't breathe the gases from the shot; don't return to the face after a misfire for at least one-half hour; don't attempt to draw the charge in case of a misfire; don't leave any detonators or explosives in a mine over night; don't charge or load any hole which has not been properly placed or has been drilled 'on the solid'; don't light the fuse of dependent shots at the same time the first shot is lighted; don't expect to get satisfactory results wih a permissible explosive or any explosive when a miner uses it for the first time; don't think that permissible explosives can take the place of other precautions.

A South Dakota Dredge

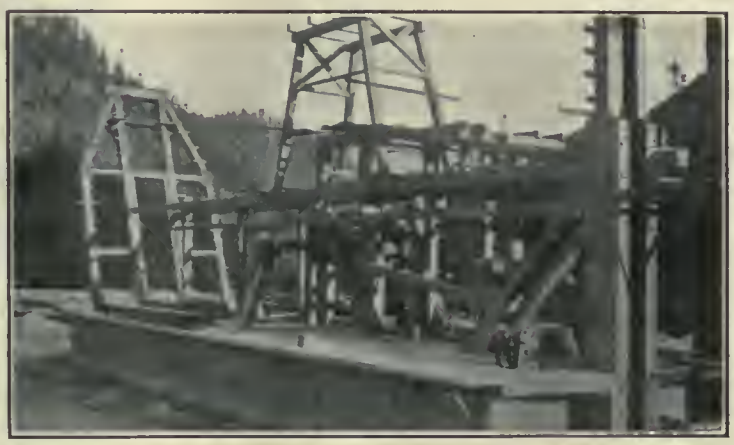
The Castle Creek Hydraulic Gold Mining Co., owning placer ground near Mystie, in the central part of the Black Hills, expects to begin dredging this spring. The hull and framework have already been erected, and the machinery is to be set up as soon as the weather will permit. The dredge is being built by the Stearns-Roger Manufacturing Co. of Denver, under the supervision of J. R. Henderson, whose long experience with the Yuba Construction Co. and the Boston machine-shop at Oroville, assures a good boat. The dredge is of the California type, with close-connected buckets of 5-cu. ft. capacity. The hull is 102 ft. long, 36 ft. 7 in. wide at water-line, 42 ft. wide at deck-line, 7 ft. 10 in. deep, and contains about 230,000 ft. of the best Oregon lumber. The accompanying figure gives a very good view of the boat, showing the framework. It will be noticed that standard lines have been closely followed. One particular feature in connection with the framing is the substitution for the old cast-iron washers, which are placed on top of the stringers, of an angle-iron connection, doing away with all cast iron in the framing and giving a much safer material with which to work.

The upper and lower tumblers, main driving-gears, the buckets, and the rollers, are made of Tiseo steel. The digging ladder, of structural steel, is designed for work at a depth of 35 ft. below water-line. The revolving screen is 6 ft. outside diameter, 26 ft. long over all, and composed of six longitudinal T-bars, 4 by 4 by ½ in. The perforated screen-plates are made ½ in. thick, the holes being reamed to give a slightly larger outside diameter to allow material to pass freely. On the inside of the screens are placed longitudinal bars for breaking up the clay balls. The screen is carried on friction rollers in the usual way.

The pumps are of Buffalo Steam Pump Co. manufacture, and are of the standard centrifugal type, the main pump being 10 inches and the auxiliary 3. These pumps are direct-connected to electric motors. The entire dredge is electrically driven, the motors being of General Electric Co. manufacture, 2300 volts, alternating current. The current is furnished by a power-plant placed on the bank, equipped with horizontal tubular boilers, Corliss engine, and General Electric generator.

The spuds are 24 by 36 in. and 50 ft. long. In steel spuds the method of construction has required countersunk rivet-heads, which, as ordinarily made, weaken the structure. The tremendous strain concentrated upon the spud point causes the rivets sooner or later to loosen, and makes replacement of the spud necessary, together with extensive repairs. To overcome this trouble the builders of the Castle Creek dredge are providing a special construction whereby, by means of angle-iron covering, the line of the spud is brought out beyond the edge of the web plate, so that the rivet-heads can be left full; in other words, they are not required to be countersunk, with the exception of the few heads which come directly into the angle-iron protector. Another detail is the milling off of the lower end of the structural portion of the spud, so that where it enters into and rests upon the cast-steel spud point, the fit is accurate. The cast-steel spud point is made with a shoulder, and the recess caused by this shoulder, into which the structural portion enters, is also machined. This gives an excellent bearing point, with contact all over the surfaces on the sides taking the pull. The spud point is made extra long and of circular section, so that there are no projections or angles to catch when swinging the dredge.

The stacker ladder is approximately 100 ft. long and carries a 30-in. wide, 7-ply conveyor-belt. The idlers are troughing, of the Webster manufacture. The lower tumbler-bearings are of the swivel type, similar to those in use on the El Oro dredges at Oroville. In general, the dredge follows the latest approved construction, but in many details innovations have been made. For instance, larger bearings and a larger proportion of pin area have been allowed. These, though unimportant as regards the general construction of the dredge, are expected to prove extremely important as bearing on the continuous operation of the machinery and of the parts of the dredge, as well as on repair costs.



Castle Creek Dredge, Mystic, South Dakota.

WORLD'S SPELTER PRODUCTION

United States Geological Survey figures for 1909 and 1910, compiled by C. E. Siebenthal, are as below, the figures being given in tons of 2000 lb., and those for 1910 subject to revision.

Locality.	1909.	1910.
Australia	.....	560
Austria and Italy	13,931	14,667
Belgium	184,194	190,243
France and Spain	61,859	64,075
Rhine district (Germany)	82,863	96,454
Silesian district (Germany)	159,731	154,605
Great Britain	65,422	69,535
Holland	21,548	23,123
Poland	8,758	8,960
United States	255,760	269,184
Total	854,066	891,406

Proposed Mineral Law for State of Texas

The following is an abstract of a proposed new law governing the entry and purchase of mineral lands in Texas. The original draft was prepared by a committee from the Chamber of Commerce of El Paso, and a copy has been furnished by H. Vincent Wallace, one of its members.

Section 1.—All land which is now owned by the State of Texas, or the Public Free School land of said State, Asylum, and University land, and all land which may hereafter be so owned, also all land so owned which has been heretofore sold with a reservation of minerals therein, are included within the provision of this Act, and shall be declared to be free and open to exploration, location, and purchase, by citizens of the United States and those who have declared their intention to become such, under regulations prescribed by law, and none other shall acquire rights under this act.

Section 2.—That mineral lands or claims referred to in this Bill shall be known respectively as: (a) lode claims; (b) bedded deposit claims; (c) oil or natural gas claims.

Section 3. Lode Claims.—Mining claims upon veins, lodes, reefs, or ledges of quartz or other rock in place, bearing gold, silver, lead, tin, copper, antimony, bismuth, cinnabar, zinc, vanadium, molybdenum, uranium, manganese, or other valuable deposits shall not exceed 1500 ft. in length by 600 ft. in width, measured in a horizontal plane, and no location or filing of a lode claim shall be made until the actual discovery of the vein or lode in place within the limits of the claim located. The claim or location shall be rectangular in form. The two ends and the two sides shall be parallel respectively.

Section 4.—The locators of all mining locations on lode claims heretofore made or which shall hereafter be made on any mineral vein, lode, or ledge, situated in the State of Texas, their heirs and assigns, so long as they comply with the laws of the State of Texas governing their possessory title, shall have the exclusive right of possession and enjoyment of all the surface included within the lines of their location, and all veins, lodes, and ledges which lie inside such surface lines extended downward vertically, and nothing in this Section shall authorize the locator or possessor of a vein or lode which extends in its downward course beyond the vertical lines of his claim, to enter upon the surface of a claim owned or possessed by another.

Sections 5 to 9, covering Contents of Location Notice, How to Locate a Lode Claim, Equivalent Discovery Work, Time for Discovery Work, and Annual Expenditure, are similar to the corresponding provisions of the State Law of Arizona.

Section 10. Affidavit of Annual Labor.—This provides for the filing of an affidavit in the usual form, on or before March 31 of each year.

Section 11. Bedded Deposit Claims.—Deposits of alum, asphaltum, soda, sulphur, kaolin, fire-clay, borax beds, auriferous cement or auriferous gravel, marble, mica, slate, gypsum, phosphate, guano, and deposits containing precious stones or gems which do not occur in veins, building stone, and coal shall be known as bedded deposit claims. Also bedded deposits or finely disseminated sheets of porphyry rock which contain copper or other valuable mineral but which cannot be traced as veins on the surface shall be classed as bedded deposits.

Section 12.—A bedded deposit claim shall be subjected to location and entry in the same manner as for a lode claim, except that their exterior limits shall conform to the legal subdivisions of the Public Survey, and the size of the claim is limited to 20 acres to each individual or person, and an association of persons may locate a claim in common, not exceeding 20 acres to each individual in the association, and not exceeding 160 acres to the entire association.

Section 13. Provision for Locating Lode or Bedded-Deposit Claims on Lands, the Surface Rights to Which Have Been Sold by the State, with the Reservation of Minerals Thereon.—In the event any land included within the operation of this Act has been heretofore sold by the State with a reservation of the mineral therein for the State or University or Asylum or Public Free School fund or has been purchased by one with a waiver of such one's right to the mineral therein, or if such land should be sold or purchased, the mineral therein which comes within the provisions of this Act shall be subject to prospecting and location, either as lode or bedded-deposit claims, as hereinbefore provided, and may be sold by the State as hereinbefore provided. Anyone desiring to prospect in land described and specified hereinbefore in this Section 13, shall proceed in the following manner: In case the owner or owners of such surface rights and the person or persons making the discovery or location cannot agree as to the value of, or damage to such surface rights, then each party or parties shall name an appraiser and both appraisers present their valuation to the owner and locator, respectively, within fifteen days time counted from the day they are nominated. If the appraisers do not agree, the matter in controversy or right, shall be subject to arbitration as provided in Title 6, Chapter I, Texas Civil Statutes, Volume 1.

Section 14. Patents for Lode and Bedded Deposit Claims, How Obtained.—Any person, association, or corporation authorized to locate a claim under this Act, having claimed and located a piece of land for such purposes, who has or have complied with the terms of this Act, may file in the General Land Office an application for patent, under oath, showing such compliance, together with a plat and field notes of the claim or claims in common, made by or under the direction of the General Land Office, showing accurately the boundaries of the claim or claims, which shall be distinctly marked by monuments on the ground, and shall post a copy of such plat, together with a notice of such application for patent, in a conspicuous place on the land embraced in such plat previous to the filing of the application for a patent, and shall file an

affidavit of at least two persons that such notice has been posted, and shall file a copy of the notice in such Land Office, and shall thereupon be entitled to a patent for the land in the manner following: The Commissioner of the General Land Office, upon the filing of such application, plat, field notes, notices, and affidavits, shall publish a notice that such application has been made, for the period of sixty days, in a newspaper to be by him designated as published nearest to such claim, and he shall also post such notice in his office for the same period. The claimant at the time of filing the application, or at any time thereafter, within the sixty days of publication, shall file with the Commissioner a certificate of the County Surveyor or his deputy, or properly qualified Mineral Surveyor if such be appointed, that five hundred dollars worth of work or labor has been expended or improvements made upon the claim by himself or his grantors; that the plat is correct, with such further description by such reference to natural objects or permanent monuments as shall identify the claim, and furnish an accurate description to be incorporated in the patent. At the expiration of the sixty days of publication the claimant shall file his affidavit, showing that the plat and notice have been posted in a conspicuous place on the claim during such period of publication. If no adverse claim shall have been filed, with the Commissioner of the Land Office, at the expiration of the sixty days of publication, it shall be assumed that the applicant is entitled to a patent, upon the payment to the proper officer of five dollars per acre, and that no adverse claim exists; and thereafter no objection from third parties to the issuance of a patent shall be heard, except it be shown that the applicant has failed to comply with the terms of this Section.

Section 15.—Where an adverse claim is filed during the period of publication, it shall be upon the oath of the person or persons making the same, and shall show the nature, boundaries, and extent of such adverse claim, and all proceedings, except the publication of notice and making and filing of the affidavit thereof, shall be stayed until the controversy shall have been settled or decided by a court of competent jurisdiction, or the adverse claim waived. It shall be the duty of the adverse claimant, within thirty days after filing his claim, to commence proceedings in a court of competent jurisdiction, to determine the question of the right of possession and prosecute the same with a reasonable diligence to final judgment; and a failure so to do shall be a waiver of the adverse claim. After such judgment shall have been rendered, the party entitled to the possession of the claim, or any portion thereof, may, without giving further notice, file a certified copy of the judgment roll with the Commissioner of the Land Office, together with the proper certificate that the requisite amount of labor has been expended or improvements made thereon, and shall pay to the proper officer five dollars per acre for his claim, together with the proper fees, whereupon the whole proceedings and the judgment-roll shall be certified by the Register to the Commissioner of the Land Office, and a patent shall be issued thereon for the claim, or such portion thereof as the applicant shall appear, from the decision of the court, to rightly possess.

Section 16. Bedded Deposit Claims, as described in Section 11 of this Act, shall be subject to entry and patent, under like circumstances and conditions, and upon similar proceedings as are provided for Lode Claims; but where the lands have been previously surveyed, the entry in its exterior limits shall conform to the legal subdivisions of the lands.

Section 17. Failure to Contribute.—This is identical with the corresponding section in the Mining Regulations of the United States.

Section 18. Oil, Petroleum, or Natural Gas Claims. Any person or association of persons desiring to prospect for oil, petroleum, or natural gas on land which is now owned by the State of Texas or the Public School land of said State, and all land which may hereafter be so owned, also all land which has heretofore been sold with a reservation of minerals therein, may do so in the following manner: (*a*) By filing his application, accompanied by the five-dollar fee, with the County Surveyor, for a permit to explore and prospect for oil, petroleum, and natural gas. (*b*) It shall be the duty of the County Surveyor to forthwith transmit such application to the Commissioner of the General Land Office, who upon receipt of a fee of one dollar is hereby authorized to grant to any person or association of persons, corporate or otherwise, a permit, to be recorded in the General Land Office, for an exclusive right to explore and prospect for petroleum, oil, or natural gas, all of same during a term of not to exceed two years, upon a designated tract of Public Land. That upon the termination of the period for which the original permit was granted, and the receipt of satisfactory evidence of the compliance with the conditions prescribed in the succeeding clauses *c* and *d* of this Section 18, when such compliance shall not have led to the discovery of oil or gas in commercial quantities, during the two years covered by such original permit, then the Commissioner of the General Land Office shall grant an extension of the permit for one year, upon the payment by the applicant or his successors in interest, of an additional fee of one dollar per acre. No extension, however, shall be granted, unless satisfactory proof has been duly submitted, as set forth in clauses *c* and *d* of this Section, of the development of such claim. Provided, that the land included in any one permit, granted under this Act, shall not exceed one hundred and sixty acres, and that it shall be in a compact body, whose boundaries shall coincide with the legal subdivisions of Public Land Surveys. (*c*) That before the expiration of six months from the date of permit, the holder or owner of the permit shall commence actual work leading to the physical development of said claim, and on or before the expiration of twelve months from the date of the permit, said holder shall file in the General Land Office his sworn statement that such actual work leading to the physical development of the claim was begun within the six months period dating from the date

of the permit, and that oil or gas has been discovered, or at least one thousand dollars has been expended in drilling, or in purchase of machinery, the installation of water-supply, or other work necessary precedent to, valuable for, and leading up to the discovery of oil or gas, and that a continuous and *bona fide* attempt at development has been made during the six months preceding the filing of said statement; failure to file such a statement, or filing a statement untrue or false, shall work immediate revocation of the permit and termination of the rights of the locator under this Act. (*d*) That during the second year of this permit the holder thereof shall be required to expend not less than three thousand dollars in the physical development of such claim in the manner specified in the preceding clause *c* of this Section, and the holder shall file with the Commissioner of the General Land Office a sworn statement that such expenditure was made as set forth in the preceding clause *c*.

Section 19.—That an assignment by sale, mortgage, or other forms of transfer may be made to any person, association, or corporation qualified to acquire a permit in his or its own right, and such assignment shall be filed in the General Land Office within thirty days after such assignment.

Section 20.—That at any time after granting a prospector's permit or its extension, and before its expiration and cancellation, or the expiration or cancellation of its extension, and before the filing in the General Land Office by the applicant or his successors in interest, of satisfactory proof of the discovery of oil or gas in commercial quantities, which filing must be made within thirty days after actual discovery, the applicant shall have a preferential right to lease the land included in the permit under the following conditions: (*a*) The lease shall be granted for a period of ..... years, or such portion thereof as the lessee shall elect, with the option of a renewal and renewals for equal or shorter periods. (*b*) Application for a lease for the land applied for shall be made within sixty days after the filing of proof of discovery. (*c*) A royalty of ten per cent of the gross receipts for the sale of the oil or gas shall be paid semi-annually, dates of payment to be fixed by the Commissioner of the General Land Office, and paid by the lessee, on the basis of sworn statements of the amount of those receipts submitted by him, on dates of payment as indicated by the Commissioner of the General Land Office, but the book and accounts shall be open to examination and inspection at all times by State officers. And said royalties shall become a prior lien upon all productions of oil or gas from said lease. (*d*) In the event any land included within the operation of this Section has been heretofore sold by the State with a reservation of the mineral therein to the State or Public Free School or Asylum fund, or has been purchased by one with a waiver of such one's rights to the mineral therein, it shall be subject to prospect and leasing as set forth in this Section, and such purchaser who has waived his rights to mineral shall receive one-half of the royalties derived by the fund to which such royalties are accredited, and such royalties shall be in compensation for rights of ingress or egress and for damages done to such surface owner.

Section 21.—Chapter LXXI, Revised Statutes of 1895, and Chapter 99, passed at the regular session of the Twenty-ninth Legislature and approved April 15, 1905, both of which relate to the sale of mineral lands, are hereby repealed.

Section 22.—The fact that there has been sold much land with the reservation of minerals therein, and there being no law providing for the sale of the minerals in such land, creates an emergency, and an imperative public necessity exists that the constitutional rule requiring bills to be read in both Houses on three separate days, should be suspended, and this bill be placed upon its third reading and final passage, and that it take effect from and after its passage, and it is so enacted.

MINERAL RESOURCES OF PRINCE WILLIAM SOUND

Copper and gold prospects in the vicinity of Prince William sound, Alaska, may make that region an important producing centre for those metals. Two copper mines and one gold mine are already in active operation there and a number of other properties have been developed, some of which have made shipments of copper ore. The mineral resources of the region have been examined by U. S. Grant and D. F. Higgins, geologists, who have reported the results of their work in the United States Geological Survey's Bulletin 443. The report includes a large reconnaissance geologic map of the region and a detailed topographic and geologic map of a part of Latouche island. Valdez and Cordova are the two most important settlements in this region. From Cordova the Copper River & Northwestern railway has built about 130 miles of line eastward and northward across the Copper River delta, passing Alaganik, near which is McKinley lake, where there are several gold prospects.

Copper is the most important metal found in the district. It was first discovered in 1897, and the prospect first located was developed into the Ellamar mine, now one of the two producing mines. The second mine, the Bonanza, was located in the same year, and both have been worked commercially since 1900. In 1908, the latest year for which production is given in the report, 1,324,963 lb. of copper, valued at $174,895, was exported from the Prince William Sound region. These figures, however, represent less than half the amount and value of the metal extracted in the previous year. Since this report was printed, the annual copper production of Prince William sound has much increased in value.

Prospecting has been active since 1903, and numerous claims have been located. The copper usually occurs as chalcopyrite, mixed with pyrrhotite and pyrite. The investigations indicate that the ore is of deep-seated origin. Most of it contains gold ranging in amount from 25 cents to $4.80 per ton. The average is probably about a dollar per ton.

Building a Mine-Sluice

By Dennis H. Stovall

The term 'sluice' is usually applied by the Western placer miner to the conduit or water-channel leading across the diggings; the 'flume' is that which carries the water from the head of supply to the reservoir or penstock. The flume is built to remain, at least as long as its hard service and the action of wind and water will allow; but the sluice is not a permanent structure. With the cutting away of the gravel banks, and the moving of the giants and pipe-lines, the sluices, too, must be moved. For this reason the sluice must be built in short sections. Because of its being a 'knock-about' affair, the sluice is one feature of the placer mine too often slighted. Its construction, with some miners, is nothing more than the nailing together

A Well-Built Sluice.

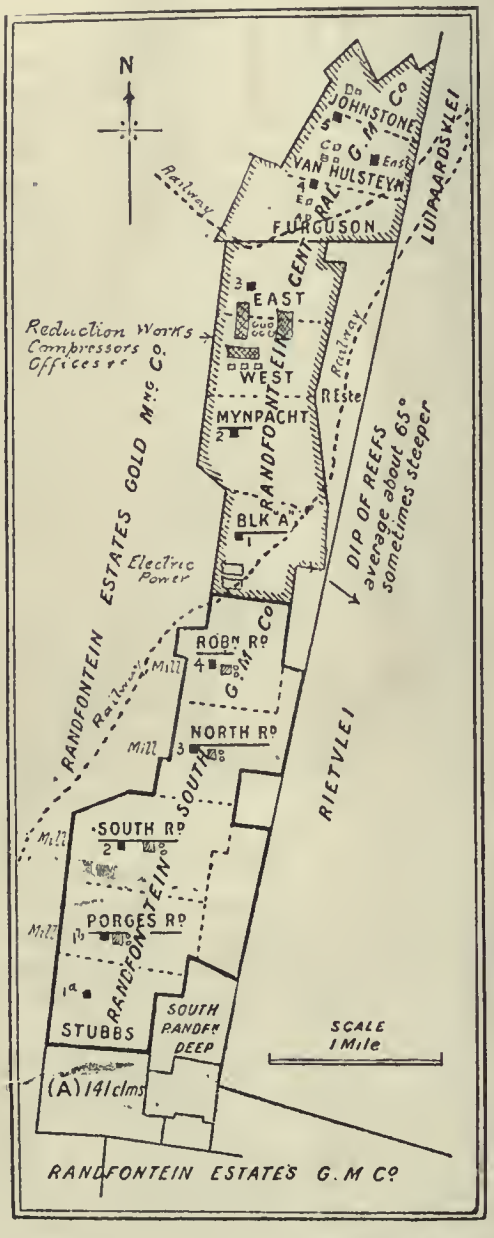
of a few boards, and the making of a trough that will carry water. As a matter of fact, the building of a sluice is important, since upon its construction depends the amount of gold found in the riffles at clean-up. Unless the sluice is solidly built, and properly laid, it will not remain firm when subjected to a constant flow, and to the thumping and pounding of the heavy boulders which must pass through. If it does not remain in place, the riffles will not remain intact, but will become loosened sufficiently to allow the escape of gold, thus causing a far greater loss than would cover the cost of a properly constructed sluice.

Sluices are built in sections, each section being usually 12 ft. long. The width and depth depend upon the number of 'giants' or the flow of water that must be accommodated. A 4-ft. sluice will care for 2 giants, with an ordinary flow of by-water. If only 1 giant is employed, a 3-ft. or even a 2½-ft. sluice is large enough, if given a depth of 2 ft. Placer miners have found by experience, however, that it is advisable not to make the sluice too narrow, as this results in a rapid current and a waste of gold, the fine particles of precious metal not having a chance to settle. Unless the water is spread thinly, or not over a depth of 6 in., the 'flour gold,' as the placer miner calls it, will be lost, as it is carried along in suspension in the upper portion of the current. When the width and depth of the sluice are determined, the next thing is the determination of grade or pitch. A fall of between 7 and 10 in. to each 12-ft. section is enough. The maximum is 12 in. to the section, which gives a grade of 8.35%, and the minimum is 3 in., or a grade of 2.08%. The miner should generally use a grade between these two; for the maximum causes the water to flow too swiftly, and does not allow the fine gold to settle; while the minimum causes a flow that is too sluggish, thus allowing an accumulation of mud and worthless sand in the riffles. If the sluice is to accommodate but one giant, the braces need not be larger than 2 by 4 in., and the boards for the bottom 1 by 12 in. The cross-bottom plates should extend 12 in. beyond the side of the sluice, to give ample room on which to set the braces and build a walk, provided the latter is needed. The better practice, however, is to place cross-sills on the uprights of the sluice and lay a walk of 12-in. boards on these. By having the walk directly over the sluice, the miner has a better opportunity to give it a careful inspection. One end of each sluice section is built with the boards of the floor and side extending 2 in., the other being drawn in an equal distance. This is done to allow the sections to overlap and join snugly, end to end, when placed together in the diggings. The usual practice is to use tongue-and-groove boards for sluice floors. But if the sluice is constructed of lumber that is thoroughly seasoned allowance must be made for swelling when the water is turned on. Carefully selected lumber, with planed edges, and free from knots, even though without tongue and groove, serves very well for sluice construction. Most sluice-building is done in the summer when the lumber is dry, and the natural swelling that later results, makes the floors and walls water-tight. The final touch to the sluice construction is the placing of the false wall-board. The purpose of this is to protect the main wall from the battering of the boulders. It is nailed to the main wall, but only lightly, for it must be removed at clean-up to allow the lifting of the riffles; moreover, it is necessary to replace the boards two or three times during the season, and unnecessary nails only add to the difficulty. If the false wall-boards are used as cleats for holding down block riffles, it is then necessary to nail them securely; otherwise the blocks will float.

Platinum when clean is not readily amalgamated even with the assistance of an electric current. As native platinum is often alloyed with a small amount of iron its surface is not very bright, and it is probable, therefore, that platinum would not be amalgamated on plates, though a certain amount might be retained simply by its weight. In all ordinary cases, simple washing is the best method for the recovery of platinum.

Randfontein Consolidation

Some years ago when it was the fashion to divide properties into as many producing units as possible, for market purposes, the Randfontein property on the Rand, in Transvaal, was divided among twelve different concerns. Lately the properties were consolidated into two different producing concerns, one the Randfontein South with 400 stamps, the other the Randfontein Central with 600 stamps. The



600-stamp mill has not yet commenced work, but it is rapidly approaching completion, and as it will be the largest mill under one roof in the world, a few particulars may prove interesting.

The ore is collected after being classified at each of the different mines into a 300-ton bin, from which it is transported by steam locomotives and 40-ton hopper-cars to the 1000-ton receiving-bin, built of reinforced concrete below the rail-level, near the main crusher station. From this huge receiving-bin there are six conveyor-belts carrying the ore to six trommels, 14 ft. long by 4 ft. diam., for classifying purposes. The ore is discharged from the trommels onto the six belts, the waste rock being received by bins underneath, while the clean ore from the belts is discharged into six jaw-crushers of cast steel, sectionalized construction, width of opening 39 by 17 in., driven by independent 50-hp. motors. The crushed rock discharges onto cross-belts underneath which deliver to two main fine belts going into the centre of the huge mill at the roof-level. Here the ore is handled by two shuttle belts delivering the ore into the mill bins, which have a storage capacity of 13,000 tons. As before stated, the mill has 600 stamps, each weighing 1650 lb., which is lighter than those at the City Deep and other modern plants, where the stamps weigh 2000 lb. The stamps are arranged in units of ten, with four king-posts to each unit. Each group of 20 stamps is driven by a 100-hp. motor through short counter-shafts fitted with belt tighteners. The original duty expected of this mill was 9¼ tons per stamp per 24 hours, but it has been decided to add to the number of tube-mills, so that the capacity of the mill will be considerably increased. In the construction of this huge mill timber is used for the whole of the battery framing, which is supported on a mass concrete foundation with timber pads under the mortar boxes and a layer of bituminous concrete under the concrete pile-blocks. The mortar-box foundations are pierced throughout their length by a tunnel into which all the anchor bolts are brought and secured. The mill building is built of steel, and is 635 ft. long, 70 ft. wide, running due east and west. The mill supply-tanks are 60 ft. diam., situated on a mound at the east end of the mill. As is the case with all the modern mills now on the Rand, there are no amalgamation plates in the mill, but these are placed in the gold-recovery house. The pulp from the mortar boxes is conveyed by steel-lined launders, Robeson-Davidson centrifugal pumps being used in all places where found necessary. The sand-plant is arranged in two independent portions and consists of 36 steel tanks of 60 ft. diam. The slime-treatment plant is placed between the divisions of the sand-plant and consists of 23 tanks 70 ft. diam. with sides 14 ft. deep, and coned in the base to a depth of 7 ft. The gold-recovery house covers an area of 310 by 70 ft., steel framed, and occupies a position close to the 16 tube-mills. Here are the fixed amalgamating tables, five Betty zinc-lathes, six 24-in. filter-presses, and forty steel extractor-boxes, each of which is made up of two portions in parallel. The solution-sumps are eight in number, five being 60 ft. diam. and three 70 ft. diameter.

The whole of the power needed for this huge reduction plant is obtained from the company's own power station, where current is generated at 6600 volts, 3-phase, 50-cycle, by two 1000-kw., three 2000-kw., and two 6000-kw. turbo-alternators, the steam-pressure being 140 lb. to the square inch superheated to 500° F. The switch gear consists of 21 operating panels on a gallery. Steam is obtained from three batteries of eight water-tube boilers with a capacity of 17,000 lb. of steam per hour each. Power is transmitted to 6600 volts by cable to the substations and laid underground to avoid atmospheric disturbances. In order to further minimize risk of inter-

ruption to supply, the Merz-Price system of protection is installed.

In addition to this equipment of 600 stamps and accompanying ore-reduction plant, there is the mill of the Randfontein South, equipped with 400 modern stamps and the necessary equipment, which it is also intended to convert to a motor-driven plant, so that the consolidated concern will possess no less than 1000 heads of stamps. The cost of production of electrical power at the generating works is 37d. per unit, which is cheaper than locally bought power to be supplied to the neighboring mines by the Victoria Falls Power Co., Ltd.

The nominal capital of the amalgamated concern will be £4,500,000 in £1 shares, the present Randfontein Central and Randfontein South receiving 2,000,000 shares as at present, the 500,000 being reserve to be used for development and further extension of the ore-treatment plant as the necessity arises. There are already twelve working mines in various stages of development on the property, the line of outcropping reef being seven miles long, while in addition to the two reefs now being developed and worked the scheme ought to bring through other additional reefs proved to exist on the property under profitable treatment. The size of the property is equal to 2150 claims, all held under *mynpacht* and claim title, and as the reefs have a very steep inclination, the claims will yield a much higher tonnage than the average claim on the Rand. The developed ore on November 30 last is officially stated to be 6,055,076 tons, of an average value of 6.9 dwt., of which 5,351,130 tons average no less than 7.45 dwt. per ton.

Randfontein Central Shaft No. 1.

Randfontein Central Mill.

When the new Central mill with its 600 stamps and 16 tube-mills starts work, the tonnage treated will be in the neighborhood of 234,700 tons per month, which ought to produce 78,345 oz. of a value of £332,787, which will easily bring the Randfontein property head and shoulders above the East Rand Proprietary Mines, Ltd., which since the amalgamation has held the position of the premier producer on the Rand and of the world. At the present time the East Rand Proprietary, with its 820 stamps and 25 tube-mills, is crushing about 186,000 tons per month, and producing 60,000 oz. of fine gold, while the next competitor on the list is the Crown Mines, Ltd., with 675 stamps and 15 tube-mills, crushing 120,000 tons and producing 50,000 oz. of gold per month. The Crown Mines is spending considerable sums in adding to the equipment, and it has seemed possible that the company might supplant the East Rand Proprietary at the head of the list of producing mines of the world, but this new amalgamation at Randfontein, when carried into effect and perfected, promises easily to surpass the present two largest gold producers here. Not only so, but it is intended to bring the equipment of the Randfontein mines up to a capability of 3½ million tons per year, which, if attained, means a monthly production of 97,931 oz. of a value of £415,983 per month, which will still further advance its position on the list and make it doubly secure, not only as the chief gold producer of the Transvaal, but of the world. When the present equipment is fully at work the company ought to earn at least £120,000 per month profit, or £1,440,000 per year; equal to at least the present dividend of 15% on the huge ordinary capital of the company after making all necessary allowances for outgoings, particularly in the shape of debenture interest. When the milling capacities of the plant are increased to the fullest extent, and the debenture issue reduced, the profits and dividends ought also to be increased, but it is scarcely necessary to point out that with such huge equipments it is necessary to keep large supplies of ore available, and at Randfontein this seems the only point requiring urgent attention. It will, however, take time to get this huge concern smoothly working, and meantime the ore reserves will probably be materially increased.

No loafing was permitted in 1910, and no vodka was sold at the Kolchan mines in East Siberia. Drunkenness was extremely rare. The police were instructed to remove at once any suspicious characters, and local visitors from town were given a cold reception, unless they had business. All passports were inspected at the lake landing, and suspicious cases turned back. The exuberant and indiscriminate hospitality which characterizes most Siberian mining camps was discouraged. The foreign staff was well housed and fed, consequently most efficient; and every available minute of the open season was utilized. This policy must be pursued at all the Siberian gold mines. Without it, nothing can be accomplished. A good steward and good cooks are necessary.

Geology at Treadwell Mines-II

By Oscar H. Hershey

*In the Alaska-Mexican mine, the levels are driven largely along or in the foot-wall, and the average assays are not a good indication of the total gold content. It is known, however, that the portion between the 880 and 990-ft. levels is, so far as ore is concerned, the best part of the mine. Near the surface the main swell in the dike is relatively small, but largely ore down to the 440-ft. level. Thence to the 660-ft. level the main swell is very wide, and the ore-shoot tends to hug the foot-wall side of the northwestern half. Near the 770-ft. level it lengthens so as to extend almost the entire length of the swell. It varies greatly in width, and in some places is confined under a horse. Below the 990-ft. level the ore-shoot contracts and tends to draw to the northwestern part of the swell as it did above the 770-ft. level. The eastern swell is largely ore, though I believe it is most extensively stoped in the southeastern half. Below the 330-ft. level, a new swell appears under a part which at the surface is a long pinch, and at the 1100-ft. level it has reached a maximum width of 75 ft. Nearly all of it is ore on all levels on which it is wide enough to stope. It is separated from the big northwestern swell on one side, and the main Mexican swell on the other side, by very short pinches. Indeed, on the Alaska-Mexican 990-ft. level and Alaska Treadwell 1050-ft. level, there is a practically continuous ore-shoot from end to end of the developed portion of the dike, a distance of 2500 ft., though it does not everywhere include all of the width of the dike.

In short, the evidence is too conflicting to warrant the statement that the ore-shoots are closely controlled by the structure of the dikes except that, of course, commercial ore is confined to the swells and pitches with them. Mr. Becker suggested that the pressure that crushed the dikes was applied in a nearly horizontal direction, but Mr. Spencer thought it likely that the movement was nearly vertical. He regarded the fractures as produced during general continental uplift which involved expansion rather than shortening. A horizontal pressure exerted unequally in different zones might explain the banding in the gold content and the amount of ore on different levels. I have no very strong conviction as to the direction of movement. To my mind the dikes have behaved like heterogeneous bodies of rock that would, naturally, yield unequally to pressure. It may be that that is partly the secret of the apparently unsystematic distribution of the severely crushed areas. On account of its physical character, the dark diorite was not as generally crushed and converted into ore as the light diorite; the latter also may have varied in texture and composition in a manner common to granitic and dioritic masses in general. Certain seams are sometimes pointed out as limiting ore, but they appear to me to be post-mineral fractures, and their presence in places on the borders of orebodies is perhaps due, not to their having limited the formation of the ore, but to the physical condition of the rock on the borders of the orebodies having been favorable to their development there.

As to the nature of the waters to which the formation of the Treadwell ores is assigned, Mr. Spencer argues, from the character of the metasomatic replacement accomplished by them, that they were heated ascending waters of magmatic origin emanating from rock masses far deeper than those in which the mineral deposits are found. He says that "such a reservoir of molten rock as is here assumed, would be an adequate source of water and of all the chemical elements which are found in the ore deposits." Dawson thought it more probable that "the water included in the adjacent sedimentary deposits became vaporized by the heat of the intrusive mass and found its way to the surface in the form of steam through the substance of that mass." I am inclined to accept the magmatic theory, but I am not certain that the gold was derived from the magma that may have supplied the water. Dawson thought that the slaty argillites at depth may have furnished both the gold and the pyrite. My difficulty arises from the following facts: All the larger albite-diorite dikes, and many of the smaller ones, in the vicinity of Treadwell were more or less subjected to mineralizing action. Those along the chloritic slate band on the foot-wall side of the meta-gabbro dike were in large part converted into commercial ore; those in the black slate at a distance from the chloritic slate practically never were. The Starr and Bear's Nest dikes contain a little disseminated pyrite throughout, though the larger portions of them are not notably mineralized. Here and there, however, are portions that have been converted by vein action into material resembling the ore in the mines, but they seem nowhere to carry commercial ore. Assays run generally from 20 to 60c. per ton, and rarely reach $1. They have not the amount of gold that goes with other similar material in the dikes along the chloritic slate belt. If the solutions derived their gold from the dioritic magma that supplied the water and were not influenced by the wall-rocks of the dikes, they must have deposited as much gold in connection with a certain amount of quartz and calcite veining and pyrite impregnation in one set as in the other. I doubt that the slate walls have had an important influence over the deposition of gold in the broad dikes. At any rate, I would expect the carbon of the black slates to have had a stronger influence than any mineral in the chloritic slates. Another explanation is possible. The gold may have originally been present in an extremely disseminated condition in the meta-gabbro dike, part of which later was converted into chloritic schist and slate. Much of the latter at great depth became incorporated in the albite-diorite that was intruded in or along the border of the band. The vein-forming waters may have dissolved the gold from the chloritic slate and deposited it higher in

*Continued from *Mining and Scientific Press*, page 296.

the crushed portion of the albite-diorite dikes. The dikes in the black slate may have had a much poorer source of gold. This hypothesis is weak, in that it seems improbable that the amount of chloritic slate involved could have yielded sufficient gold to supply the many millions of dollars' worth of it in the ore-dikes.

Perhaps the calcite present in the ore-dikes has had an influence on the deposition of the gold. Mr. Becker thought the calcite was hardly derived from the decomposition of the plagioclases of the albite-diorite, as there was not enough of the anorthite molecule present. It seems that the black slates are, as a whole, rather calcareous, and occasionally contain thin beds of black limestone. The greenstone schists are composed largely of chlorite and calcite. But the most probable source of most of the calcite in the ore-dikes is the meta-gabbro of the hanging wall and its modified form, the chloritic slate and schist. Mr. Becker says calcite is more abundant in the meta-gabbro than in the diorite. That in the chloritic slate band which became included in the albite-diorite at great depth was probably dissolved and re-deposited higher in the ore dikes. In that case, the dikes along the chloritic slate band should be richer in calcite than those at a distance in the black slate, but I am unable to state from observation that they are. I offer the preceding speculations merely as suggestions, as I am not certain as to the cause of the marked difference in gold content of the two sets of dikes, though I am satisfied that it is in some manner related to the fact that one is in or near the chloritic slate and the other wholly in black slate.

Dawson expressed the opinion that the ore-dike of the Alaska Treadwell mine represents the upper portion or feather edge of a granitic intrusion, and that in depth the ore mass would be found to pass gradually into ordinary unaltered granite. Development has shown, however, that there is not a great increase in thickness of the dike and gradual decrease in average gold content with depth. Although the dike material must have expended energy as it arose and had less power to rend the slates, this may have been largely or wholly offset by the fact that as height was attained there was less slate to lift. There seems to have been a rather even balancing of these opposing conditions within the vertical range of the present mines. (If the slates subsided on the magma, the physical effect was the same so far as the dikes were concerned.) I expect the larger albite-diorite masses, including the Treadwell-Mexican, to become less dike-like in depth and more like the small batholiths that are commonly found in the vicinity of the great granitic and dioritic masses of the Pacific Coast region from Alaska to southern California. Of course, there must be a point below which the Treadwell-Mexican batholith made its way by overhand stoping rather than by merely forcing the slates apart, and below that point it probably widens into a great body that may be part of the Coast Range dioritic *massif*. The crushing and mineralization are probably dissipated within this enlarged part of the batholith, as suggested by Dawson. But I anticipate that this change will not occur within a depth to which economic conditions at the Treadwell mines will permit mining.

I have recently become interested in the question of whether there is, in the majority of large gold-quartz veins throughout the world, a gradual decrease in the gold content of the primary sulphide ore with depth.[6] If such a rule exists, the Treadwell group of mines is a conspicuous exception to it. The annual statements of the company show that the total yield per ton of the Alaska Treadwell mine was $3.79 during the first five years up to May 1890; declined to $1.88 in 1900-01; averaged $2.20 from June 1902 to May 1909, and was $2.79 for the year ending May 31, 1910, with a general average of $2.43. For the Alaska-Mexican mine, it was $2.79 in 1894; reached a minimum of $1.89 in 1900; rose to $2.92 in year ending December 15, 1903; reached $3.03 in year ending December 15, 1906, and $3.97 in year ending December 15, 1909, with a general average of $2.68. For the Seven Hundred Foot mine it was $1.72 in 1899; $1.50 in 1901; and $2.41 for year ending December 15, 1909; with a general average of $1.94. For the Ready Bullion mine, it averaged $2.57 for 1898 and 1899; reached a minimum of $1.48 in year ending December 15, 1902; and rose to $2.17 for year ending December 15, 1909, with a general average of $1.94. The marked decrease in the value of the ore milled in the early history of the Alaska Treadwell mine was the result of increasing the tonnage by mining low-grade rock. Doubtless some of the decline in value, and probably nearly all of the recent increase in all the mines, has been the result of advancing the mines down through the alternating bands of high gold content and low gold content, brought out in this paper. A. C. Spencer expressed the opinion in 1906 that it was impossible to make out any progressive change in the character of the ore as depth was attained and that the assay charts showed the ore in the lowest levels to be quite as good as in the upper workings. Since that date, all the mines have penetrated to better levels. The best level in the Alaska Treadwell mine is 1300 ft. below sea-level; in the Alaska-Mexican mine, 900 ft. below sea-level; and in the Ready Bullion mine, 1000 ft. below sea-level. The general superintendent also expresses the opinion that there has been no general impoverishment of the dikes in depth. The assay-charts that I have studied fully support his view. The thick oxidized zone once present near the surface of the dikes was removed by glacial action, and only a very shallow zone formed since the disappearance of the ice. As Mr. Spencer says, "there has been no important secondary concentration of value by oxidizing-waters near the surface."[7] Practically all the ore belongs to the zone of primary sulphides. There can be little doubt that such ore as has been mined from the surface to the lowest levels of the mines will continue to a much greater depth.

[6] *Mining and Scientific Press*, July 16, 1910, p. 85.

Discussion

Readers of the MINING AND SCIENTIFIC PRESS are invited to use this department for the discussion of technical and other matters pertaining to mining and metallurgy. The Editor welcomes the expression of views contrary to his own, believing that careful criticism is more valuable than casual compliment. Insertion of any contribution is determined by its probable interest to the readers of this journal.

Mine Accounting

The Editor:

Sir—L. A. Whittaker's article in the issue of January 21 has touched on a branch of the mining industry which has been neglected by a great many engineers. The time is slowly coming when the mine accountant will be classed as an indispensable member of the operating staff. At a great many small properties the 'guess' system is used in the distribution of working costs, and the actual costs of mining or milling are often juggled to keep them low, for the approval of some stockholder, whose main hobby is that one thing. When a comprehensive daily report system is in operation, showing the proper distribution of all working costs, the engineer knows just where he stands every 24 hours. I enclose a copy of the daily report made by each mine boss at the Liberty mine. It may be of help to some in working up a report system.

S. S. CLARKE.

Leadwood, Missouri, February 2.

LIBERTY MINING CO. — REPORT FOR ____ SHIFT ____ FOREMAN

OPERATION							(MINE) MAINTENANCE		DEVELOPEMENT		
DRILLING			MUCKERS	HOISTING and TRAMMING			OCCUPATION	NAME	DRILLING		REMARKS
	NAME	HOLES	FEET		NAME	OCCUPATION	NAME			NAMES	HOLES FEET	
1				1		HOISTING ENGINEER		TIMBERMEN		1		
2				2		"		"		2		
3				3		DINKY ENGINEER		"		3		
4				4		"		(DRILL) MAINTENANCE		4		
5				5		TOP LANDER		BLACKSMITH		5		
6				6		"		" HELPER		6		
7				7		STATION TENDER		MACHINIST		MUCKERS		
8				8		"		"		1		
9				9		"		MAINTENANCE HOISTING AND TRAMMING		2		
10				10		"		TIMBERMEN		3		
11				11		TRAMMERS		"		4		
12				12		"		SHAFTMEN		5		
BLASTERS REPORT						"		"		6		
	NAME	HOLES FIRED				"		CAR REPAIRER		TRAMMERS		
1		STICKS OF POWDER USED				"		MACHINIST		1		
2		FEET OF FUSE USED				"		CARPENTER		2		
3		NUMBER OF CAPS USED			PUMPING			(PUMP) MAINTENANCE		3		
4						PUMPMAN		PUMPMAN		4		
HOISTING REPORT DELAYS						"		MACHINIST		5		
ORE		POOR ROCK				"		"		6		

Daily Mine Report, Liberty Mine.

Leadwood, Missouri, February 2.

Suppressing a Government Report

The Editor:

Sir—With reference to your editorial on the above subject, I suggest that if what the United States authorities knew, more than a year before they made it public, as to orebodies at the Montgomery-Shoshone mine, had been promptly given the publicity now so much asked for, many poor folks' dollars would have been saved to outsiders who were made dumping ground by the insiders. If publicity is a good thing for corporations dealing with the public, why not for the Government also in such cases—particularly prompt publicity?

LOUIS LANE.

Chihuahua, Mexico, January 17.

[Prompt and full publicity in mining is desirable from every point of view. Unfortunately, officers of the United States Geological Survey have no legal authority to force entrance to a mine. They must go, if at all, on terms laid down by the mine owners. Under these conditions, it is impossible for the Geological Survey to take up the particular work our correspondent has in mind.—EDITOR.]

Potassium Cyanide

The Editor:

Sir—It was refreshing to see, on the front cover of a recent issue of your paper, that a firm of chemical manufacturers is attempting to establish a more sensible standard for cyanides, and it is to be hoped that engineers and the press will fall in line. The method of expressing the percentage of all cyanides in terms of potassium cyanide is crude in the extreme, to say nothing of the absurd appearance of a content of considerably over 100% that it gives to a number of cyanides.

While on the subject of cyanide, I should like to raise a protest against the use of the symbol Cy. that is so often found in some of the best text-books and in the writings of some of our foremost metallurgists, instead of the proper symbol CN. The same applies to a number of other substances, as Am for NH_4, and sometimes Aq for H_2O. So long as the radical goes in and out of combination in entirety it does not so much matter, but when the chemical action is such that the radical is broken up, these supposed abbreviations, a slovenly form of writing, at best, give to an equation expressing

the reaction a one-sided appearance. Note, for instance, when abbreviations are used, the mixed-up appearance of the equation expressing the reaction that takes place when concentrated sulphuric acid is added to crystallized potassium ferrocyanide:

$$K_4FeCy_6 + 6H_2SO_4 + 6H_2O = 2K_2SO_4 + FeSO_4 + 3Am_2SO_4 + 6CO$$

and the clearness when the proper symbols are employed:

$$K_4Fe(CN)_6 + 6H_2SO_4 + 6H_2O = 2K_2SO_4 + FeSO_4 + 3(NH_4)_2SO_4 + 6CO$$

Fortunately, Aq is seldom used for H_2O, but if I had used it in the first equation it would have made it even more complex.

Your paper and its sister contemporary, *The Mining Magazine*, have been making an excellent fight to bring about the standardization of technical terms, and have accomplished much. Surely these cases I have instanced require to be amended.

F. H. Mason.

San Diego, California, January 19.

Proposed Mineral Law for Texas

The Editor:

Sir—In view of the fact that the State of Texas is the actual owner of all its lands, and realizing that the present law acts as a hindrance, rather than an incentive, to the development of its mineral resources, the El Paso Chamber of Commerce has recently taken the matter up, and a committee was appointed to draft a bill, to be presented at the present session of the Legislature. As a member of that committee, I take pleasure in submitting a copy of the proposed bill,* together with the following criticisms made by W. H. Winter, attorney-at-law, and a member of the committee. Mr. Winter's criticisms are as follows:

(1) The title of the draft as prepared, is cumbrous, and probably insufficient to cover all of the things proposed by the bill.

(2) If it is desired to provide for the location of minerals on land heretofore sold by the State where the State has attempted to reserve all minerals in such lands, this should be done by a separate bill.

(3) There are a few paragraphs of the bill which appear to be loosely drawn and are somewhat ambiguous, but it would require some study to perfect them.

(4) In Section 5 of the proposed bill, I submit that if the apex rule is not to be recognized, then there is no necessity of requiring the locator to give the number of feet claimed on each side of the centre of the discovery shaft, neither is it necessary nor expedient that the course of the lode or vein should be given. If the claimant can not follow the vein on its dip outside of the side lines, nothing is to be gained by making these requirements, and useless litigation may result therefrom, and unnecessary and costly burdens are imposed on the locator. Such requirements are of no benefit, either to the State, the locator, or the adjoining proprietors.

*See page 328.

(5) It is my experience that no benefit results from requiring discovery work, and the requirement on the part of the locator to do annual assessment work has proved the one farce in the Federal mining law. The doing of annual assessment work seldom, if ever, develops the property, the State derives no benefit therefrom, and most frequently the money required thereby might as well be thrown away. I would therefore suggest that Sections 6, 7, 8, 9, and 10 of the proposed bill be stricken out, and in lieu thereof a simple provision be substituted requiring the locator, his heirs or assigns, to pay to the State the sum of not less than $25 nor more than $50 per claim each year until patent is obtained.

(6) The size of the 'Bedded Deposit Claims', usually called placers, is too small. For this class of minerals, one hundred sixty (160) acres as a maximum claim for an individual, and a section of land for an association, is small enough. The size of the claim should be increased rather than diminished.

(7) Section 17 of the proposed bill, in order to make it effective, should contain an additional provision authorizing the co-owner who pays for development of the property, or who does or pays for the annual assessment (if annual assessment is to be required), or who pays the yearly sum of not less than $25 nor more than $50 per claim to the State of Texas (if this provision is adopted instead of annual assessment work), to proceed against his co-owner so in default, in the District Court where the land is situated, to quiet his title against his co-owner so in default.

(8) The size of the proposed oil and gas claim in the proposed bill is too small. The maximum amount of land authorized to be located by an oil or gas claim should not be less than one section, and especially is this true if $3000 is to be required of the locator in physical development of the property during the second year after each location. Perhaps it would be advisable if the bill gave the locator the option of making payment to the State of Texas of $1 or even less per acre the second year, in lieu of this expenditure.

H. Vincent Wallace.

El Paso, Texas, February 16.

Routing the Strike Promoter

The Editor:

Sir—The question of maintaining amicable relations with employees is one that naturally attracts a considerable portion of the attention of the mine manager. The best managed and most meritorious mine can be easily brought to the verge of ruin by a disastrous strike, and the unreasonable attitude often adopted by the men is a perpetual source of annoyance to the engineer in charge. To prevent a strike is much to be preferred to settling one; thus the problem assumes high importance whenever difficulties of this nature develop. Various plans have been proposed to overcome the evil, but the great trouble with many of them lies in the fact that they work admirably in theory and fail disastrously in practice. The prevention of a strike ofttimes spells

the difference between the manager's success or failure, particularly when the mine has not been developed to a high state of productive efficiency.

If a man is financially interested in a property it necessarily follows that he will do everything in his power to promote its welfare. He will also be the last person on earth to do anything that will deprive him of his share of the profits. Consequently if the employees of a mining company held stock in the mine they would naturally desire to see the company progressing, and would be apt to do anything in their power to increase its prosperity. Certain it is that they would not do anything to impair their property's profit-earning ability. The ordinary man is primarily interested in his pocket. Accordingly, if employees are financially concerned in a company's welfare, they will view with disfavor any attempt to create dissension between employer and employees. In this natural self-interest arises the greatest obstacle to labor troubles. Every strike works incalculable harm to all concerned, and the exercising of a little foresight is able to prevent trouble, even in districts where strife between employers and employees has been the rule rather than the exception.

Whenever financial conditions permit, companies presenting employees with small blocks of stock would be insuring industrial peace. It is not altogether the value of the stock, but rather the knowledge that he is part owner in the property that carries the greatest weight with the recipient. He would feel that he was to a certain extent his own employers, and would naturally take pride in assisting the company to maintain the highest possible rate of profitable production, and would be at all times against any effort to create disorder in the camp. In presenting its employees with stock the interested company would naturally be forced to adopt certain restrictions. It might require a man to be in its employ two or three years before receiving the stock bonus, or it might provide that its workmen must be able to do the work required. It would give the mine manager an opportunity to replace the incapable and inefficient workmen with those of proved merit, so that within a few months he would have the best force of workers in the district.

It is generally acknowledged that many of the strikes that have occurred in the mining districts during the past ten years have been directly due to the influence of outside agitators. In practically every instance a satisfactory basis of settlement would have been reached had not the professional agitator put in an appearance when least wanted. If the men in these cases were directly interested in the mines, they would have paid scant attention to the visiting disturber. Of course, in every camp there are men who are never satisfied; individuals who would cry for the moon if Fate presented them with the earth. Fortunately such people are in a hopeless minority, and are usually objects of abhorrence to their associates. When men are not interested in a property, save as a place of employment, they at times listen to the natural grumblers, and often one dissatisfied individual causes strife among a hundred peaceably inclined men; but if the men were directly interested in the prosperity of the company they would disregard the complaints of the eternal pessimists.

With a reliable corps of satisfied and interested workmen the manager could give to other matters the attention constantly demanded, feeling certain that no labor clouds were about to obscure the bright horizon of his company's progress and prosperity. If a pessimist constantly complained and attempted to cause disorder the manager would soon become acquainted with the fact, and the discharge of the disgruntled one would in all probability be greeted with approval by the entire camp. And if a professional agitator made his appearance he would soon discover that his room was infinitely preferred to his company.

The great body of the laboring class is composed of orderly, peaceable citizens, amenable to reason; men who realize that a mining company, like any other industrial or commercial enterprise, is strictly a business proposition. They are not desirous of engaging in strife with the manager, nor do they think they can tell the manager his business. There is always, however, a certain faction continually preaching that the laborer is being crushed lower every year by 'the grinding heel of capital,' and that in resistance lies salvation.

The discouragement of labor troubles by co-operative methods has been tested for several years by numerous industrial and commercial companies, and it has invariably found that when the men are financially interested in the firm, labor disturbances are of infrequent occurrence. Many mine managers look upon this plan with a friendly eye, but the average director of the mining company apparently fails to grasp its import. With the principle universally applied, and the mine properly managed, there appears no good reason why strikes should prevail. Of course, it should not be expected that the worker will be satisfied with a stock bonus if other conditions are unsatisfactory. Unless the mine is provided with proper safeguards against accidents, and with due regard for the health of the men, it will be found impossible to retain the excellent corps of workers that may have been assembled. The ordinary man refuses to work in a property where the hazards are extreme, no matter what the inducements may be. For a brief period he may run the risks, but it is only a question of time ere he will leave for a better managed mine.

In mining, as in all other pursuits, the experienced man is to be preferred. When the workers of years experience are constantly leaving and new men taking their places, it is evident that something is radically wrong. And it is the duty of the manager to ascertain why this condition prevails. For the welfare of a property is best promoted by the employment of men fully conversant with their duties. And it will always be found that the employee of many years standing has a good-will for the company that it is useless to expect the new worker to cherish.

A. H. Martin.

Grass Valley, California, February 15.

Concentrates

Most of these are in reply to questions received by mail. Our readers are invited to ask questions and give information dealing with the practice of mining, milling, and smelting.

Dendritic markings are due usually to skeleton growths of manganese minerals and have no known economic significance.

Undercurrents are put in sluices to draw off the platinum at certain gold-placer mines. When the grade is sufficient the water passing through the undercurrent can be returned to the main sluice lower down.

Mica schist is a metamorphic rock and may be developed through alteration of either sedimentary or igneous rocks. It is impossible to lay down a general rule, and a microscopic study would be necessary to determine its derivation in a particular case.

Tarnished zinc may be cleaned by applying with a rag a mixture of 1 part sulphuric acid to 2 parts of water. Afterward carefully rinse the zinc with clear water, and dry. Any article cleaned with acid is roughened by the treatment and will soon tarnish again.

The owner of a prior lode claim subsequently included within the boundaries of a placer location does not lose any surface rights by reason of the existence of the placer location, and the placer claimant can not mine off any of the surface of the existing and valid lode location.

Alloys of silicon, aluminum, chromium, and tungsten are used in the processes of steel manufacture, chiefly for the purpose of removing the oxygen which has been introduced into the steel during the removal of the carbon, but also in order to make the steel harder and stronger.

Zinc dust, when used for precipitating gold solutions, is fed automatically by means of a conveyor-belt. To prevent possible oversight and consequent loss of gold in solution, the feeding apparatus should be placed in a well-lighted and easily accessible position. An excellent place is at the point where the chemist does his work.

Gold coins minted by the United States contain gold to the full face value of the coin. In addition they contain copper used in alloying the gold. The cost of the copper is paid by the one who deposits the gold at the Mint, the charge being two cents per ounce of gold. There is also a melting charge of $1 per lot up to 1000 oz., and a refining charge when the bullion is base.

After an applicant for patent for a mining location has done all that he can toward perfecting his application, by filing necessary proof, and has paid his purchase price and a certificate of entry has been issued, the courts have uniformly held that he is no longer required to perform the annual labor, as long as his entry remains uncancelled, even if a protest prevents him from securing patent.

Porphyry was originally used as a rock name to indicate a rock intermediate between a rhyolite and a granite. The striking characteristic of such a rock is the presence of large crystallized minerals in a ground-mass finely crystalline or non-crystalline. From this it became customary to refer to all light colored rocks having this structure as porphyries. It is better now to use porphyritic as a structural term and to only use porphyry in a loose general sense. Microscopic examinations are necessary to determine the exact nature and appropriate name for each rock.

Adverse possession of mining claims in Nevada is governed by the following statute. (Section 3706, 'Cuttings Compiled Laws of Nevada.') "No action for the recovery of mining claims or for the recovery of the possession thereof shall be maintained, unless it appear that the plaintiff, or those through or from whom he claims, was seized or possessed of such mining claim, or were the owners thereof, according to the laws and customs of the district embracing the same, within two years before the commencement of such action. Occupation and adverse possession of a mining claim shall consist in holding and working the same, in the usual and customary mode of holding and working similiar claims in the vicinity thereof, etc."

Fault fillings may consist of rock from any of the beds cut by the fault plane, of any igneous rock later intruded, or of material brought in by solution. Along the plane of movement, owing to inequality in stresses, unequal strength of materials, and pre-existing fractures, irregular spaces are opened. These are often enlarged by circulating waters. They are also filled (1) by broken rock moved up or down to them with the walls at the time of faulting; (2) by falling fragments when actual open spaces have been left at the close of the period of movement; (3) by intrusion; (4) by solution. The final result is usually a cemented breccia between the cheeks of the fault or walls of the vein, as the whole comes to be called when the filling carries mineral of value.

Power to assess capital stock of a mining corporation in order to purchase additional ground is open to some question. Each case would depend upon the particular state of facts. If the additional ground were necessary for the economic development of the property already owned, the power would seem to exist. If the additional ground were lawfully contracted for so that an obligation existed on the part of the corporation to pay the purchase price, it probably would be considered such a debt as to justify an assessment. The statute of California governing the power of levying assessments provides that the directors may do so "for the purpose of paying expenses, conducting business, or paying debts." If the articles of incorporation and by-laws gave the power, the directors would have authority ordinarily to contract for additional ground.

Special Correspondence

TONOPAH, NEVADA

Fire at the Belmont.—Heroic Rescues but Many Lives Lost.

A fire occurred in the mine of the Tonopah-Belmont Development Co., at Tonopah, on February 23, whereby several miners lost their lives by suffocation in the dense volume of gas and smoke which filled a part of the workings. The fire was in or near the base of a winze that extends on a 45° incline from the 1000-ft. level to the 1166-ft. level, connecting also with the 1100-ft. level. Level 1000 is connected with the shafts, but 1100 and 1166-ft. levels are connected with the 1000-ft. level only by the incline winze and by various raises. Fire was discovered about 6 a. m. by one of the officers while making the rounds of the mine, and while not considered serious, prompt effort was made to control it. When the men reported for work at 7 o'clock smoke was coming up the Belmont shaft and they were accordingly lowered through the Desert Queen. There is some dispute whether they went to fight the fire or to take

Belmont Shaft, Tonopah, Nevada.

up regular work, but apparently in any event a number went to their working places and were trapped. The officers made every effort to control the fire and rescue the men, F. L. Bradshaw, manager, and J. F. Fitzgerald, mine foreman, narrowly escaping by climbing through the stopes. Not all were so fortunate, 17 lives being lost. Rescue work was carried on through the Desert Queen shaft by beating back the smoke on the 1000-ft. level with compressed air and water, which was kept up for 24 hours. Rescuers and smoke-fighters finally reached the top of the winze, made their way down it to the 1100, then forced a volume of air and water to the 1166 level and put out the fire. Friday the bodies of 11 men were found on 1166, included among which was that of Frank Burke, the shift boss. Some were found on 1100. Several men died in the work of rescue, among whom was William J. Murphy, who brought up the shaft two cage-loads of men through the dense smoke, but in making the third trip lost his life. The two shafts are 1900 ft. apart, and the distance the rescuers had to make their way from the Desert Queen shaft to the incline winze was over 2000 ft. Herewith is given a view of the head-frame, hoist-building, and bins at the Belmont shaft, taken last October. Frederick L. Bradshaw is the company's manager, J. F. Fitzgerald is general mine foreman, R. J. King is mining engineer. The following is believed to be a correct list of the dead: William J. Murphy, Frank Burke, Mike Hannigan, John Ryan, Clarence David, Robert Frazier, John Gilfoil, Matt Slemsick, Manuel Cardoza, Mike Plamanzas, Nick Ordovich, Bozo Begovich, John Mee, Mike Scobaly, Chris. Mirkovich, George Donderro, A. Sarciavich. Fire-fighting apparatus, including Draeger helmets, were brought from Goldfield, but not being in serviceable condition, could not be used. The Mine-Rescue Car of the U. S. Bureau of Mines, in charge of Sumner S. Smith, was rushed through from Alma, Wyoming, but did not arrive till Sunday afternoon.

BUTTE, MONTANA

Cost of Producing Copper at Butte Mines. — Compressed Air for Hoisting. — Butte & Superior Output. — Tuolumne Shipments and Development.—East Butte.—Boston-Corbin.

The porphyry property owners of Nevada and Utah are proclaiming that they are in a position to produce copper cheaper than the mines of this district, but such statements do not bother the management of the Anaconda company. It has been stated that Butte mine operators can produce copper at as low a cost as any district in the world. For several months the Anaconda company has been putting the metal on the market in New York at a little less than 9c. per pound, including all freight and other charges. This reduction in the cost of production has not been brought about by any reduction in salaries or wages, but by the economies which naturally followed the merger. When the compressed-air hoisting system is in operation, there may be a further reduction, it is estimated, of about a cent per pound. While it is not possible to estimate the exact saving which will be effected by the substitution of electric-driven air-compressors for operating the hoists, it is certain that the elimination of the expense of coal will make a great reduction in costs. Some persons have estimated that this will result in a reduction of the operating expenses of at least $2,000,000 per year. Unless there is some unforeseen delay, the Mountain View mine will be operating its hoists by the compressed-air system by April 1. Mining men are awaiting with much interest the practical effect of this system, and if it prove as successful as expected, there is no doubt that it will come into general use at all the Butte mines in the near future.

The Tuolumne company has given the Washoe Smelting Co. the contract for treating its ore. There were three bids received—one from the East Butte company, one from a Salt Lake concern, and the third from the Washoe company. The contract for treating the Tuolumne ore was previously held by W. A. Clark. The Tuolumne is shipping 100 tons of ore daily, which is sampling from 7 to 11% copper. In addition to the mining of this ore, the company is sinking the shaft from the 1400-ft. station, intending to continue to a depth of 2000 ft. Advices received here are to the effect that the new head-frame, hoist, and other new equipment ordered for the property some time ago, will be ready within the six months promised by the builders. As soon as this equipment is installed the Tuolumne will double its output, having ore blocked out in large quantities.

Michigan capitalists have organized the Laurium-Montana Mining Co. to develop three claims situated four miles west of Butte. The group has two veins of gold and silver-bearing quartz, samples of which have assayed $247 to $1350 per ton. The directors of the company are: August Hilden, Abraham Boti, Victor Lampinen, William Nousianen, Oscar Miekka, Henry Wiltala, and Oscar Karri. Machinery has been ordered, and just as soon as it is in position, development work will be commenced. The Butte & Superior company is continuing to ship about 400 tons of ore daily to the Basin concentrator. It is being reduced at a cost of $3.90 per ton. In the course of a few weeks shipments are to be increased to 600 tons per day, which the company estimates will give net profits of $1500 per day. Officials of the company believe the earnings this year will be more than enough to pay off its indebtedness. Sinking of the Ophir shaft of the Butte Central Copper Co. to 1000-ft. depth is in the hands of contractors, who have been at the work about two weeks, and they have progressed at the rate of 5 ft. per day. While this work is going ahead, development is progressing on the 100, 200, 300, and 500-ft. levels. A body of ore 12 ft. wide, and assaying 40 oz. silver per ton, has been struck on the 100-ft. level near the west end-line of the Ophir claim. On the 200-ft. level the same body of ore has been found.

The East Butte company is understood to be earning close to $50,000 per month, and that since the first of the year its copper has been produced at 8c. per pound. The

reduction in the cost is said to be due to the economies which have been introduced and to the high grade of ore, which contains gold and silver as well as copper. Driving on the vein at the eighth level has extended 1100 ft., and the orebody has widened to 20 ft. The ore assays 7% copper and $2.50 per ton in precious metals. The Boston & Corbin Copper & Silver M. Co., operating the Boston-Corbin mine at Corbin, has decided to erect a concentrator. It is claimed there is 200,000 tons of ore exposed by development at this date. The mine is opened by consecutive levels from 100 to 900-ft. depth. It is understood the equipment for the plant has been ordered. H. E. Emerson has had the directing of the mine development during the last three years.

The High Ore mine has been completely cleared of smoke and gases created by the fire, but hoisting will not be commenced for the present. Considerable repair work is required, necessitating the employment of a force of men. The burned area is being cleared, and now that the fire has been subdued, it is realized that it was serious in character and that for some days it gave the mine management uneasiness. It was feared that the fire would so get through the workings that it would prove a second Anaconda fire, which has been burning since 1889 and still continues to burn, although well bulkheaded.

SALT LAKE, UTAH

The Utah Copper Co. — Progress at Park City, Tintic, and Alta. — Results of Operating the South Utah.—The Galena King.

The Utah Copper Co. has declared its first quarterly dividend of the year of 75c. per share, amounting to $1,145,100, making a total of $7,000,000. The first section of the Arthur mill, the old Boston Consolidated, was to begin operating in its remodeled form about March 1. The Silver Shield company drove into what was supposed to be a wall of the vein and found that it was a horse with good ore on the other side. The new orebody is 6 ft. wide, the ore assaying 18% lead and 7 oz. silver. The company is having a milling test made of a 150-ton lot. The Silver King company at Park City has found ore in a raise, 120 ft. from that discovered some time ago, and supposed to be a continuation of the same orebody. The ore is of shipping grade, carrying about 1½ oz. of silver to each per cent of lead. The annual meeting of the Daly West, held at Denver, resulted in the re-election of the old board of directors. The report showed that during the past year the mine operated at a profit of $238,000, and paid its stockholders three dividends amounting to $162,000, leaving a cash balance for the year of $76,000. The superintendent estimates that there is ore on the 1700, 1800, and 1900-ft. levels sufficient to keep the mine running for a year. Conditions developed during the last quarter of the year were not encouraging, as the ore was not found on the 2100-ft. level. The ore discovered in the New York Bonanza has been followed a distance of 140 ft., the vein varying from 6 to 20 inches. Some sinking and raising has been done at the intersection of the cross-fissures, but no ore was found in doing this work. The ore taken out runs from $40 to $50 per ton, in addition to which there is some zinc. The heading of the Snake Creek tunnel has now passed beyond the brecciated limestone through which it has been passing in the last 200 ft. and which has caused trouble on account of water and the necessity of timbering. A little water still appears at the floor, but the face and roof are dry. The face is in a distance of 10,700 ft. Shipments made by Park City operators for January totaled 5618 tons, the Daly West leading with 1815 tons, and the Silver King Coalition second, with 1781 tons.

In Tintic district the May Day reports new ore on the 500-ft. level, where driving was done to cut the orebody opened on the 300. The new find has not been developed sufficiently to determine its extent. The Uncle Sam, which is under the same management as the May Day, is shipping ore valued at $1000 per day. A recent 60-ton shipment netted the company $3300. The new railroad spur that the Scranton people built at a cost of $2000 is in use, and this will effect a saving of 40 cents per ton on all ore hauled. The company will increase its shipments from 700 to 1000 tons per month. Two grades are shipped, about 30% of the ore carrying 34% zinc, the remainder being a zinc-lead ore containing 40% each. Tintic district ore-shipments for the past week are 172 cars, Centennial-Eureka leading with 45 cars, and Iron Blossom second with 39.

In Beaver county the South Utah company has found high-grade ore in virgin ground. The vein has been followed for 100 ft. During January the mill treated 22,090 tons of ore which yielded 2091 tons of concentrate averaging 9.88% copper. Production for the month was 386,764 lb. of copper, 140 oz. gold, and 2532 oz. silver. The average of the concentrate was the lowest since October, but the production of copper was slightly higher than in December, the best previous month. Since October the company has produced 1,259,917 lb. of copper. Under the changed mining methods, which involve a system of back-stoping, 250 men do all work in mine and mill, whereas 400 were required by the old method of square-setting. Mining costs are about 90c. per ton, and milling costs about 50c. Concentration is at the rate of 10 and 11 tons to one. The Revenue, 15 miles west of Newhouse, has been developed during the winter by driving two adits, each 120 ft. long. Recent samplings of some portions of this mine showed ore worth $150 per ton. An old mill is on the ground which will be put in operating condition in the spring, and the ore is to be delivered over an aerial tramway.

Rebuilding the surface workings of the Utah Mines Coalition Co., at Alta, which were wrecked in a recent snowslide, will be commenced at once. The compressor and dynamos were unharmed, but all of the rest is a total wreck. The loss is about $10,000. The new buildings will be erected under a large cliff so as to protect them against a repetition of the disaster. With two weeks of favorable weather the mine can be put in such condition that operation can be resumed. The Cardiff people opened sulphide ore in the north drift in which a 2-ft. streak of ore was being followed. The ore is a higher grade than was the streak, and is similar to that found in the south drift from which the shipments of last summer were made. The Rexall's tunnel is in 800 ft., and a drift on a small fissure 40 ft. back from the face is in malachite. The tunnel will give a depth of 700 ft. on veins which are exposed on the surface. The Howell-Johnson Leasing Co. is making a 20-ton test shipment of ore from the old Maxfield mine which it is operating.

A company of Tintic men has been organized to operate the Galena King at Stockton. The incline will be retimbered and the lower levels explored. This mine has some good ore, but the lower levels were flooded by water. The extension of the Honerine drain-tunnel may overcome this difficulty. The Utah mine, of Fish Springs, shipped three cars of ore in February, and a fourth car is being hauled to the railroad. The Utah Smelting Co. is planning to erect small smelters in different camps during the coming summer. Three of the producing coal mines in the vicinity of Salina have been merged as the Southern Utah Fuel Co. Plans are being made to operate a salt refinery in Millard county, eight miles west of Clear Lake. A large spring brings the salt to the surface as brine, and in the hot months of summer the latter evaporates to a point that precipitates the crystals and does away with the necessity of pumping into beds for a special evaporating process. Two railroad projects are being considered which should benefit the mineral industry of the State. One is to build 60 miles southwest from Wellington, on the Denver & Rio Grande, to the coalfields in Emery county; and the other is to extend the Laramie, Hahn's Peak & Pacific from Fox Park, Wyoming, into the asphalt beds of Wasatch county, eastern Utah. This road is already built 55 miles from the Union Pacific at Laramie, and the projected extension is reported to be fully financed by Boston men.

LONDON

Cornish Tin Mining. — Wheal Kitty and South Crofty. — Historical Data Concerning the Gold Mines of the Kolar Districts.—Success of Mysore Mine.

In the midst of much that is depressing in connection with Cornish tin mining, it is pleasant to record the success of the two re-opened mines, Wheal Kitty and South Crofty. I referred a short time ago to the success attending J. H. Collins' work at Wheal Kitty, and I am now able to give an account of the position at South Crofty. This mine is the near neighbor of Dolcoath and Carn Brea & Tincroft. The veins contain much wolfram and arsenic as well as tin. The mine was acquired for the present company in 1906 by the Allen-Meyerstein group in London. The capital is £50,000 in £1 shares, of which the previous owners received 20,000 shares carrying a liability of 5s. per share, and on the formation of the company the promoters procured subscriptions for 20,000 shares at par. A short time afterward the remaining 10,000 shares were sold at £4 each. The total cash funds were, therefore, £65,000. A new shaft has been sunk and much development work has been done; a modern dressing plant has also been provided. The company first made profits in 1909, when 15% was distributed. It is now announced that the dividend is to be the same for 1910. During 1910 the amount of ore raised was 60,916 tons, and the production was as follows: 630 tons tin concentrate, value £56,561; 126 tons wolfram concentrate, value £13,579; and crude arsenic, 736 tons, value £7664. The total receipts, including sundries, were £77,315, or 25s. 6d. per ton, and the costs £62,500. An allowance of £2968 was made for depreciation, £5000 has been placed to reserve, and £7500 has been distributed as dividend. During the year improvements have been made in the arsenic-refining plant, and the defects which gave rise to a lawsuit for damages have been remedied. The new main shaft is completed to the 1350-ft. level and is now being sunk 120 ft. farther. During the year 4697 ft. of development work has been done, and the ore disclosed has averaged a rather higher content than during the last two years. The manager, Josiah Paull, deserves credit for the way he is conducting development operations, and the energy and enthusiasm of Francis Allen, the chairman, should also receive recognition. The ore is of low grade; it is not clean tin ore, as is that at Wheal Kitty, and requires very careful dressing for the separation of wolfram, pyrite, and arsenopyrite.

As a contrast to the success of South Crofty, the continued failure to win success at Botallack must cause Mr. Allen many moments of regret. At the present time efforts are being made to raise fresh capital by means of a drastic reorganization. The mine was re-opened in 1906 by the Allen-Meyerstein group at the same time as the South Crofty. Owing to the lack of records, and of exact information relative to the state of the workings, the results of operations have been disappointing. The capital of the company consists of £100,000 in ordinary shares of £1 each, 72,103 'A' shares of 5s. each, entitling holders to 5% of the tin sales and half the profits, and £4787 in income bonds; while the money advanced on loan by Cornish Consols, a finance company belonging to the Allen-Meyerstein group, is £20,689. For the protection of creditors the company has had to go into the hands of a liquidator, and the directors are making strenuous efforts to continue operations. It is proposed to form a new company with a capital of £100,000. Holders of the 100,000 ordinary £1 shares in the old company will be offered half the number of new £1 shares on which there will be a liability of 5s.; the holders of the 'A' shares will receive one new share of £1 each in place of four 5s. shares; and the holders of income bonds will receive shares equal to the nominal value of their present holdings. To induce shareholders to come forward, special terms for underwriting are being offered to them. In order to satisfy Cornish Consols for the loans above mentioned, £20,000 in shares are to be issued. The mine, unfortunately, has not enjoyed the advantage of continuous management since it was re-opened. At first William Thomas was manager, then W. R. Thomas, and now A. B. Climas; for a time Bainbridge, Seymour & Co. were the consulting engineers; they have been succeeded by Pettit & Poore. Over £70,000 has been spent during the last four years. The surface plant consists of 20 stamps erected and another 20 ready on the spot, together with concentrating machinery. It is to be hoped that shareholders will persevere in their venture.

The sustained success of the gold mines in the Kolar district of Mysore is apt to make people forget that for years the development of the deposits was a failure and that it was by a mere fluke that operations were continued. Another erroneous idea that many people have is that the titled and military gentlemen whose names appear on the list of directors of John Taylor & Sons' Indian gold

Kolar Goldfield, View From Robertsonpet Road.

mining companies are of the guinea-pig type, so well known in London. So far from this being the case, these gentlemen were practically the fathers of the schemes for opening the mines, and have faithfully followed their fortunes, reaping reward from the profits and not from the markets. It is opportune, therefore, to quote some of the history of the Kolar district that appeared in recent issues of the *Daily News* of Bangalore, India. In local circles in India it is claimed that Mysore was the Ophir of David and Solomon, the argument being that the other products mentioned in the Bible, ivory, sandal-wood, apes, and peacocks, are mentioned in the earliest records, whereas other countries, such as Rhodesia, cannot give similar corroborative evidence. The earliest indisputable testimony relating to gold mining in Mysore is found in the 'Arthasastra' of Kantilya, 750 years after Solomon's time and 250 years B. C.; it is here recorded that gold was worked in the districts of Shimoga and Chittadroog. The numerous old mines found by the Geological Survey in the neighborhood of these two towns testify to the importance of the industry in former times. It has also been shown by inscriptions in the Tanjore temples that active gold production took place in the thirteenth, fourteenth, and fifteenth centuries. In recent times activity dates from 1878, when James Hayes and Walter Elliot obtained a license to mine for gold near the village of Oorgaum. Mr. Elliott, who was the active prospector, died shortly after work was started, and his assistants, Lavelle and O'Brien, continued his work. The first-named found gold quartz near Oorgaum and took it to General De La Poer Beresford, at Bangalore, who started a small syndicate among his fellow officers and acquired the rights over 10 square miles. At this time the boom in the Wynaad district, on the Malabar coast, was at its height, and 25 mining companies, with a total capital of five million pounds, had been floated in London. It was hoped that the proximity of Mysore to Wynaad would be a help among promoters. This hope was not borne out, and no assistance came from London just then. Eventually four companies were formed in India. Of these the Madras, Oorgaum, and Balaghat companies were registered in Madras and were under the management of Arbuthnot & Co., and the Kaiser-i-Hind was registered in Bombay. These were small companies

formed for prospecting work. Promising ore was struck in the Oorgaum in May 1880, and a trial crushing produced 100 oz. from 40 tons. Captain Bell McTaggart, then attached to the artillery at Bangalore, resigned his commission, and proceeded to London with the idea of interesting capitalists. This he was successful in doing, and by the middle of 1881, eleven companies were at work, including the Mysore and the Nundydroog, managed by John Taylor & Sons. The years 1881 to 1885 gave disappointing results. In the latter year only three of the companies were actively working, four having closed, and another four awaiting developments. The historic meeting of the Mysore company was held in 1885 for the purpose of winding up. A number of mining engineers had reported adversely and recommended that operations should cease. The only favorable report came from B. D. Plummer, the superintendent of the Nundydroog mine, and, as he had the support of John Taylor, his views were adopted, though only by a small majority. Work was accordingly continued and Mr. Plummer was made manager. From that day onward the Mysore mine went forward and has won celebrity, and other adjacent mines have also become highly profitable.

ELY, NEVADA

Mill Work Retarded by Frozen Ore.—Giroux Equipment and Development.—Railroad, Utah to Ely.

The extremely cold weather recently prevailing has proved a serious hindrance to the milling operations of the Nevada Consolidated by the freezing of its ores in transit from the mines to the concentrating plant at McGill, a distance of 20 miles. The ore, made wet from melting snow and ice, is taken from the open pit by steam-shovels and dumped into cars, after which it usually stands on sidetracks for several hours before being started to the concentrator, and as the temperature has ranged from 10 to 20° F. below zero, the ore is frozen solid in the cars when it arrives at the plant, and has to be removed by dynamite. The company has been fortunate this year in the fact that the weather has been generally favorable for its operations. It has averaged 8000 tons of ore per day, which will soon be increased to 10,000 tons by the starting of the seventh and eighth sections of its concentrator in April. The heavy snow-fall of the past few weeks is a guaranty of an abundance of water for the summer and fall months, which makes possible the operation of the concentrator to its full capacity.

The Giroux Consolidated has completed the equipment of its Giroux shaft, which has reached the depth of 1400 ft. The 600 and 1200-gal. pumps installed on the 1200-ft. level are gradually draining the old workings. Development is progressing on the 770 and 1200-ft. levels, and a cross-cut will be started next week from the 1400-ft. station to the Alpha workings. The company will soon commence shipping high-grade smelting ore to the Tooele smelter in Utah. No announcement has been made as to when the concentration of sulphide ores will be commenced. The company has a concentrating plant of 500 tons capacity which could be put in condition to operate in a short time, but the water-supply now available is not sufficient to keep it in steady operation. The management is hopeful that with the development on the 1400-ft. level a sufficient water supply can be obtained from that source to meet the requirements of the mill.

It seems probable that a railroad will be constructed from Tintic, Utah, to the Ely district. The Tooele smelter, owned by the Cole-Ryan people, is unable to get a sufficient tonnage of ore from the mines of Utah to keep it in profitable operation, hence the owners are anxious to have a direct transportation line into the Ely district. The construction of the road, it is understood, will be backed by W. A. Clark and the Cole-Ryan interests. This road would give the Giroux company, controlled by Cole and Ryan, a direct outlet for its ores and concentrates to the smelter at Tooele, and would also insure it a reasonable freight rate on all supplies coming from the East. It would obviate the necessity of this company building a smelter in Ely district, which might cost as much as the construction and equipment of the proposed road. The length of the proposed road would be about 100 miles, and the line would serve several other mining camps of note between Tintic and the Ely district. The Ely Consolidated is developing large bodies of low-grade sulphide ores on its 500-ft. level. It is the intention of the management to resume sinking the Zack shaft, and make it 600 ft. deep. The Boston-Ely is meeting with success in driving its cross-cut on the 1245-ft. level to the contact.

REPUBLIC, WASHINGTON

New Development Planned.—Plant of the North Washington Power & Reduction Co.—Extension of Lone Pine Vein.

The Eureka-Republic company is to be organized for the purpose of developing and operating the Mountain View, Iron Mask, Flag Hill, and Bodie claims, the deed for which has not yet passed. The Flag Hill has yielded some rich ore from small lateral veins, specimens of which showed native gold. A north-south vein on the same claim has been developed by an adit and cross-cut, showing a width of from 2 to 5 ft., with ore running from $2

Lone Pine Vein, Republic, Washington.

or $3 to $14 per ton, a large tonnage of which, already mined, remains on the dump. The Iron Mask adjoins the Flag Hill on the east and crops 4 to 5 ft. wide for some distance. The only development consists in pits and open-cuts in rather low-grade ore, which will pay a small profit over the costs of mining, haulage, and milling. The Mountain View adjoins the Flag Hill on the southwest and presents good prospects. The Bodie claim is situated in a separate zone, on the southerly extension of the San Poil mine. A 2-compartment shaft was sunk in the hanging wall to a depth of 200 ft., from the bottom of which the vein may be tapped by a short cross-cut.

The construction of the mill for the North Washington Power & Reduction Co. is well advanced, and the management believes it will prove to be a successful metallurgical plant. The method of treating the ores to be adopted involves old and well known principles, but the machinery to be employed, from the coarse crushing of the ore to the recovery of the bullion, will all be of the latest pattern. The concrete retaining walls for the main building are finished. The excavations for the Chilean and

tube-mills and coarse crushers are practically completed. The framing of timbers for each section of the plant is well along. The shed for the precipitation tanks and filter-presses has been built, and the framework for the main section of the mill is up and ready for the sheeting. All of the machinery has been ordered and is in transit. It has been discovered that the Lone Pine vein, in its northeasterly course, not only crosses the Insurgent ground, but passes beyond it into the Last Chance claim, owned by the Lone Pine-Surprise Consolidated M. Co. Charles P. Robbins, of that company, accompanied by Richard Marsh, an assayer, came into camp from Spokane, and examined the premises, with a view to future action, either in the way of developing or leasing and bonding the ground now, for the first time, known to contain a rich vein. The discovery was made at a depth of nearly 200 ft. Where the vein should crop out on the Last Chance ground, the surface débris is deep and is believed to cover the apex from sight.

MEXICO

Mining and Transportation Interrupted in Chihuahua.—Cookson & Co. Buying Lead Bullion.— Contracts for Railroad Building. —Veracruz Oilfields.—Operations at Guanajuato.—The San Toy.

Mining operations in western Chihuahua have been checked perceptibly by the revolutionary disturbances in that State. The concerns that have continued to operate have done so under difficulties, and if the trouble continues, the obtaining of supplies and the safe transportation of bullion and pay-roll money may become such serious questions as to cause a widespread suspension of operations. Due to traffic interruptions on Chihuahua railroads, it has been necessary to make shipments of products through Sonora, and to obtain stores through Sonora points. There has been some revolutionary activity in the State of Sonora, and traffic on the Yaqui River line of the Southern Pacific has been interrupted. The disturbed conditions have resulted in brigandage in various sections, and some mining concerns have suffered. The revolutionary disturbance has lasted longer than was believed probable when the first outbreak occurred, and the situation has steadily grown more serious. There have been a few outbreaks in the southern portion of the Republic, but so far the Government has been able to prevent extensive trouble there. Important changes in the official family of President Diaz are reported to be pending.

The lead bullion of the Towne smelter at San Luis Potosi, which now goes to the United States, may be contracted for by Cookson & Co., the lead and antimony refiners of Newcastle-on-Tyne, England. The matter is now under consideration, and Clive Cookson, one of the principals, will soon arrive in Mexico in connection with that and other business affairs. For several years the Cooksons have purchased the lead output of the Torreon smelter, and they have been notified by the management of that plant that a material increase in production is anticipated this year, beginning in March. This results from the contract recently made with the Compañia Minera de Naica for the output of its lead-silver mines in the Naica camp of Chihuahua. Several hundred tons per day will be supplied to the Torreon plant. The Cooksons own the principal antimony mines in Mexico, situated in the States of San Luis Potosi and Queretaro, and operate an antimony smelter at Wadley, a station on the National railroad in San Luis Potosi. This smelter product amounts to hundreds of tons per month, and is shipped to England through the port of Tampico. The antimony properties were purchased several years ago from M. Elsasser and A. Weill, of Mexico City, each of the men receiving £80,000. The only antimony properties distant from transportation are those at Santa Maria de Mlera, in the State of Queretaro, a wagon-haul of about 100 kilometres to Bernal, on the National road, being necessary. Contracts for the railroad that will open the Sombrerete, Chalchihultes, and Nieves mining districts of Zacatecas, and the Nombre de Dios district of Durango, have been let by the National Railways of Mexico to the Compañia Bancaria de Obras y Bienes Raices, and the International Contracting Co. The former, which has already commenced work, will build 170 kilometres out of the city of Durango, and the latter will build from Cañitas, a station on the Mexican Central in Zacatecas, to Sombrerete, 126 kilometres. The Robert S. Towne interests, having extensive holdings in the Zacatecas districts, that will be opened, and which formerly held the concessions for the railroad, have agreed to a cash contribution to the construction fund, and subsidies aggregating $1,280,000 have been granted by the States of Zacatecas and Durango. The 296 kilometres of railroad will cost several million pesos. The town of Sombrerete will be served by a branch 11 kilometres long, its situation in the mountains making impracticable the construction of the railroad through it. A few years ago the Towne people organized a company to build this railroad, but the financial depression in the United States interfered with the plans, and some time later the concessions were taken over by the National Railways. A railroad that will benefit the Sonora mining industry is under construction by the Mexican Union Railway Co., the English concern that last year took over the mineral railroad extending from Torres, on the Sonora

State of Chihuahua, Mexico.

railway, to Represo. This line is to be extended from Represo to Ures, about 70 kilometres. It is expected to have the first 10 kilometres completed in March.

Recent developments in the oil districts of Veracruz are causing oil men to look to the future, and the formation of a producers' agency, patterned after the organizations that have proved successful in California, is being given consideration. California men interested in Mexican oil are expected to lead in the movement. An abundant supply of fuel-oil will solve Mexico's fuel problem, and benefits will be hastened by an organization that will contract to market the products and guarantee deliveries to consumers. Prices of oil lands and oil leases have advanced as a result of the gushers in the Juan Casiano and Potrero del Llano fields. E. L. Doheny, head of the Mexican Petroleum and Huasteca Petroleum companies, has announced that $2,500,000 will be spent in constructing a pipe-line from the Juan Casiano field to Mexico City. A concession for such a line was granted by the Mexican Government a few days ago, and right-of-way for a portion of the distance has been arranged. The pipe-line will be built as far as some convenient railroad point on the high central table-land. The Juan Casiano field is to be given a railroad to connect with

water transportation. The great gusher brought in by the Pearson interests in the Potrero del Llano field is now under control, and much of the oil is being saved.

Twenty of the 40 stamps of the new mill of the Providencia Mining & Milling Co., in the Guanajuato district, are operating, and the other 20 will be soon in use. It is estimated that the ore reserves in the company's Tajo de Dolores mine represent about five years supply for the mill. The Proprietary Mines Co. of America is financing both the Providencia M. & M. Co. and the Mineral Development Co., and due to the fact that its attention has been concentrated on the Providencia plant, the Nueva Luz work of the Mineral Development has been temporarily suspended. Now it is not expected to reach the mother lode of the Guanajuato district with the Nueva Luz cross-cut before fall. The Oro Grande Mines Co. has increased the capacity of the Guanajuato Amalgamated plant, taken over last year, to 500 tons per day, by adding re-grinding equipment. The Jesus Maria mine, an Amalgamated property, has been shut down, and ore for the plant is being obtained from the Refugio and Bolañitos mines and dumps of the Oro Grande. The company is making a monthly profit from milling, and is spending the most of it in unwatering the mine and development. An aerial tramway, 2 kilometres long, is being built to give the San Matias custom mill, of the Mexican Milling & Transportation Co., connection with dumps and open-cuts beyond the Sirena mine, in the Guanajuato district. A large tonnage of low-grade ore can be obtained. Due to a scarcity of profitable ore, only 40 of the 80 stamps of the Guanajuato Consolidated Co. are now in operation. The annual report of the San Toy Mining Co., operating in the Santa Eulalia district of Chihuahua, show that in 1910 the company marketed 20,181 tons of ore, of a gross value of $529,470. The net income for the year was $437,563, and the net profits $157,566. At the end of the year the undivided profits amounted to $295,350.

NEW YORK

Unchanged Financial Status. — Retirement of Gould from Mo. P. — Decision of Interstate Commerce Commission.—Support for Mining Issues.—The Guggenheim Exploration Co.— Pioche Merger.

Eastern financial affairs have aroused little interest during the past week. Any excuse is made to serve in justification of prevailing dullness. Adopting the habit of the Supreme Court of the handing down its decisions on Monday, the first business of the day of each week is given to watching the wire for any possible action in the important cases pending before that tribunal. The holidays have been made to serve also as excuses for stagnation in the market. The simple truth is that the situation remains unchanged, and for the present the stock market is playing to an empty house. One important event of the week is the apparently complete abdication of George J. Gould as the controlling head of the Missouri Pacific railway. This step marks the passing of the Gould influence in American financial affairs. It is said that Mr. Gould is to retire not only from the presidency of the road mentioned, but from all active business. The possibility of tariff changes, the prospect of an extra session of Congress, the admitted need of currency reform on the one hand and the disposition of the general public to oppose the centralization of financial power on the other, are elements adverse to creating and maintaining market movement. The great transportation companies have been forced to yield to public demand in the recognition of commissions and commerce courts, all tending to force the public service corporations to go upon an investment basis. The important event of the week in market circles was the decision of the Interstate Commerce Commission, denying the increase in freight rates demanded by the railroad companies. The importance of the decision goes to the stock market rather than to any matters of railroading, and is a more radical step in the direction of terminating any speculation in rails than any yet taken. The effect is stagnation during a stage of transition, and speculation must turn to issues having a natural hazard: the monopoly of trading enjoyed by the New York Stock Exchange must either dry up for lack of public support, or it must take steps in a direction in which some advances have already been made. With markets in mining issues properly protected and placed upon a basis where the element of good faith can be assured, public support will be given freely. The natural hazard of mining has no terrors for the investor. He is willing to lose to Mother Nature. There are to be some changes in Eastern financial markets. Investment brokers may become more numerous, and while mining matters could hardly be duller, the logic of events points to a wider and more general activity than has ever been known heretofore. The promised fight by Thomas L. Chadbourne, of Houghton, Michigan, against the proposed Calumet & Hecla consolidation has already drawn the fire of the management of the big company and also a warm retort from J. Parke Channing. The last-named gentleman resents the assertion of Mr. Chadbourne that the valuation placed upon the Ahmeek, in which Mr. Chadbourne is most largely interested, was not as high as the mine deserved. Mr. Channing's reply, in part, is: "In valuing a property, I know neither one side nor the other, and its past record and future prospects alone guide me in my decision." It is certain that in so large a task as the appraisal of the properties of the Lake copper country, it would be a waste of time to proceed upon any other basis. To have a deciding voice in so important a piece of work is about as much glory as an engineer might expect to attain in his career. While the Boston Stock Exchange committee has reported favorably, the rank and file of the brokers are hoping that it may not be consummated. Many of the companies to be included are ranked as semi-speculative, and their stocks are comparatively active. For all these to be merged in one issue, and that of such an investment character as to almost preclude speculation in it, means a heavy loss in commissions for Boston brokers.

The Guggenheim Exploration Co. is to ask the public to come in. The concern has been something of a close corporation, though the stock has been traded in on the Curb. Now the capital stock is to be increased from $20,000,000 to $50,000,000; a 100% stock dividend is to be declared; the remaining ten millions of new capital stock will be held in the treasury, the forty millions which will then be outstanding will be put on a 6% dividend basis, and application will be made for admission to the New York Stock Echange. Whether this is a step in the way of eventually making a merger of all the Guggenheim companies, remains to be seen. The Exploration company has always been looked upon as the most successful of the Guggenheim corporations, having been the receptacle of a large share of the Nevada Consolidated and Utah Copper dividends. The merger of the properties at Pioche, Nevada, which has been prematurely announced two or three times, is now said to be nearing completion. The consolidation, as at present contemplated, will include the Nevada-Utah, the Consolidated Pioche, the Ohio-Kentucky, and the Prince Consolidated. Although the Consolidated Gold Fields of South Africa, Ltd., has failed to acquire the Golden Cycle mine at Cripple Creek, the company evidently intends to broaden its operations in America. A subsidiary company has been formed under the English law, and the services of John Hays Hammond as consulting engineer has been secured. The twelve stockholders of the United Verde Copper Co. held an annual meeting this week in New York. Some time ago W. A. Clark was quoted as saying that "if there is a marked increase in copper production, it must come from the porphyry mines." His position is not altogether supported by the figures on the United Verde production, which show 38,663,880 lb. for 1910, as compared with 36,694,063 in 1909, and 36,183,089 in 1908, while in 1907, the year of high prices, the property turned out but 33,012,339 lb. If the porphyry mines made high records for themselves last year, so did the United Verde.——The consolidation of the Ray Central and the Arizona Hercules is said to be definitely agreed upon. Ray Central has not been making great progress recently; the Weed & Probert report has not yet been given out.

General Mining News

ALASKA

BERNERS BAY REGION

Bulletin 446 of the U. S. Geological Survey, lately issued, deals with the topography and geology of a region of 50 square miles contiguous to Berners Bay, situated 45 miles northwest of Juneau. The bulletin describes the fissure veins, quartz veinlets in diorite, and stringer lodes of that region, and gives data concerning 12 mining properties in that district, consisting of the Ivanhoe, Horrible, Ophir, Bear, Kensington, Eureka, Comet, Johnson, Indiana, Jualin, Fremming, and Greek Boy. There are five mills in the region, having in all 90 stamps. The ores of the district comprise gold, chalcopyrite, galena, sphalerite, in quartz, calcite, dolomite, sericite, epidote, and chlorite. These mines are on Sherman and Johnson creeks.

COPPER RIVER

The Bonanza copper mines are situated in Wrangle mountains, close to a stream called the Kennicott, which flows into the Nizina, the latter emptying into the Chitina, the principal tributary of the Copper river. Kennicott, at the lower camp of the Bonanza, is the terminal station of the Copper River & Northwestern railroad, which starts at Cordova, traverses a 40-mile stretch of tide-flats, proceeds nearly 100 miles northerly along Copper river, thence nearly easterly along the course of the Chitina and Nizina, making a route of 200 miles between Cordova and Kennicott. The Bonanza camp is supplied with bunk and mess houses, warehouses, sawmill, assay office, and other buildings. The lower camp is connected with the mines by a 15,000-ft. aerial tramway, the upper terminal being 4000 ft. higher than the lower terminal. It is stated that a concentrator is being built at the lower camp. The mine is developed by 2000 ft. of workings. The ores consist of azurite on and near the surface, and chalcocite in the deeper workings.

THE INNOKO

Pay-gravel has been found on Ophir and Spruce creeks, where there will be activity next spring. Some winter

Map of Innoko Region.

dumps have accumulated on Little creek, and these will be sluiced when the season opens. Gaines creek is reported to have good pay-gravel, where work is being planned for next spring; this may be said of Yankee creek, also. These are all tributary streams of the Innoko.

PRINCE WILLIAM SOUND

Business men of Valdez have had surveyed, and purpose building, a 7-mile railroad from that place to Mineral creek, which is the centre of mining activity. The Mineral Creek Power Co. has been incorporated, the plan of the company being to generate power for the operation of stamp-mills to be built in that vicinity this year. Joseph Bourke, F. M. Boyle, C. D. Shaw, and M. Blum are the incorporators. The same company intends erecting a stamp-mill to treat custom ores being mined in small lots on Mineral creek. Work is in progress in placer ground of that locality. The Black Diamond lode mine has been opened by an adit whereby a 5-ft. vein of gold ore of milling grade was found. The Valdez-Bonanza, being developed by adit levels, has a 7-ft. vein, the ore in which assays from a trace of gold to $292 per ton. It is claimed that a body of iron ore, suitable as fluxing material, has been discovered on Hinchinbrook island.

THE YUKON

Hydraulic equipment is being hauled from Circle City to the Barnette placers on Mastodon creek. Berry and Lamb are hauling supplies to their placer properties on Eagle and Mammoth creeks, where work is to begin with the opening of the season.

ARIZONA

COCHISE COUNTY

The Copper Queen Copper Co. has a force of 75 men engaged in construction work at its smelting plant at Douglas. Two reverberatory furnaces, and six roasters of the McDougall pattern, are being built. The concrete foundations for the roasters, and for the steel building in which they are to be housed, are complete. Storage-bins, intended to hold the concentrate that is required to be roasted, are of concrete, and these are nearly finished. The concentrate is to be delivered to the bins in cars hauled over an elevated track; it will be conveyed to the roasters by a belt-elevator. The new stack, to be 22 ft. diam., 300 ft. high, supported by a concrete foundation 60 ft. diam., has been commenced, the bricks for which are to be manufactured at Ancho, New Mexico. An extension to the flue-dust chamber, now finished, was built of tiling. The new converter flue, connecting with the recently built dust-chamber, is of sufficient capacity to carry the gas and fume from the 8 stands of converters with which it is connected. This flue is 11 ft. diam. at the end where it receives the gas and fume, and 13 ft. diam. where it discharges them into the dust-chamber. A 276-ft. tunnel, 30 by 15-ft. cross-section, was made to serve for slag-haulage. The tunnel is lined with concrete walls 4 ft. thick, with a supporting wall in the centre. With the completion of the reverberatories and roasters the concentrate, fine ore, and flue-dust will be treated in them instead of in the blast-furnaces.

MOHAVE COUNTY

As the result of a 3-weeks run of the Tom Reed Mines Co.'s 10-stamp mill, in Goldroad district, a clean-up of bullion was made, valued at $60,000. The shaft at this mine is to be sunk to a depth of 500 ft. The power system is to be improved. The Chloride district has a camp called Copperville, in which are the Copperville, Samoan, Lucky Boy, and other veins. The project of cross-cutting all those veins, by driving an adit, probably will be undertaken by the Arizona Southwestern Copper Co. Such an adit would cut the Samoan vein, owned by this company, at 700-ft. depth, which is considered below the leached zone. The Lucky Boy and Brighter Days veins are on claims belonging to T. B. Scott. The mine of the Frisco Mines Co., situated at Union Pass, has been sufficiently developed to expose about 750,000 tons of ore, estimated to have an average value of $12.50 per ton. The *Kingman Miner*, whose editor inspected the property, states that the vein has a dip of 20° and a width of 35 ft. The mill, recently built, has a Gates crusher, a 6-ft. conical Hardinge ball-mill, and a tube-mill, by which the material is reduced to 200-mesh. It is then cyanided in Pachuca agitat-

ing tanks, and Burt filters. The mill machinery is operated by Meitz and Weiss oil-burning engines, said to supply power at a cost of $5.50 less per horse-power month than steam-power. The oil costs about 6c. per gallon delivered at the mill.

YAVAPAI COUNTY

(Special Correspondence.)—G. W. Hull, of Jerome, is to resume development work on the claims of the Huron Gold company, situated near Huron station. The old workings have been cleaned out, and the buildings made ready for occupancy. The Eleanor Placer M. Co. is to commence work on properties in French gulch, near Prescott. Results of tests made are favorable, and the owners expect a profitable season.

Prescott, February 24.

The United Gold Mines Co., operating a mine and a small Nissen stamp-mill at Congress, has opened the property by sinking a 540-ft. shaft, from a number of stations in which the ore is developed. A larger mill is required and steps have been taken to raise funds to buy additional equipment. The directors are D. J. Sullivan, T. M. McGill, C. M. Raible, D. A. Burke, H. M. Sullivan, H. A. Cronin, and S. Newhall.

YUMA COUNTY

George Wood and A. J. Pickerell have sold to F. L. Smith, of Detroit, the Mineral Hill mines, situated 18 miles east of Parker. The property comprises 13 claims, and lies within two miles of the Planet mine, in the Bill Williams country. It has been developed by 500 ft. adits, drifts, and cross-cuts, whereby bodies of copper-iron ore are exposed.

CALIFORNIA

AMADOR COUNTY

The 40-stamp mill at the Zelia mine is operating again after a brief shut-down. The Bunker Hill mill, whose batteries were recently increased from 20 to 40 stamps, is operating at full capacity, and it is claimed there is sufficient ore accessible in the mine to keep the mill operating several years. Dividend No. 56, of 5c. per share, was paid on February 15.

ELDORADO COUNTY

A. G. Kulberg and Charles Edner have built a stamp-mill in the vicinity of Fairplay. It is to be operated on ore taken from a 4-ft. vein on their property.

INYO COUNTY

Ballarat is situated in Panamint valley, between the Argus range on the west and the Panamint range on the east, and that region is called the South Park mining district, which is said to have good surface indications of mineralization. Ballarat has a publicity committee which is trying to establish a mineral collection of ores representative of that district. The town is about 45 miles east of the Owens valley line of the Southern Pacific Co., and is 70 to 80 miles west of the Tonopah & Tidewater road.

KERN COUNTY

The Yellow Aster mine, Randsburg, has a force of 150 to 200 miners and millmen. There are 130 stamps operating in the mill. Much of the ore is exposed by stripping off the overburden, and is subsequently mined on the glory-hole plan. Three 7-ton locomotives and 21 3-ton cars were added to equipment in 1910. These are employed in removing waste, and in hauling ore to the mill. Ore said to assay $50 to $100 per ton has been found on the 425-ft. level of the Sunshine mine, owned by T. W. and B. M. Atkinson. Ore of high grade has accumulated on the 200, 300, and 425-ft. levels; on this the mill is to be operated. Development and stoping are being done with three air-drills. C. P. Christensen is superintendent for the Stanford Mining & Reduction Co., which operates a 10-stamp mill at Johannesburg. The mill has been running on ore taken from the Pinmore mine.

MARIPOSA COUNTY

The interests of J. E. Myers and associates in the Bullion Hill M. Co. have been purchased by J. M. and A. L. Richardson of Minneapolis. The company owns the Bullion Hill mine at Exchequer. The office of the company has been moved to Merced. Development work is to proceed under direction of B. R. Binns. The building of a milling plant is one of the probabilities.

MONO COUNTY

The Tri-Metal M. Co., which erected a cyanide plant at Benton to treat a dump of 20,000 tons of tailing, is leaching at the rate of 70 tons per day.

NEVADA COUNTY

The Murchie mining property near Nevada City has been purchased at trustee's sale by John J. Myers and C. F. Humphrey at $91,000. The buyers expect to organize a company to which the property will be transferred, and the intention is to begin operations later in the season. The prospect is that drift mining may be resumed this season at North Bloomfield, on what is known as the Humbug Bar Townsite mine, in which lot owners are interested. North Bloomfield is situated on a high bar between two forks of Humbug creek, and the townsite is said to be underlain by auriferous gravel. C. J. Graham has a bond and lease for most of the gravel rights of the place. The Red Cross mine, at Omega, was sold by the county to satisfy a claim for taxes. It was bid in by W. H. Martin at $2600, in the interest of E. J. Deane, who previously had a bond on it. Mr. Deane has a company organized to take over the property and operate it. The equipment consists of a 20-stamp mill, a sawmill, and other buildings.

SAN BERNARDINO COUNTY

The U. S. Smelting, Refining & Mining Co., which finds its lead concentrator and Huff electrostatic separators, for iron-zinc ores, a success at Midvale, Utah, may install separators of the Huff pattern in its concentrating plant at Needles. Mr. Mougin, who has charge of the Midvale plant, is at Needles making tests on ores received at that place. The California Gold & Copper Co. has built a leaching plant near Vontrigger, where it has developed a body of ore on the 200-ft. level of the mine.

SHASTA COUNTY

The Mammoth Copper Co. now has three furnaces in blast in its Kennett plant, and it is claimed the bag-house is disposing of the fume in a satisfactory manner; but it is probable that the bag-house will be increased in capacity.

SIERRA COUNTY

Mining auriferous gravel in this county has received an impetus by the success of operations of the Gold Star and Monte Cristo, at Fir Cap ridge, the Deadwood Con. at Poker Flat, the Gibraltar, near Hawley ranch, and the Columbia, on American hill. It is claimed there are extensive channels of gold-bearing gravel in Sierra county which never have been worked, some of which lie beneath a lava capping. The Gold Star gravel mine, at Forest, lately produced 300 mine-cars of gravel in 30 days, from which gold valued at $6.70 per car was extracted. The property belongs to the Alleghany Channel & Gold Quartz M. Co. The channel has been opened by bedrock adit-levels, and is said to have a width of 250 ft., and has been further developed by drifts and raises. The Alaska mine, situated near Pike City, has a vein that is 8 ft. wide at the face of the drift on the 400-ft. level. The ore extracted from this level contains $4 per ton in gold. The workings are kept free of water by operating electric pumps.

COLORADO

BOULDER COUNTY

The Zophar M. Co., developing a tungsten property in Nederland district, has installed an air-compressor, and purchased drills, to drive an adit into Baker hill, whereby a depth of 500 ft. on the orebody is to be attained. Weaver Bros. are erecting a small cyanide plant at Salina. The Metal Mining Association is considering the project of erecting a cyanide plant of large capacity to treat custom ores of this county.

CLEAR CREEK COUNTY

(Special Correspondence.)—Driving has been started on the Ocean Wave vein that was intersected 5300 ft. from the portal of the Capital adit. An 8-in. streak of ore is being followed. John Hurley is operating under lease. N. Williams, of the Ruler property, has uncovered a 6-in. streak of ore assaying $65 per ton in gold, silver, and copper. J. Hansen has the contract to drive the west drift on the Commonwealth vein, intersected 5000 ft. from the portal of the Wilcox adit. Machine drills have been brought into use. A body of zinc ore 2 ft. wide has been found in the east drift on the Mendota vein, opened by the Victoria adit, by the Mendota Mines Co., lessee. A carload of ore was shipped last week from the Scepter mine, on Democrat mountain, to the Stahler concentrating plant in Denver, where tests are being made.

Georgetown, February 19.

(Special Correspondence.)—The Colorado Blue Bell M. Co. is installing an electric-driven air-compressor and hoist, and machine drills. B. Martelon is manager. It is stated that work will be resumed next month in the McClelland adit, the portal of which is at Dumont. The bore is 7000 ft. long, but it will be necessary to drive on the Freeland vein 1000 ft. before the heading will cut under the old shaft. A 1200-ft. raise will then be made to drain the mine workings. An 8-in. streak of ore, assaying $30 per ton, has been opened at the breast of the Hoosac adit. Driving has been started to explore contiguous ground. The Metropolitan adit, on Donaldson mountain, is being driven at the rate of 7 ft. per day. The working force at the Oneida, at Freeland, is being increased, and ore shipments amount to 30 tons per day. The ore is entirely of a smelting grade and brings from $50 to $55 per ton. A force of 40 men is employed at the Saratoga mine, on Seaton mountain. Ore is being shipped to the Golden smelter for treatment. John Owen is manager. Machol & Co., lessees on the Seaton mine, and operating through the Newhouse adit, are breaking 25 tons of mill-dirt per day. The ore is sent to the Newton mill for concentration.

Idaho Springs, February 19.

LAKE COUNTY

The Progressive shaft, on the north Fryer hill, is being put in good condition, and a station is being cut out for the installation of a pump. The old hoisting plant is being replaced by a new one. Prospecting is in progress on the first level in an effort to open a shoot of ore. J. Johnson and partners, lessees on the McRea, Fryer hill, after prospecting and developing eight months, have opened a 5-ft. vein of silver ore. By continuing to drive on this vein the operators think lead ore may be found, as the occurrence of silver without lead is not usual on Fryer hill. The shipment of a car of ore is to be made. Ore-shipments from the Silent Friend, South Evans gulch, amounts to 500 tons per month; the ore is silicious and contains gold. The property is developed to considerable depth, and is drained by the Yak tunnel. Work on the St. Louis, South Evans gulch, is confined mostly to a streak of ore above the adit level. There is a shaft on the property which has a depth of 300 ft. below the adit, and this is to be sunk 150 ft. deeper, by which it is expected to reach the granite, and it is in this formation that fissures may be found. By this deeper exploration the Kezar M. Co., which owns the property, hopes to open the extension of the Hahnewald oreshoot. J. B. Stewart is in charge of the work. Lessees of the Garbutt mine, Breece hill, after getting the consent of the Ibex M. Co., drove a cross-cut from shaft No. 4 of the Little Johnny group to a position 200 ft. below the bottom of the Garbutt shaft; and they are now raising from that place to make a connection with the shaft. They chose this method in preference to sinking 200 ft. Raney & Newman, lessees on the Matchless, Fryer hill, are shipping 30 to 40 tons of iron ore per day. This ore contains considerable silica.

Bull Hill, Cripple Creek District.

PARK COUNTY

The Moose Smelting & Refining Co., for which J. L. Seward is chief engineer, is to erect a smelting plant at Alma, especially to smelt the ore of the Moose mine, which was operated profitably about 35 years ago. It is claimed the tonnage of ore on the Moose dumps is sufficient to justify the building of the smelter, which is to have a 150-ton furnace. The company is made up of New York men, and has an office at Denver.

SAN JUAN COUNTY

The Silver Ledge mine, situated between Silverton and Red Mountain, has been under development during the winter, and the plan is to have enough ore blocked out by May 1 to warrant starting the mill at that time. The orebody has been opened on the 300 and 500-ft. levels, where it has a width of 30 ft. in some parts. The ore consists of lead-zinc sulphide, accompanied by gold and silver. The mill was operated last season, the product being two kinds of concentrate: one containing 45% zinc

and 8 oz. silver, and another running 79% lead and 9 oz. silver. It is probable that the shaft will be sunk to the depth of 1000 ft. The Iowa and Silver Lake tramways were damaged last week by snowslides, and this caused cessation in transporting ore to the mills for a short time. Much ore is being exposed in the Iowa. The Sunnyside mill, at Eureka, is operating at full capacity; recent experiments with a Richards classifier were satisfactory. The Intersection Leasing Co. is mining and milling ore steadily; the capacity of the mill may be doubled. The Highland Mary mine, on Cunningham gulch, may resume work under new ownership next spring, as negotiations for the purchase of the property are said to be pending.

SAN MIGUEL COUNTY

The Primo Chemical Co. is preparing to start its mill again, at Newmire, for treating vanadium ore, after having been idle since last October. The plant of the Vanadium Alloys Co., situated at the same place, is reported to have resumed operating. The General Vanadium Co., operating at Fall creek, employs 12 miners, and turns out 60 tons per month of ore containing 2½ to 3½% vanadium. The mine is opened by three adits. This company has contracted to purchase similar ore from other producers in this vicinity.

SUMMIT COUNTY

Near Frisco is the King Solomon tunnel, now in nearly 5000 ft., intersecting a number of veins, one of the strongest being vein No. 11. By sinking a winze on this vein a body of ore was found, samples of which assayed 50% lead, and 1½ oz. gold per ton, together with some silver and copper. The force has been increased and work on No. 11 will be aggressive.

TELLER COUNTY (CRIPPLE CREEK)

The cross-cut being driven from the Roosevelt tunnel to the C. K. & N. vein will redound to the benefit of the El Paso mine and other properties of Cripple Creek district. This cross-cut is to be completed within the next few weeks. It is expected to drain the El Paso's lower levels. It is estimated that the tapping of the C. K. & N. watercourse will increase the outflow through the tunnel to 20,000 gal. per minute. The February output of the Blue Bird mine, on Bull hill, was close to 1500 tons of ore. Several lots of 6 and 8-oz. gold ore have been sent out from Dante No. 2 shaft, the ground reached by it being in the hands of lessees. The Cariolanus mine, on Battle mountain, part of which is operated by Erickson Bros. under a sub-lease, has a body of ore of smelting grade on the 500-ft. level. This ore is north of the main shaft. The vein has a width of 2 to 3 ft., and the ore samples 1 to 3 oz. gold per ton. Nelson & Son, also lessees on this property, are mining ore that runs about 1 oz. gold per ton. The Mary McKinney company, operating the mine of that name at Anaconda, has 20 miners employed, producing 50 tons per week incidental to the development being carried on. The main orebodies are still being mined by lessees. Edwin Gaylord has a lease on the Abe Lincoln, situated on Poverty gulch. This property belongs to the Stratton estate. The Golden Cycle has reached a depth of 1600 ft., and this is said to be the deepest shaft in Cripple Creek district.

IDAHO

METAL OUTPUT FOR 1910

F. Cushing Moore, State Inspector of Mines during 1909 and 1910, in his report for the latter year, gives figures showing the production of gold, silver, lead, copper, and zinc of the State by counties. Shoshone county, in which the Coeur d'Alene mining district is situated, stands at the head, as a matter of course, and is credited with 3110 oz. gold, 7,262,271 oz. silver, 229,950,506 lb. lead, 5,003,639 lb. copper, 5,995,600 lb. zinc, of a total value of $15,272,024. Owyhee county ranks second, with a total output of gold and silver valued at $556,925, produced mostly at De Lamar and Silver City; Lemhi is third, with an output of lead, silver, and gold valued at $544,708; Elmore, in which are the mines at Pine, Rocky Bar, and Atlanta, produced gold and silver valued at $214,716; Boise county yielded $180,459, mostly gold from Boise Basin and contiguous country; Custer is credited with a gold, silver, and copper output valued at $178,614, of which $107,586 was for copper; Nez Perce's output of gold and silver was valued at $51,462; Blaine, $38,728; Idaho, $25,945. Each of 11 other counties produced metal in small amounts. The metal production of the State is shown by the following figures: Gold, 49,289 oz.; silver, 7,890,388 oz.; lead, 239,144,570 lb.; copper, 5,837,639 lb.; zinc, 5,995,600 lb. Total valuation of all metals, $17,135,695, as against $15,606,826 for 1909.

SHOSHONE COUNTY

(Special Correspondence.)—The Hecla M. Co., operating the Hecla mine and mill at Burke, paid a dividend of $10,000 on Feb. 20, making a total of $2,140,000 to date. Recent development on the 1200-ft. level resulted in opening strong orebodies. Rich ore has been found on the property of the Pittsburg Lead Co., on Nine Mile, near Wallace. This ore is found in a winze sunk from one of the levels, the vein in which it occurs being 20 ft. wide.

Wallace, February 25.

(Special Correspondence.)—The Jack Waite mine, a new lead producer, situated on one of the tributaries of Eagle creek, 12 miles from Murray, was bonded to the Jack Waite M. Co. on Nov. 1, 1909, the price specified having been $250,000. The final payment of $100,000 was recently made by Lee Mantle, of Butte, one of the principal stockholders, and the title has passed to the purchasing company. In the last 15 months $50,000 has been expended in development and equipment. The lowest adit level, in a distance of 950 ft., gives a vertical depth of 450 ft. on the vein. The principal vein has a width of 6 to 8 ft., is on the contact of quartzite and slate, and contains high-grade steel galena ore.

Murray, February 24.

(Special Correspondence.)—Recent development in the Stewart mine has resulted in opening a vein of lead-silver ore parallel to what has been considered the principal vein. In driving 75 ft. the new vein was proved to be 7 ft. wide, containing ore of milling grade. It has been demonstrated that the Stewart now has three defined veins of ore. Ore-shipments to a concentrating mill at Wallace amount to 350 tons per day.

Kellogg, February 25.

(Special Correspondence.)—Federal Mining & Smelting Co. is making additions to its milling plant at the Morning mine. The building is being enlarged to accommodate a plant for the re-treatment of the middling and slime by means of the MacQuisten tubes. The sorting plant also is being enlarged. It is believed by the company that the new process may go far toward solving the problem of the economical treatment of the Morning ores, which contain carbonate of iron and are low grade. More than 400 men are employed at the mine. The mine of the Gold Hunter M. & S. Co., which has been operated 20 years, and paid but two dividends, now has reserves of ore sufficient to keep the 200-ton mill operating five years. Mine work is now carried on through No. 6 adit-level, having a length of 4700 ft. A winze was sunk to a depth of 200 ft. on this level, 4500 ft. from the portal, and as the result of driving from the base of this winze a shoot of rich ore was opened on the south vein; similar ore was found on the north vein at this depth. It is ascertained that the two veins are dipping toward each other. A new orebody has been opened on the level 400 ft. above No. 6, which is 22 ft. wide. The property is at Mullan, and Dennis Ryan is manager. It is announced that the capacity of the mill is to be doubled.

Mullan, February 25.

MONTANA

DEER LODGE COUNTY

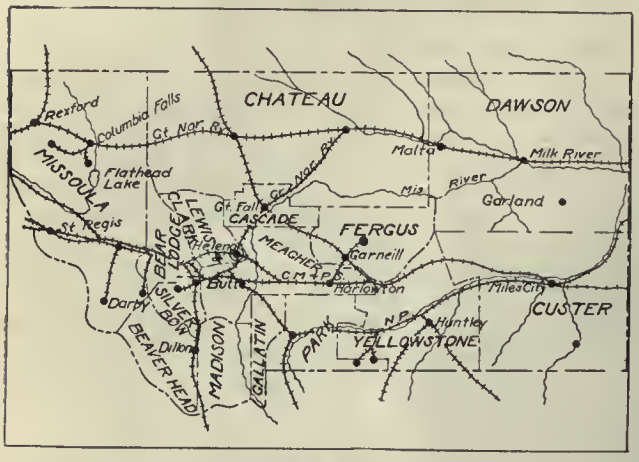
(Special Correspondence.)—The Gold Coin, in the Georgetown district, is likely to pass into the hands of Denver and Eastern investors. A short time ago an option was given to Fred L. Klein of Denver, and later the mine was

examined by H. S. Sanderson of that place, who has returned to Denver with the samples. The Gold Coin is owned by the Anaconda National Bank, controlled by Yegen brothers, and while here Mr. Sanderson was under the special guidance of a representative of the banking firm.

Anaconda, February 25.

FEROUS COUNTY

(Special Correspondence.)—The Rhein Gold Mining Co. has acquired the property of the Meredith Mining Co., better known as the New Year group, situated in Judith basin. It is a gold property, consists of seven claims, and has a good mill. A. S. Wright, of Chicago, is in charge for the new owners, and announces that operations are to be commenced on an extensive scale. The Chicago people obtained the property after it had been placed in the hands of a receiver in consequence of some differences between tne previous owners over the management of affairs. The Barnes-King Gold Mining Co. is to hold its annual meeting



Northern Montana.

at Kendall, March 1. Those who have been in correspondence with some of the New York stockholders say the company may make an effort to purchase the North Moccasin mine, which is to be sold to satisfy a judgment for $100,000. The North Moccasin is known to have a rich gold vein, but a cave-in completely closed the shaft a few years ago, and the owners were unable to raise the money necessary to re-open the mine. Kendall Mining Co., of Kendall, paid its seventy-fifth dividend on Feb. 23, which was $10,000, making a total of $1,355,000 to date. The Kendall mine is controlled by Finch & Campbell of Spokane and their associates. This property, the Cumberland at Maiden, and the Gold Reef at Gilt Edge, have been lately the principal producers of Judith basin.

Lewistown, February 24.

LINCOLN COUNTY

It is asserted that six mining properties in the Libby district are to be in operation this year. One of these is the Hazel T., on which a vein containing 40 in. of steel galena was opened by 70 ft. of driving. Further development showed an increase in width to 10 ft., in which the ore assayed $43 per ton. The same vein, when intersected at another place, proved to be 38 ft. wide. The vein is between porphyry and quartzite. George Chandler of Spokane is one of those interested.

MADISON COUNTY

(Special Correspondence.)—The Bismark mine, situated near the head of South Boulder canyon, is owned by the Montana-Illinois Copper Mining Co. An effort to find the downward extension of a body of copper ore, discovered near the top of the mountain, was recently successful. Under direction of W. L. Credon an old cross-cut in the lower tunnel was extended southerly, which resulted in opening a body of ore which assayed about 2% copper, 2 oz. silver, and $3 in gold. Farther on a body of lead ore, 1 ft. wide, containing 20 to 30% lead, 7 oz. silver, and 1.47% copper was exposed. Further driving opened a third body of ore which assayed 4% copper, 8 oz. silver, and $1.20 in gold per ton. Plans for the first unit of a concentrator are being considered, and as the property has a water-power site, with a railroad close by, the cost of mining and milling would not be high.

Virginia City, February 25.

NEVADA

CLARK COUNTY

F. B. Miller, George Colton, and A. Morrison have taken a lease on a part of the Duplex group at Searchlight. The Quartette Mining Co. recently cyanided 150 tons of mill tailing for Charles Hamil. This stuff resulted from the milling of some ore sent to Searchlight from the Jumbo mine at Hart, Cal., and the treatment was in the nature of a test. James Montgomery and Clarence Summers are mining in Newberry district, 18 miles southeast of Searchlight. They have accumulated some ore that assays $15 per ton. Their camp has a good supply of water.

HUMBOLDT COUNTY

The lessees of the Seven Troughs district are active in development and ore-production. The Tyler Leasing Co., whose shaft on Coalition ground is 425 ft. deep, is to sink 75 ft. deeper. The vein has been opened on the 400-ft. level. The Florence, Fresno, and Kahler & Andregg leases are in active hands. Three other leases have been let on Coalition claims. The Darby Gold Reduction Co., now operating the Mazuma Hills mine, has made the necessary improvements and has let a contract for 500 ft. of sinking. It is estimated that 250 miners are employed in this district.

NEW MEXICO

SOCORRO COUNTY

(Special Correspondence.)—The Ernestine M. Co., for last week, had an output of 8588 oz. silver and gold, and 45 sacks of concentrate, from 695 tons of ore. The new mill at the Deadwood mines is operating steadily; the first clean-up gave 1600 oz. of gold and silver bullion, and 50 sacks of concentrate. The mill machinery is driven by a De La Vergne high-compression oil engine, the cost of power being estimated at approximately $100 per horsepower per annum. The half-month clean-up at the Socorro mines amounted to 20,000 oz. of silver and gold bullion. The Wilfley tables are to be placed in use again as a means of increasing the mill's capacity. The Gold Dust Mines Co. is drifting east and west on the vein from the point of intersection. Sinking below this level is in progress. The Enterprise M. Co. is sacking high-grade ore taken from the third level, and a winze is being sunk from the fifth level. The Oaks company has development work in progress on several claims of the Tunnel group. The contractors are delivering ore from the mine of the Treasure M. & R. Co. to the mill, and the intention is to increase the tonnage. The unusually heavy fall of snow in the mountains of this region gives assurance of a plentiful water-supply next summer.

Mogollon, February 25.

OREGON

The Oregon legislature has enacted into law the Bureau of Mines bill, providing for the establishment by the State of a mining bureau, to be under direction of the board of regents of the State Agricultural College, at Corvallis. The object sought to be attained is to promote the classification and study of the ores and minerals. An appropriation of $2000 was made, this sum to be used in getting the work started. Oregon mining men are asked to meet in Portland on May 16, 17, and 18 to form a State chapter of the American Mining Congress.

MEXICO

CHIHUAHUA

(Special Correspondence.)—The January production of the Rio Plata Mining Co. amounted to 71,289 oz. silver. The decrease from that of last fall is due to the shortage of labor, caused by the insurrection in Mexico, Chihuahua being the State in which the insurrectos are active.

Decisions Relating to Mining

Specially reported for the MINING AND SCIENTIFIC PRESS.

DUTY OF MINE OWNER IN CASE OF NEGLECT OF MINE FOREMAN

Where the owner of a mine knows that the mine foreman is neglecting the performance of his duties, or that the mine is in a condition which endangers the health or the safety of the miners, it is his duty to act promptly and have such dangers removed; but where the owner himself is not in fault he can not be made liable for the neglect of duty imposed by the statute upon the mine foreman. He necessarily must operate his mine through others, and when he complies with all statutory provisions enacted for the protection of his workmen by employing competent assistance, he has done all that is required of him and can not be subjected to liability for which he is not responsible.

Dempsey *v.* Buck Run Coal Co., (Penn.) 76 Atlantic 745. March 1910.

LIABILITY OF MINE OWNER FOR INJURY FROM IMPROPER VENTILATION

The statute of Pennsylvania requires the owner of a mine to place the mine and the underground works in charge and daily supervision of a mine foreman. The statute commits to such foreman the charge of matters pertaining to the ventilation of the mine and prohibits the superintendent from interfering with him in the performance of these duties. Accordingly, where the owner of the mine placed a competent mine foreman in charge of the mine, whose duties require him, among other things, to protect the miners against insufficient or inadequate ventilation, such mine owner has complied with the statute requiring him to use precaution for the safety of the miners, and the mine owner is not liable for injury to a miner resulting from neglect or failure of such foreman to properly conduct the air currents along the face of the working places of the mine. In an action to recover damages for injuries to a miner sustained by an explosion of gases in an anthracite coal mine on an alleged failure of the mine owner, a corporation, to perform its duties, it was conceded that the company had employed a competent certified foreman and that at the time of the accident he was in charge of the underground workings of the mine. There was no evidence, however, that the owner had not provided and maintained an adequate supply of pure air for the mine. Neither did the evidence show that the owner had, in any manner, failed to perform the statutory duties imposed on him, unless he should have driven the top-heading in order to permit the air currents to circulate in the breast above the place where the miner was injured. The evidence, according to the decision of the court, showed no failure on the part of the owner to furnish any material required by law, the want of which contributed to the accident. By command of the statute the interior of the mine is taken out of the possession and control of the owner, and placed in charge of a certified foreman, with whom the owner's superintendent is forbidden to interfere, and who has power to compel compliance with his directions so far as they relate to the safety of the miners engaged in the mine. It was therefore the duty of the mine foreman to provide such headings as were necessary to ventilate the mine, and it was his duty, and not the owner's, to determine the necessity for another heading in the breast, and to provide such heading, if good ventilation in that part of the mine required it. Anything and everything that affects the health and safety of the workmen while engaged at their work is, by the statute, placed in the keeping and charge of the mine foreman. Whether the air currents should have been conducted to one breast by means of brattices, or a top-heading should have been driven to another breast, or a heading driven to any other place in the mine for the purpose of ventilating the breast where the accident occurred, were questions to be determined and matters to be regulated by the mine foreman.

Dempsey *v.* Buck Run Coal Co., (Penn.) 76 Atlantic 745. March 1910.

Company Reports

TRINITY GOLD MINING & REDUCTION CO.

This company operates the Headlight, a gold mine near Carrville, Trinity county, California. The first annual report for the year ended November 30, 1910, shows that $25,686 has been spent in the development of ore, of which 400,000 tons have been blocked out, of an estimated net value of $1,200,000. On improvement account, 158,449 has been expended for the improvement of a 40-stamp mill, hydro-electric power plant, electric lighting and water systems, 200-ton cyanide plant, etc., and $14,968 on equipment. Operation began on December 3 and it was expected that by February 1, 1911, it would reach full scale. The ore is to be mined through glory-holes, at a present cost of 52c. per ton, which it is hoped to reduce to 32 cents.

RIO PLATA MINING CO.

This is an American company operating a silver mine in the State of Chihuahua, Mexico. The annual report for the year ended November 30, 1910, shows that 617 tons of ore of an average content of 9.07 oz. silver per ton was shipped to the smelter, and 13,952 tons of ore of an average content of 46.48 oz. silver per ton was milled, one-third of the silver content being recovered by concentration and 86% of the remainder by cyanidation. The cost of mining was $2.45 per ton, cost of milling and concentration $2.05, and the cost of cyaniding $3.90, making a total cost for mining and reduction of $8.40 per ton, or 18c. per ounce of silver recovered. The company made a profit of $245,062 on its operations during the year and has an earned surplus. There remain in the treasury 26,336 shares of capital stock. The improvement account amounts to $351,764, but there is no apparent annual charge for depreciation or for interest on capital. There is also no statement of ore reserves, beyond the mention of 2500 tons of broken ore in the stopes.

PORTLAND GOLD MINING CO.

The annual report of the Portland Gold Mining Co., recently issued, shows that during 1910 the receipts from its mine and mill were $2,122,319. Dividends were paid amounting to $240,000, leaving a cash balance on hand of $134,849. The value of the mine and old and new mills is placed at $4,725,400, which, with the addition of supplies and ore on hand, cash in bank, securities, permanent equipment, and railroad rolling stock, makes a total valuation of $5,402,898. The production of the mine for 1910 was 67,515 tons, of a gross value of $1,241,168. A new mill at the mine was completed during the year, making available for profitable treatment three million tons of ore now on the dump, in addition to large bodies of low-grade ore in the mine. The beneficial effect of the new drainage adit is already becoming evident, as the water in the fifteenth level has receded 17 ft. and is going down at a rate which, if maintained, will drain this level by the end of the summer. The development of new ore has more than kept pace with extraction. Heavy expense was made necessary in 1910 through the removal of the backs of old stopes.

L. VOGELSTEIN & Co. report the following figures of consumption of copper in Germany during 1910:

		Tons.
Imports		184,877
Production		24,000
		208,877
Exports	9,157	
Stock in Hamburg	9,050	
		18,207
Consumption		190,670

The consumption in 1909 was 150,245 tons. Of the imports in 1910, 159,346 tons were from the United States.

Personal

Professional men are invited to send news of their engagements and travels. Such news is interesting to friends.

R. B. McGinnis has gone to Brazil.

F. Lynwood Garrison is at Quebec.

J. W. Hill has been in San Francisco.

C. H. Munro has returned from London.

E. A. Montgomery was in San Francisco.

Charles Janin has returned from Grass Valley.

F. H. Probert is examining the Butte & Superior mine.

Edmund Juessen has returned from Oregon and gone to Blair, Nevada.

S. S. Fowler was in San Francisco on his way from New York to British Columbia.

John L. Whitney is manager at the Water Lily mine near Jamestown, California.

Frank Bailey has gone to London, but will return to British Columbia in a few weeks.

F. H. Morley and wife sailed on Tuesday on the *Manchuria* for a three weeks holiday in Hawaii.

Fred L. Morris returned to San Francisco from New Zealand on the steamer *Oarangi*, arriving March 4.

Baylies C. Clark has been appointed superintendent for the Lightner Gold Mining Co. at Angels Camp, California.

H. G. McMillan has succeeded Ernest Bamberger as manager for the Daly West M. Co., operating at Park City, Utah.

H. W. Ross is in San Francisco. He will leave soon for Casapalca, Peru, where he will be manager for Backus & Johnston.

C. F. Tolman, of the University of Arizona, delivered a lecture on 'Arizona Mines and Mining,' at Prescott, on February 23.

Henry M. Adkinson, manager for the Gold Pioneer M. Co., who has been in Telluride district two years, is soon to be in Denver.

L. A. Greene, business manager of the *Mining and Scientific Press*, was married February 27 to Miss Mollie Mathes of Oakland, California.

The American Society of Mechanical Engineers will hold its sixty-third meeting at Pittsburg, Pennsylvania, May 30 to June 2, inclusive.

A Congress of Technology will be held in Boston on April 10 and 11, in celebration of the fiftieth anniversary of the granting of the charter of the Massachusetts Institute of Technology. Fifty or more papers will be presented at the Congress, written by graduates of the Institute, and will thus serve to record the part the alumni of the institution have taken in the development of scientific industry.

Book Reviews

Any of the books noticed in this column are for sale by, or can be procured from, the Mining and Scientific Press.

Syllabus of a Course of Lectures on Economic Geology. By John C. Branner. Third edition. Pp. 503. Ill., index. Stanford University, 1911.

This work is intended primarily for the use of students both while in college and afterward. It is printed on one side of each leaf only, so that the opposite page may be used to enter notes from lectures. It is a most valuable treatise to the student of geology and mining. It is replete with references, which are of much value in pursuit of the subject.

The following publications have been recently issued by the U. S. Geological Survey:

Mineral Resources, 1909: 'The Production of Petroleum in 1909,' by D. T. Day; 1910; 129 pp. 'Lithium in 1909,' by F. L. Hess; 1910; 7 pp. 'The Production of Tungsten, Nickel, Cobalt, Vanadium, Titanium, Molybdenum, Tantalum, Uranium, and Tin in 1909,' by F. L. Hess; 1910; 16 pp. 'The Production of Anthracite Coal in 1909,' by Edward W. Parker; 1911; 12 pp. 'The Production of Quicksilver in 1909,' by H. D. McCaskey; 1911; 13 pp. 'The Production of Mica in 1909,' by Douglas B. Sterrett; 1911; 14 pp. 'The Production of Antimony, Arsenic, Bismuth, and Selenium in 1909,' by Frank L. Hess; 1911; 9 pp. 'Gold, Silver, Copper, Lead, and Zinc in the Eastern States in 1909' (mine production), by H. D. McCaskey; 1911; 17 pp. 'The Production of Slate in 1909,' by A. T. Coons; 1911; 14 pp. 'The Production of Tungsten, Nickel, Cobalt, Vanadium, Titanium, Molybdenum, Uranium, Tantalum, and Tin in 1909,' by F. L. Hess; 1911; 16 pp.

'Thirty-first Annual Report of the Director of the United States Geological Survey to the Secretary of the Interior. 1910.' 131 pp.; 2 pl.

Bulletins: No. 436. 'Fauna of the phosphate beds of the Park City formation in Idaho, Utah, and Wyoming,' by G. H. Girty. 1910. 82 pp.; 7 pl. No. 441. 'Results of spirit-leveling in Alabama, Georgia, North Carolina, South Carolina, and Tennessee, 1896 to 1909, inclusive; R. B. Marshall, chief geographer. 1910.' 145 pp. No. 443. 'Reconnaissance of the geology and mineral resources of Prince William Sound, Alaska,' by U. S. Grant and D. F. Higgins. 1910. 89 pp.; 12 pl.

Water-Supply Paper: No. 262. 'Surface water-supply of the United States, 1909, Part II, South Atlantic Coast and eastern Gulf of Mexico,' prepared by M. R. Hall and R. H. Bolster. 1910. 150 pp.; 5 pl.

Geologic Folio: No. 174. 'Johnstown (Pa.) Folio,' by W. C. Phalen; 1910; 15 folio pages of text, 3 maps, 1 columnar section; price 25c. To be published also in octavo form, price 50c.

The Geological Survey has copies of these publications for free distribution (except the one whose price is stated), but can not give more than one copy to any one person, and requests for all the papers can not be granted unless satisfactory reason is given. Applications should be addressed to The Director, U. S. Geological Survey, Washington, D. C.

Relations of Present Profiles and Geologic Structures in Desert Ranges. By Charles R. Keyes. From Bull. Geol. Soc. America, October 1910. Pp. 22. New York, 1910. Describes the character of mountain-forming agencies in the arid regions of the Southwest.

Deflation and the Relative Efficiencies of Erosional Processes Under Conditions of Aridity. By Charles R. Keyes. From Bull. Geol. Soc. America, October 1910. Pp. 36. Des Moines, 1910. An interesting discussion of the effect of erosion by the wind.

The Lake Superior Mining Institute's report of the fifteenth annual meeting, held on Gogebic Range, Michigan, August 24-26, 1910, is received. In it is printed the interesting and valuable papers read at the meeting.

A Central African Glacier of Triassic Age. By Sydney H. Ball and Millard K. Shaler. From *Journal of Geology*, November-December 1910. Pp. 24. Ill. Chicago, 1910.

Significance of Thrust-Planes in the Great Basin Ranges. By Charles R. Keyes. From the *Trans.* Iowa Academy of Science. Pp. 12. Des Moines, 1910.

The Ultimate Sources of Ores. By Charles R. Keyes. A paper read before the A. I. M. E., March, 1910. Pp. 24. Des Moines, 1910.

Oil Resources of California. By Mark L. Requa. Pp. 24. San Francisco, 1910. Notable resumé of the history, geology, and production of petroleum in California.

The Colorado School of Mines' biennial report for 1910 contains a paper on the non-metallic minerals of Colorado by John C. Bailar.

Market Reports

LOCAL METAL PRICES.

San Francisco, March 2.

Antimony	12—12¾c	Quicksilver (flask)	$52½
Electrolytic Copper	14½—15¼c	Tin	45 - 46¼c
Pig Lead	4.75—5.70c	Spelter	7—7¼c

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

METAL PRICES.

By wire from New York.

Average daily prices in cents per pound.

Date.	Electrolytic Copper.	Lead.	Spelter.	Silver, per oz.
Feb. 23	12.25	4.40	5.61	52½
" 24	12.23	4.40	5.61	52⅞
" 25	12.23	4.40	5.63	53
" 26	Sunday.	No market.		
" 27	12.23	4.40	5.64	52¼
" 28	12.23	4.40	5.65	52⅛
Mar. 1	12.23	4.40	5.65	52¼

ANGLO-AMERICAN SHARES.

Cabled from London.

	Feb. 23. £ s. d.	Mar. 1. £ s. d.
Camp Bird	1 13 6	1 12 6
El Oro	1 5 6	1 5 0
Esperanza	1 12 7½	1 14 1½
Dolores	1 5 0	1 5 0
Oroville Dredging	0 7 0	0 7 0
Mexico Mines	7 5 0	7 3 9
Tomboy	0 15 0	0 15 0

(By courtesy of W. P. Bonbright & Co., 24 Broad St., N. Y.)

COPPER SHARES—BOSTON.

	Closing prices, Mar. 2.		Closing prices Mar. 2
Adventure	$ 5	Mohawk	$ 44
Allouez	34	North Butte	28¼
Atlantic	4	Old Dominion	39
Calumet & Arizona	51½	Osceola	110
Calumet & Hecla	478	Parrot	12
Centennial	12¼	Santa Fe	1¼
Copper Range	66	Shannon	11
Daly West	3	Superior & Pittsburg	15
Franklin	9½	Tamarack	42
Granby	34	Trinity	4⅛
Greene Cananea, ctf	6	Utah Con	12¼
Isle-Royale	12¾	Victoria	1¾
La Salle	4⅞	Winona	8¼
Mass Copper	6⅞	Wolverine	119

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

MINING STOCK QUOTATIONS—NEW YORK.

(By wire from Catlin & Powell Co., New York.)

	Closing prices, Mar. 1.		Closing prices Mar. 1.
Amalgamated Copper	$ 64	Miami Copper	$ 19⅝
Arizona-Cananea	3	Mines Co. of America	5⅛
A. S. & R. Co.	77⅝	Montgomery-Shoshone	⅛
Braden Copper	3⅞	Nevada Con	18⅞
B. C. Copper Co.	6¼	Nevada Utah	1
Butte Coalition	18⅝	Nipissing	11
Chino	21¼	Ohio Copper	1¾
Davis Daly	1⅝	Ray Central	1⅜
Dolores	5⅛	Ray Con	17¾
First National	2⅛	South Utah	⅞
Giroux	6½	Superior & Pittsburg	14¾
Greene-Cananea	6⅛	Tenn. Copper	38¼
Guanajuato Con	⅛	Trinity	4⅛
Inspiration	7⅞	Tuolumne Copper	4¾
Kerr Lake	7	United Copper	4⅛
La Rose	4⅞	Utah Copper	46⅛
Mason Valley	9¼	Yukon Gold	4

OIL SHARES

San Francisco, March 1.

Alma	$ 95	Occidental	$ 15
Apollo	—	Palmer	1.45
Associated Oil	46.75	Paraffine	90
Bay City (New Stock)	—	Pinal	5.25
Brookshire	1.15	Premier	70
Caribou (New Stock)	1.45	Record	5.50
Claremont	1.42	Republic	61
De Luxe	1.00	Sauer Dough	85
Empire	1.45	Silver Tip	1.10
Enos	45	S. W. & H.	25
Fulton	1.10	Sterling	1.60
Illinois Crude	20	Turner	1.30
Jade	23	Wolverine	40
Monte Cristo	2.15	W. K. Oil	2.60
Nevada Midway	11	Yellowstone	25

(By courtesy of San Francisco Stock Exchange.)

COMSTOCKS

San Francisco, March 2.

Alpha	$ 6	Hale & Norcross	$ 16
Alta	10	Julia	17
Andes	10	Justice	5
Belcher	45	Kentuck	10
Brunswick Chollar	21	Mexican	1.75
Brunswick Potosi	21	Occidental	41
Bullion	10	Ophir	1.15
Caledonia	30	Overman	25
Cassidy	—	Potosi	25
Challenge Con	10	Savage	12
Chollar	14	Scorpion	11
Confidence	45	Seg. Belcher	8
Con. Imperial	4	Sierra Nevada	24
Con. Virginia	1.10	Silver Hill	4
Crown Point	60	Union	51
Exchequer	11	Utah	6
Gould & Curry	15	Yellow Jacket	32

(By courtesy of San Francisco Stock Exchange.)

SOUTHERN NEVADA STOCKS.

San Francisco, March 2.

Atlanta	$ 14	Mayflower	$ 5
Belmont	6.05	Midway	14
Booth	7	Montana Tonopah	91
Columbia Mtn	2	Nevada Hills	2 65
Combination Fraction	14	Pittsburg Silver Peak	75
Fairview Eagle	45	Rawhide Coalition	3
Florence	2.25	Round Mountain	41
Goldfield Con	6.75	Sandstorm Kendall	10
Gold Kewenaa	6	Silver Pick	5
Great Bend	1	St. Ives	16
Jim Butler	28	Tonopah Extension	1.25
Jumbo Extension	38	Tonopah of Nevada	8.35
MacNamara	15	West End	55

(By courtesy of San Francisco Stock Exchange.)

CURRENT PRICES FOR CHEMICALS

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

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

	Min.	Max.
Acid, sulphuric, com'l, 66°, drums, 100 lb.	$0.80	$1.00
Acid, sulphuric, com'l, 66°, carboy, 100 lb.	1.00	1.50
Acid, sulphuric, C.P., 9-lb. bottle, bbl., lb.	0.13	0.18
Acid, sulphuric, C.P., bulk, carboy, lb.	0.09½	0.12
Acid, muriatic, com'l, carboy, 100 lb.	1.60	2.00
Acid, muriatic, C.P., 6-lb. bottle, bbl., lb.	0.15	0.20
Acid, muriatic, C.P., bulk, carboy, lb.	0.10½	0.15
Acid, nitric, com'l, carboy, 100 lb.	5.25	6.50
Acid, nitric, C.P., 7-lb. bottle, bbl., lb.	0.16	0.22
Acid, nitric, C.P., bulk, carboy, lb.	0.12½	0.15
Argols, ground, bbl., lb.	0.20	0.25
Borax, cryst. and conc., bags, 100 lb.	2.75	3.85
Borax, powdered, bbl., 100 lb.	3.00	4.00
Borax glass, gd., 30 mesh, cases, 100 lb., tin lined	10.00	13.00
Bone ash, 60 to 80 mesh, bbl., 100 lb.	4.50	5.50
Bromine, 1-lb. bottle, lb.	0.55	0.65
Candles, adamantine, 12 oz., 40 sets to case	3.50	4.15
Candles, adamantine, 14 oz., 40 sets to case	4.00	4.55
Candles, Stearic, 12 oz., 40 sets to case	4.95	5.50
Candles, Stearic, 14 oz., 40 sets to case	4.65	5.20
Clay, domestic fire, sack, 100 lb.	1.50	2.00
Cyanide, 98 to 100%, 100-lb. case, lb.	0.20¾	0.24¾
Cyanide, 98 to 100%, 200-lb. case, lb.	0.20	0.24
Cyanide, 127-129%, 100 lb. case, lb.	0.27½	0.28½
Cyanide, 127-129%, 200-lb. case, lb.	0.26¾	0.27½
Lead acetate, brown, broken casks, 100 lb.	8.75	9.00
Lead acetate, white, broken casks, 100 lb.	10.00	10.25
Lead acetate, white, crystals, 100 lb.	11.75	12.25
Lead, C.P., test., gran., 100 lb.	13.00	15.00
Lead, C.P., sheet, 100 lb.	15.00	18.00
Litharge, C.P., silver free, 100 lb.	10.50	13.00
Litharge, com'l, 100 lb.	7.50	9.00
Manganese ox., blk., dom. in bags, ton	20.00	25.00
Manganese ox., blk., Caucasian, in casks, ton (85% MnO_2—¾% Fe)	45.00	50.00
Nitre, double ref'd, small cryst., bbl., 100 lb.	7.00	8.00
Nitre, double ref'd, granular, bbl., 100 lb.	6.50	7.50
Nitre, double ref'd, powdered, bbl., 100 lb.	7.25	18.00
Potassium bicarbonate, cryst., 100 lb.	12.00	15.00
Potassium carbonate, calcined, 100 lb.	15.00	18.00
Potassium permanganate, drum, lb.	0.11	0.12½
Silica, powdered, bags, lb.	0.03	0.05
Soda, carbonate (ash), bbl., 100 lb.	1.50	1.75
Soda, bicarbonate, bbl., 100 lb.	2.00	2.50
Soda, caustic, ground, 98%, bbl., 100 lb.	3.15	3.50
Soda, caustic, solid, 98%, bbl., 100 lb.	2.65	2.85
Zinc shavings, 800 fine, bbl., 100 lb.	10.50	11.50
Zinc sheet, No. 9—18 by 81, drum, 100 lb.	9.50	10.50

CURRENT PRICES FOR ORES AND MINERALS

(Corrected monthly by Atkins, Kroll & Co.)

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

	Min.	Max.
Antimony ore, 50%, per ton	*$20.00	$25.00
Arsenic, white, refined, per lb	0.02½	0.03
Arsenic, red, refined, per lb	0.07	0.08
Asbestos, according to length and quality of fibre, per ton	100.00	350.00
Asbestos, lower grades, per ton	10.00	100.00
Asphaltum, refined, per ton	15.00	20.00
Barium carbonate, precipitated, per ton	42.50	45.00
Barium chloride, commercial, per ton	42.50	47.50
Barium sulphate (barytes), prepared, ton	20.00	30.00
Bismuth ore, 10% upward, per ton	*75.00	upward
Chrome ore, according to quality, per ton	10.00	15.00
China clay, per ton	15.00	20.00
Cobalt metal, refined, f.o.b. London, per lb	2.50	
Coke, foundry, per 2240 lb	15.00	17.50
Diamonds:		
Borts, according to size and quality, per carat	2.00	15.00
Carbons, according to size and quality, per carat	75.00	100.00
Feldspar, per ton	5.00	25.00
Firebrick:		
Bauxite, per M	175.00	
Magnesite, per M	190.00	
Silica, per M	47.50	
Flint pebbles for tube-mills, per 2240 lb	15.00	25.00
Fluorspar, per ton	10.00	15.00
Fullers earth, according to quality, per ton	20.00	30.00
Gilsonite, per ton	35.00	45.00
Graphite:		
Amorphous, per lb	0.01	0.02½
Crystalline, per lb	0.04	0.13
Gypsum, per ton	7.50	10.00
Infusorial earth, per ton	10.00	15.00
Magnesite, crude, per ton	7.50	10.00
Magnesite, dead calcined, per ton	22.50	27.50
Magnesite, brick (see firebrick).		
Manganese ore, oxide, crude, per ton	10.00	25.00
Manganese, prepared, according to quality, per ton	40.00	120.00
Mica, according to size and quality, per lb	0.05	0.30
Molybdenite, 95% MoS_2, per ton	500.00	600.00
Monazite sand (5% thoria), per ton	150.00	200.00
Nickel metal, refined, per lb	0.45	0.60
Ochre, extra strength, levigated, per lb	0.02½	0.03½
Platinum, native, crude, per oz	25.00	30.00
Scheelite (see tungsten ore).		
Sulphur, crude, per ton	15.00	25.00
Talc, prepared, according to quality, per ton	20.00	50.00
Tin ore, 60%, per ton	450.00	475.00
Tungsten ore, 65%, per ton	520.00	550.00
Vanadium ore, 15%, per ton	200.00	250.00
Wolframite (see tungsten ore).		
Zinc dust, 1400-lb. casks, per 100 lb.:		
Small lots	9.50	9.75
Large lots	7.50	8.50
Zinc ore, 50% up, per ton	*15.00	20.00

The Prospector

This department makes a charge of 25 cents to subscribers not in arrears and $3 to non-subscribers for each determination. To ensure promptness in publication of the determinations, payment must be forwarded with specimens.

W. L. P., Ketchikan, Alaska: Barite.

M. D., Spokane, Washington: Black shale.

S. A. B., Fallon, Nevada: A soft earthy variety of limestone.

J. L. H., National City, California: The black cementing material is manganese dioxide.

J. A. H., Clifton, Arizona: No. 1, quartz; No. 2, volcanic ash; No. 3, rock stained black by the oxide of manganese.

F. A. L., Glenns Ferry, Idaho: No. 1, specular hematite which would hardly be of much value to work; No. 2, highly altered granitic rock; No. 3, garnetiferous sandstone having no connection with oil; No. 4, volcanic tuff; No. 5, chalcedony.

T. S. S., Pueblo, Mexico: The specimens appear to have come from a zone of contact between sandstone and intrusive masses of trachyte and syenite. They are various phases of quartzite and feldspathic veins. No. 1, quartzite; No. 2, greenish metamorphosed rock with zeolitic amygdaloids; No. 3, trachyte; No. 4, red orthoclase with dark segregations; No. 5, fine-grained syenite dike; No. 6, porous sandstone; No. 7, quartz; No. 8, silicious sandstone or quartzite with lighter bleached portions of the same rock; No. 9, contact specimen of baked rock; No. 10, orthoclase and quartz stringer with hematite; No. 11, quartzite; No. 12, chlorite schist; No. 13, feldspathic quartzite; No. 14, quartzite; No. 15, an altered porphyritic phase of syenite; No. 16, trachyte tuff; No. 17, contact of syenite with sandstone having lignitic seams; No. 18, a phase of the trachyte; No. 19, quartz with epidote and hematite; No. 20, core of orthoclase like No. 4; No. 21, black carbonaceous slate with fossil ammonites, possibly of Jurassic age; No. 22, trachyte.

DIVIDENDS

Name of company.	No. of Divid.	Amount, cents.	Payable.
Goldfield Con. Mines Co.	11	50	Apr. 30, 1911
Belmont	6	15	Jan. 2, 1911
Montana-Tonopah	1	6	Dec. 20, 1910
Tonopah of Nevada	..	40	Jan. 21, 1911
Alaska Treadwell	92.	50	Feb. 28, 1911
Alaska Mexican	62	30	Feb. 28, 1911
Alaska United	16	15	Feb. 28, 1911
Bunker Hill & Sullivan	162	27	Mch. 4, 1911

COMMERCIAL PARAGRAPHS

N. B. Phelps, 405 Sheldon building, San Francisco, California, has been appointed representative of the Atlas Car & Mfg. Co., Cleveland, Ohio, which manufactures brick cars, electric cars, electric locomotives, mine cars, and the like.

The Geo. B. Adair & Son Co. has purchased the business of the Kilbourne & Clark Co., of Seattle, Washington. Among a number of agencies which it will handle is that of the Foos Gas Engine Co., of Springfield, Ohio. A large stock of engines will be carried.

The Griffin Co., San Francisco, announces that it succeeds the Western Engineering & Construction Co. in handling the agency for the Robins Conveying Belt Co. on the Pacific Coast. All the drawings and records of installations made through the Western Engineering & Construction Co. are in the hands of the new company, and therefore a continuity of service is assured.

Frederick G. Clapp has enlarged his geological engineering practice, and will now specialize in examining and reporting on coal in addition to oil, gas, and water. C. V. Gould, mining engineer, graduate of the Armstrong College of Science, Durham University, England, and for fourteen years coal expert in England and America, will take charge of this branch of the work. The general offices will be maintained at 331 Fourth avenue, Pittsburg, Pennsylvania.

The Wm. Powell Co., Cincinnati, Ohio, is shipping the Powell model Star valve on the contract with the Isthmian Canal Commission for all the globe and angle-valves up to and including 4 inches, for use in the construction work at Panama. The Powell Star valve was selected by the Board of Engineers in competition with valves of various other manufacturers as the best valve for the service desired. No change in construction or the metal formula used was required by the Commission to conform to the specifications, and this valve is precisely the same as the company is supplying to every user of the model Star valve.

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EDITORIAL

ANTIMONY is the latest metal to fall under the control of a European syndicate. Prices have already advanced from six to seven and a half cents per pound and a further increase is expected.

THE Cordilleran section of the Geological Society of America will meet at the University of California March 30, 31, and April 1, at the time of the meeting of the Pacific Association of Scientific Societies.

RAY CONSOLIDATED is expected to begin milling within the next ten days. Ore is already being delivered at the plant. The unit of the mill first started will have a capacity of 1000 tons. Mr. D. C. Jackling, Mr. Seeley W. Mudd, and their associates are to be congratulated on the completion of the first stage of a great work.

DAY LETTERS may now be sent by telegraph, and in conjunction with the night-letter service inaugurated a year ago, this gives Americans the cheap and satisfactory service so long demanded. The new owners of the Western Union Telegraph Company are taking the best possible means of overcoming that corporation's well earned and long standing unpopularity.

AGITATION for direct election of United States Senators will gain force as a result of the Senate vote on the case of Mr. Lorimer. There can be no escape from the logic of Mr. Root. Mr. Lorimer was elected as a result of corruption in the Legislature of Illinois and no one having personal knowledge of conditions there at the time will undertake to affirm that he could or would have been elected by popular vote.

COLORADO mining men are discussing the Joyce bill, now before the State legislature, which is designed to prevent discrimination between shippers and between districts in smelting rates. That there is discrimination is admitted, but it has always been held to be legitimate and necessary to the conduct of the business. The smelter manager must be able to adjust rates so as to call out different classes of ores in the proportion needed for economical smelting. The burden falls unequally on different shippers. To the extent that it does so because one sort of ore or another is locally more abundant, or is more cheaply mined, the inequality in smelting rate is due to natural causes. In individual cases an additional inequality has been created with the effect, if not for the purpose, of

forcing the sale of particular mines. Injustice of this sort has given force to the movement for State regulation of the industry. While frankly admitting the sporadic occurrence of such injustice in the past, we doubt the advisability of applying so radical a remedy.

ANNOUNCEMENT of the resignation of Mr. R. A. Ballinger as Secretary of the Interior has been received with universal approbation. The President's choice of Mr. Walter L. Fisher as his successor could not have been improved. Mr. Fisher is a young lawyer of proved ability and character, a man of the highest ideals, one who is a 'progressive' but who is level headed, and who can be relied upon to be accurate as well as enthusiastic.

'THEY order things differently' in Canada as well as in France. Indeed, in many things we might learn to advantage from our northern neighbors. The Dominion is about to have a Federal mining code, and in framing it the Ministry has accepted frankly and gladly the work of a committee of the Canadian Mining Institute. At Washington, when mining laws are under review, it is to a Heyburn, a Mondell, or a Carter that Congress turns for advice. A suggestion from a Raymond, a Channing, or a Winchell would probably be resented as an impertinence, if, indeed, an immediate search was not made for an axe and a grindstone.

AN INTERESTING CASE has recently arisen at Batopilas under the Mexican law of *injurias* or libel, as it is elsewhere called. Mr. Gillmore Goodland, an English mining engineer, director of the Batopilas Mining, Smelting & Refining Company, and of the Batopilas Mining Company, the New York corporation from which the former leases mines and mills, has been arrested and placed in jail on complaint of an ex-bookkeeper of the company. Mr. Goodland and Mr. A. R. Shepherd, Jr., were recently appointed by the directors to visit the properties and effect changes in methods of operation. In the course of these changes a number of men were discharged, including the complainant. Mr. Goodland wrote a private letter of discharge that forms the basis of the suit. The questions at issue are the conditions, if any, under which the employer can criticize the acts of an employee; whether such criticism may be expressed in a private letter addressed to the employee; and whether, in this particular case, the letter included anything that, correctly translated, constituted libel. It happens that under the Mexican code release under bond in such cases requires testimony from witnesses who can swear from personal knowledge that the accused has been of good conduct during the last five years. Naturally, such testimony is not often available in the case of a visiting engineer in a remote district, and the requirement has imposed hardship on Mr. Goodland. The matter will, of course, be fully investigated, but communications in Mexico have been much interrupted of late and prompt action by central authorities has been impossible. The whole situation is one that consulting engineers especially need to consider carefully.

The Problem of Nitrogen Supply

The complex relations of the traffic in the commodities that we daily use are tolerably familiar from constant association, and the general features of international trade relations—how the United States, for example, exports foodstuffs and machinery, and imports tea, sugar, silk, and wines—are matters of common knowledge. But a deeper analysis of these relations, an analysis of the traffic in the chemical elements, is one that few stop to make. A moment's consideration of how the supply of oxygen, hydrogen, nitrogen, iron, silicon, potassium, sodium, and the rest, needed by industrial operations, is secured and maintained, reveals a world of interest. Fortunately the supply of nearly all of them is plentiful and apparently almost inexhaustible; but two, nitrogen and potassium, present problems that possess an added importance for those engaged in the mining industry, for both enter into the composition of potassium cyanide.

All the simple salts of potassium are soluble, and in the decomposition of the rocks composing the earth's crust, one of two things happens; either the potassium salts are converted into complex insoluble silicates, of which the most important are the clays, or else are carried in solution into the ocean, and no economical method of recovering them from either source is yet known. Until the middle of the last century the potash industry was maintained by the recovery of the desired element from the ashes of vegetable matter, the plants having derived it from the soil. About fifty years ago there were discovered at Stassfurt, Germany, large deposits of potassium salts, apparently derived from the evaporation of sea water. Means of converting these salts into the forms desired in commerce were quickly devised, and so long as this supply remains unexhausted, no fears need be entertained, though by what method potassium can be obtained afterward is now entirely unknown. The military and commercial disadvantage of this complete dependence of the other great nations upon Germany for a supply of an important and necessary element deserves more extended comment than there is space for here.

A difficult problem is encountered in the obtaining of a supply of nitrogen, for the reason that, although the element is so abundant, it is so inert chemically that it can be made use of only through its compounds, the nitrates being the most important. These are very soluble salts, so that the chances of their accumulating in large deposits are remote indeed, the problem being further complicated by the fact that they are unstable and easily decomposed. Until the middle of the last century the supply of nitrogen was practically limited to that obtained from the oxidation of nitrogenous organic matter by the so-called nitrifying bacteria. About that time it was found that peculiar conditions in

Chile had given rise to the formation there of large deposits of sodium nitrate. A large industry quickly developed, twelve to fifteen million tons of sodium nitrate being annually imported into the United States alone from this source. More than one-half of this is used in the manufacture of explosives, some 17% in the production of fertilizers, 15% in general chemical industries (photographic films and celluloid may be mentioned as examples of the many products containing nitrogen), some 11% in the acid industry, and the remaining 5% is mostly used in the making of glass. The disadvantage of being obliged to depend upon a single country for our nitrogen supply is obvious, and still more important is the fact that the most optimistic estimates of the available supply point to its exhaustion within the next three hundred years, with a corresponding increase in cost before the end of that period. Research into other possibilities has therefore been correspondingly stimulated.

The supply of cyanides has until recently been obtained in an indirect way by the reduction of ferrocyanides obtained in gas and coke manufacture, the nitrogen in the coal yielding ferrocyanides and ammonia by distillation. Germany leads in the production of this chemical, as by-product coke-oven practice is most highly developed there. The production of nitrogen compounds from the nitrogen of the atmosphere has been attempted in three different ways—the direct manufacture of nitric acid, the direct production of potassium cyanide, and the production of cyanamid. The attempt to directly produce potassium cyanide has not been a success, but the first method has been reasonably successful, and the last entirely so. Direct production of nitric acid by passing heated air through a flaming arc is technically a complete success, but is possible only where electric energy is plentiful and cheap. The production of cyanamid is effected by passing nitrogen gas over heated calcium carbide, with the resultant formation of calcium cyanamid and graphite. More than a dozen plants for the production of this salt are in operation in Europe, and one, at least, in America. The product, as placed on the market, is an indefinite mixture of cyanamid, lime, graphite, and undecomposed carbide. The industry is as yet too new (most of the plants having been in operation less than two years) to make accurate forecasts as to its effect upon commerce in cyanides and other nitrogen salts. So far, it has been found necessary to use pure nitrogen to pass over the carbide; if producer-gas could be used for this purpose, the cost of the product would be much decreased. This at least may be said, that two practicable methods of forming nitrogen salts direct from the great nitrogen supply of our atmosphere have been devised, so that the cost of obtaining nitrogen salts will certainly not increase, and in all probability will considerably decrease. Even more recently a process has been devised for using calcium cyanamid in cyanide solutions without first forming the cyanide, so it may reasonably be expected that the cost of the salts used in cyaniding gold ores will decrease materially during the next few years. And the change from an indirect supply of nitrogen salts from sources situated in other countries to a direct supply from inexhaustible sources within our own borders, is a noteworthy step in the progress of chemical industry.

Tenabo Mining & Smelting Company

In commenting November 19 upon the sale of American mining securities in France, we reflected unfairly, as we now discover, upon the Tenabo Mining & Smelting Company. This corporation is not engaged in re-opening the old mines near Tenabo, as we had been informed, but is developing new and promising properties located in 1905. The attempt to sell stock on the New York curb was made by an individual shareholder and was not on behalf of the company. The officers of the Tenabo Mining & Smelting Company, well-known bankers and attorneys at Salt Lake, have courteously supplied us with a report on the property made in 1908 by Mr. Duncan MacVichie. He found developed at the time, 7783 tons of smelting ore having a net value of $13.38 per ton, and 17,257 tons of concentrating ore estimated at $3.88 per ton. In addition, there was an excellent prospect of finding additional ore, Mr. MacVichie expressing the opinion that an expenditure of $20,000 to $25,000 would bring the reserves up to 100,000 tons. It is evident that such a property is one of great promise and falls within the class of "legitimate undertakings greatly to be encouraged." Whether, none the less, it is sound policy to offer securities based upon such an undertaking, to French investors, is a matter for legitimate difference of opinion. A stock or bond may constitute an excellent purchase for an engineer who keeps in touch with active affairs, and yet not be suitable for the investment of trust funds. On the contrary, the low rate of interest paid by many sound securities makes them poor investments for those who can spare the time and skill necessary to watch higher paying but more speculative securities. In other words, there are, and should be, different markets for different kinds of securities. We believe that it is better to sell to the French the possibly less remunerative but more certain securities that represent established concerns. Speculative enterprises are best financed by those living near the scene of the industry, or by those who make a specialty of the particular business. A single failure—and failures must be accepted along with successes—will hurt American credit in an otherwise good market quite as much as the famous shipment of low-grade bicycles to Germany hurt export trade in machinery. On the other hand, we would heartily commend investment in mines during development, on the part of people here at home, and particularly for those familiar with mining. We hope the Tenabo may prove to be one of the great copper mines of America. There are evidently many reasons for believing that it may, but we believe it would be better policy to carry it further on domestic capital and not invite French participation till later.

Mining in the San Juan—V

By William H. Storms

A high, rugged mountain range divides Ouray from San Miguel eounty. Just over the erest of this range above the Virginius (Revenue tunnel), Camp Bird, and Atlas mines, are the famous mines of the Telluride region. The most noted of these are the Smuggler-Union, Tomboy, Liberty Bell, and Japan-Flora groups. There are several others less noted. The geology and vein structure of the mines of this district have been so frequently described heretofore, notably by T. A. Rickard in the *Mining and Scientific Press*, in the *Transactions* of the Ameriean Institute of Mining Engineers, and elsewhere, that it seems unneeessary to repeat the deseription here. The town of Telluride, like Ouray, is situated in the bottom of a eanyon deeply eroded in the voleanic and sedimentary roeks whieh ehiefly comprise the San Juan mountains. The mines are high above the town in the several glaeial ampitheatres, ealled basins. The Liberty Bell is in Cornett basin, the Tomboy

Taking Lumber up to the Tomboy Mine.

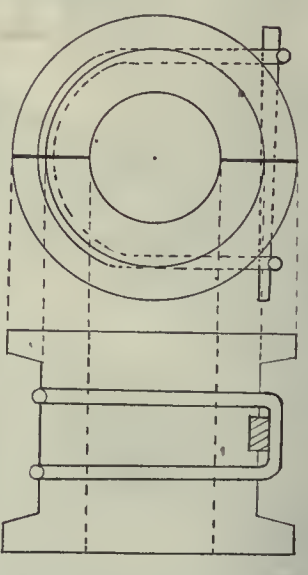
in Savage basin, the Smuggler-Union in Marshall basin, the Atlas in Silver basin, and the Camp Bird in Imogene basin. These basins are rudely eireular and are almost surrounded by towering eliffs of lava, whieh rise from 1000 to nearly 3000 ft. above their relatively level floors. The mills of the Liberty Bell and Smuggler-Union mines are situated down in the eanyon of the San Miguel river, in the southern outskirts of the town of Telluride; those of the Tomboy and Japan-Flora are at the mines in Savage basin. Some smaller mills are at intermediate points in the steep side eanyons, sueh, for instanee, as the Valley View, Cimarron, and Columbia mills. Transportation of ore is mostly by means of aerial ropeways, although there are some good roads and excellent trails. The road from Telluride to Savage basin is four miles long and was built by the eounty at an expense of $50,000. In many plaees it is eut in the solid roek, in others great rip-rapped eribs of timber maintain the roadway in plaee. At one point on this road from Telluride to the Smuggler-Union mine the road has been eut through a tunnel where it passes around a jutting spur of roek. The engineering features of these roadways must be seen to be appreeiated. Wagons travel over these mountain roads, though most of the freighting is done by means of paek animals, long lines of which may be seen almost any day slowly ereeping along the faee of the mountain, aseending or deseending the ribbon-like road. The aeeompanying illustration shows how most of the lumber is taken from town up to the mines. When eovered with snow, traveling on these roads beeomes extremely dangerous. Supplies are also sent up to the mines on the rope-ways, and not infrequently men travel in the buekets, notwithstanding that there is an ever present element of danger. This, perhaps, is no greater than riding on skips and eages in mine shafts. The danger of riding in the tramway buekets only seems more evident. There are many miners for whom the deepest mine workings have no terrors, but who are timid if elevated a few feet above the ground.

The famous Smuggler-Union mine with its great produetion and interesting history was being worked by a system of leases at the time of my visit to the distriet. Owing to laek of time I was unable to inspeet the underground workings, whieh are very extensive, and I spent only a short time in the neighboring Tomboy mine, whieh is about 3000 ft. southeast of the former. The Tomboy vein is reaehed through an adit whieh strikes the vein at what is known as the 1650-ft. level, the datum being a level in one of the neighboring ridges where the vein outerops. The mine has been worked for years through a number of adits driven on the veins at various levels. A shaft from the surfaee passes the adit at the 1650-ft. level and has been sunk 450 ft. below it, to the 2100-ft. level. Adits or levels have been opened at 350, 500, 650, 800, 1050, 1200. 1350, 1500, 1750, 1900, and 2100 ft. below the surface. The shaft is an ineline following the vein and dips at an angle of 73°. Present mining praetiee is to drive a drift on the vein, which is about 5 ft. wide, and to eut raises at every 20 to 25 ft., building strong ehutes at the foot of eaeh raise. Manways are provided at eaeh 100 ft. The main gangways are not timbered exeept where loose ground requires it. The stopes are opened from the several raises in ore, leaving a solid bloek of ground between each ehute over the baek of the level. As stoping progresses upward only about one-third of the ore broken is drawn off. This permits the miner to keep within easy reaeh of the ore overhead until the stope is worked out, and also makes available a large tonnage of broken ore in the mine to be drawn upon as oeeasion demands. It furthermore renders the mine workings safe, until the ore is withdrawn, when if the roek walls collapse no damage is done. The solid bloek of ore left between the bottom of the stope and the gangway may be removed at any time after the ore is entirely withdrawn from the stope above, by ehuting it down into the level and shoveling it into ears, or it may be taken down when the stope earried up from the level next below is broken through. In the latter ease the shoveling eost may be saved, as the ore ean be drawn out of the stope into cars through the

Telluride, Colorado.

Smuggler-Union Mines, Telluride, Colorado.

chutes, but if this latter plan is adopted the level should first be cleared of tracks, timbers, and all débris and the rock shot down before the stope below is holed through into the gangway. This saves much annoyance and loss of time when drawing off the ore through the lower chutes. In the Tomboy mine the original Tomboy vein has been exhausted and stoping operations are now almost wholly confined to the Argentine vein, a comparatively recent acquisition. All the ore from the present workings passes out through the main adit, which is on the level of the breaker floor of the mill. The cars are made up into trains that are moved by electric motor. The ore on reaching the mill is dumped on an 8-in. grizzly, the oversize being broken with hammers to pass the grizzly. From here it goes to a large Gates breaker and is delivered to the mill-bins by a belt-conveyor that is fitted with an automatic tripper which distributes the ore wherever desired. From the bin the ore passes by chutes to suspended feeders. The mill has 60 stamps of 1050 lb. which drop 10 in. 100 times per minute. The Tyler Ton-cap 18-mesh screen is in use. The capacity of the mill is 350 tons per day—nearly 6 tons per stamp. This high capacity is due partly to the rather coarse screen and to the large area of discharge surface of the mill screen, which is 10 in. high; also in part to the character of the ore. From the mortars the pulp flows over amalgamated silver-plated copper plates that are set at a steep grade, rendered necessary by the large amount of sulphides in the ore. The sulphides are mostly galena, blende, pyrite, and chalcopyrite. Rhodonite, quartz, and calcite are also present. The mill foreman stated that 50% of the gold and silver is saved by amalgamation. From the amalgamating tables the pulp passes through mercury-traps, and from these goes to a Fernier pump that elevates it to a large spitzkasten. The overflow from the spitzkasten goes to three Callow tanks; the bottom discharge going to Richards classifiers (two for the 60 stamps). The overflow from the Callow tanks goes to six vanners and the coarse to six other vanners, each set adjusted to treat the material coming to it. From the Richards classifiers the material from the first compartment goes to two slime-tables, the remainder to twelve Wilfleys. The slime from all tables and vanners goes to slime-pump by launder, and thence to Callows before six vanners. The lead concentrate from the vanners is re-cleaned on one Wilfley. The concentrate is sent by conveyor to a Frenier pump which elevates it to de-watering cars that dump automatically. The concentrated mineral then passes through an Argall drier, is conveyed by a belt scraper to a Wilfley drier, in which it is rabbled to the farther end and thence elevated to the top of a vertical desulphurizing furnace, thence through a water-jacketed cooler, after which it is elevated to a Ding electro-magnetic separator in which the iron and zinc minerals are separated. The galena concentrate from the re-cleaning Wilfley is carried by a conveyor of the Cananea type to a launder which discharges to an elevating pump that raises it to dewatering cars, from which it passes through a Wilfley drier, and from this latter to bins where it is sacked for shipment. Thus, it will be seen that the products of this elaborate mill scheme are: Amalgam from the plates and traps, a clean lead sulphide, and separate concentrates each of iron and zinc sulphide. I am under obligations to D. A. Herron, general manager of the Tomboy mine, for various courtesies shown me both at Telluride and at the mine.



Feed-Tappet Smuggler-Union Mill

Pandora is the name given the little village that has grown up about the Smuggler-Union mills, a mile south of the town of Telluride. The Liberty Bell mill is situated about midway between Pandora and Telluride. These mills are connected with the mines up in the basins, several thousand feet above, by aerial tramways. The mountains rise in tremendous cliffs—a succession of picturesque terraces. Here and there beautiful cascades lend enchantment to the scene, which is still further enhanced by the coloring of the rocks. The scenery is grand and awe-inspiring, some might say sublime, but the beauty and sentiment of it all is wholly lost on these mining people of the San Juan, who in their eager quest for gold and for silver, have done wonderful things. For years the great mills have been sending forth an incessant roar, which, mingling with that of the water-falls, rises with a never ceasing murmur from the bottom of the deep canyon. Ever and anon the muffled boom of a blast far underground reaches the surface and reverberates from cliff to cliff, but is quickly lost in that vast wilderness of peaks and crags far up above the timber-line. It is truly a wonderful country, and affords splendid examples of the boldness, energy, and skill of the engineers who have successfully overcome the great obstacles nature has interposed in the pathway to easy success. The noisy waterfalls have been turned aside and made to drive water-wheels, supplying the mines and mills with power; frightful yawning chasms amid inaccessible cliffs have been spanned with ropes of steel which look like the strands of a spider's web far overhead. Gravity has been utilized as a means of generating power by applying the excess energy in the running ropes of the aerial tramways, to the driving of machinery. Splendid roads have been hewn in the solid rocks. It has been a great fight, and in it engineering science has won—not easily, but it has won. How best to overcome such difficulties is a great economic study; a problem which each mine manager, aided by his staff of engineers, must solve for himself. In seeking the solution he must consider every condition, every contingency, almost every possibility of the future. The manager

of the Tomboy thought it good business to build his mill up in Savage basin at the mine. All supplies are packed up to it on animals or freighted in

Tomboy Mine.

wagons up the $50,000 road. He is not harassed by the expensive up-keep of an aerial tramway like his neighbors. He had a good millsite available at the mine and made use of it. A good millsite just where you want it in the San Juan mountains is not always available. The Smuggler-Union mine being in a somewhat different situation, overlooking a precipice which plunges down so steeply that there is no dump, the management there considered it good business to build the mills down in the canyon, where the railroad runs through the mill-yard, and the mine is reached by aerial tramways. The rope-way is direct, for the mine can be seen from the millsite. The Liberty Bell mill is also at the foot of the mountain and is connected with the mine by a Bleichert tramway, though mine and mill are not within sight of each other.

Liberty Bell Mill.

Cliffs intervene and there is also a change in the alignment of the rope-way. In every case some way has been found to overcome each difficulty interposed by nature. The one thing most disquieting and seemingly more difficult of solution than all of the others, is the labor problem, but even this seems to have been solved in a manner which for several years past has permitted the uninterrupted operation of the mines and mills. There are occasional instances of ore-stealing and of mill theft, but they are rare.

As was stated in a former paper, the ores in the various mines of the San Juan differ greatly in character, which is all the more remarkable when it is considered that the fissures traverse the same rock formations. However, it is not intended to discuss here the genesis of these veins, but to refer briefly to the metallurgical treatment the ores receive in the several mills. The ore of the Liberty Bell mine is very hard, consisting of quartz generally accompanied by calcite, with usually much manganese dioxide. A great deal of clay also occurs in the vein, which it is impossible to keep

Smuggler-Union Mills.

separate from the ore going to the mill without expensive washing. The sulphide mineral is almost exclusively pyrite; galena, blende, or copper sulphides being rarely seen. In this respect the ore of the Liberty Bell is rather remarkable, being unlike that of any of the other mines of the region, excepting possibly an occasional local occurrence. The ore is delivered at the mill from the mine by aerial tramway, 80 buckets arriving per hour, 400 tons being the mill's daily capacity. From the breakers the ore goes to the mill-bins and from these passes by chutes to suspended feeders, that are actuated by a friction device known as the Hooper feeder-action, the invention of one of the millmen. The mill is equipped with 80 stamps weighing 850 lb. each, which drop 7 in. 100 times per minute. The screen used is the Tyler $^3/_{16}$-mesh Ton-cap. Crushing is done in weak cyanide solution and amalgamation is accomplished on a run of 7½ ft. of sil-

vered copper plates of the usual width, and divided into three sections by drops of ½ in. It would seem, judging from amalgamating practice generally, that a longer run of plates would be of value in increasing the amount of gold that may be saved by amalgamation. It is found that the cyanide corrodes the copper plates rapidly, their usefulness being limited to four or five months. In this mill the line-shaft is on the cam-floor, resting on the front knees, the belt-drive being horizontal.

From the amalgamating tables the pulp goes to five 5-ft. cones, from which the underflow and overflow go to separate Wilfleys. W. E. Tracy, the mill superintendent, has made what he considers a great improvement in the Wilfleys by tacking onto the tables three strips of wood which extend, like the Wilfley riffles, lengthwise of the table. The Tracy riffles are about twice the height of the Wilfley riffles and also somewhat broader. They divide the table into four longitudinal areas, and it is claimed by Mr. Tracy that the addition of these strips results in greatly increasing the capacity of the table, besides making it possible to secure a much cleaner concentrate, and higher saving—something well worth knowing. The concentrate is gold and silver-bearing pyrite. The middling from the Wilfleys is united, screened in a Bunker Hill conical screen, and the coarse sand is re-treated on another set of Wilfleys, the fine going to the settlers. The coarse tailing from the first Wilfleys goes to tube-mills, where it is ground and again amalgamated. The Wilfleys treating the overflow from the 5-ft. cones send their tailing to the settlers, where it joins that from the tube-mills. The consistence of the pulp at this stage is 6 or 7 to 1. In these settlers, which are circular tanks 33 ft. diam. and 10 ft. deep, are four stirring arms provided with sheet-iron rabbles. These arms revolve six times an hour, imparting a slow rotary motion to the pulp, which in consequence collects in the form of a broad flat cone about the centre, providing a somewhat thickened feed, which can be controlled. This goes to Pachuca-tank agitators, thence to storage vats in which the Moore filter is immersed. The time required to complete the cycle of operations with the Moore filter is 2 hr.—1 hr. filling, when the filter is lifted and lowered into the second vat, where it is given a strong solution wash for 30 min., followed by a weak-solution wash for 20 min. The cake is then blown off with weak solution under pressure. The sludge is discharged into the creek. The concentrate recovered is shipped to the smelter at Durango. Just prior to my visit to the Liberty Bell mill it was deemed advisable to remove the old wooden blocks from beneath the mortars, and to replace them with concrete blocks. The change of the first unit of 10 stamps had been made. The 10 stamps were hung up and removed, the mortars shifted to a crib of timbers in front of the battery, the old wooden blocks torn out and the new concrete blocks built and the mortars replaced in position on them. This was all accomplished within five days of the date of hanging up the 10 stamps—a record-breaking performance, I believe, of its kind.

W. H. Staver, manager for the Liberty Bell company, afforded me every opportunity to inspect the property and aided me in various ways. I am also indebted to W. E. Tracy, the mill superintendent for his courtesy.

At Pandora the Smuggler-Union has two mills. The east mill is equipped with 80 stamps, the west mill with 60. The stamps weigh 1050 lb. and drop 6 in. 100 times per minute. A Tyler 14-mesh Toncap screen is used and the discharge has been lowered to the level of the top of the dies. The amount of ore crushed per stamp daily has averaged 4⅞ tons for the past year. Amalgamation is accomplished entirely outside the batteries, no quicksilver being fed inside the mortars. The mine, both the Smuggler-Union and the Pandora vein, is being worked by a system of leases, in consequence of which the mills are arranged to crush in units of 5 stamps each. This permits a segregation of the numerous separate lots of ore coming from the various leases. There are no features of unusual interest in these mills. The ore comes from the rock-breakers to the mill-bins and passes by chutes to the feeders in the usual manner. I noticed one innovation in the stamp-battery in the form of a sectional feeder-tappet. This is secured to the centre stamp-stem just above the top of the mortar. The tappet is cast in the same form as the cam tappets, but is not so wide and is but 6 in. high. It is split, and when placed about the stamp stem is encircled by what may be described as a 'double-U' clamp which is tightened by a long wedge, as shown in the sketch on the preceding page.

After crushing by stamps the sand and slime are separated by classifying cones and the sand is delivered to tanks by means of Butters distributers. Solution is turned on and leaching proceeds for ten days, when the tanks are drained and the sand is shoveled through bottom gates to a second tier of tanks immediately beneath the first. In these leaching is continued for a further 8 or 10 days. The sand is then discharged to a waste launder which carries it to the creek. The slime from the classifying cones goes to a canvas plant of the Gates type. This canvas-plant is the unusual feature of the metallurgical practice at these mills. It consists of 106 inclined planes each 10 ft. wide and 12 ft. long covered with canvas. The slime from the cyanide plant is delivered to a series of 98 of these canvas tables. The tailing from the tables goes to pointed boxes, the bottom discharge from which is sent to 4 vanners (2 Frue and 2 Gates), a Wilfley taking the coarser discharge. Tailing from all machines goes to a lower line of 8 canvas-tables. The pulp is allowed to flow over the canvas for 45 minutes, when the feed is diverted to an extra table and clear water turned on, after which the tables are washed clean with a flat spray, this requiring 15 minutes to each table. P. H. Nelson is in charge of the canvas-plant and has reduced its operation to a science. The manager, Bulkley Wells, was absent at the time of my visit, but I was shown every courtesy by A. D. Snodgrass, assistant manager,

who gave me the freedom of the plant. Walter Reed is superintendent of the cyanide plant. I found him in the midst of a clean-up, with thousands of dollars worth of precipitate to handle, and he was at the moment, the busiest man on the job. The cyanide practice, Mr. Reed told me, was in no manner different from that described some time since by T. A. Rickard in the *Mining and Scientific Press.*

The Japan-Flora mine is in Savage basin and adjoins the Tomboy. It is comparatively a new mine, but seems to be destined to become one of the great properties of the district. A mine cannot be made in a day, nor yet in a single year in the San Juan. The Japan-Flora is operated through a shaft and is equipped with a concentrating mill consisting of rockbreaker, rolls, trommels, jigs, and concentrators. The manager is Mr. Wolfe.

Two and a half miles east of Telluride, in Ingram basin, is the Black Bear mine, said to be developing into a valuable property. It is owned and operated by a local company largely composed of Finlanders, many of whom are practical miners. The mine is operated through adits, and is equipped with a mill. Between the Liberty Bell and the Smuggler-Union mills is the mill of the Mayflower company, whose mine is 3 or 4 miles distant in Gray's basin. An aerial tramway connects mine and mill, both of which have been idle for some time. A mile and a half west of Telluride and about 1000 ft. above the San Miguel river is the old Boomerang mine, from which considerable ore was shipped in the early days of the camp. The ore in this mine occurs in flat deposits in the limestone, and carries, besides gold and silver, the sulphides of lead, iron, zinc, and copper, and also the secondary products of the oxidation of these sulphides. An aerial tramway which at one time transferred the ore from the mine down to the railroad track at the base of the hill has been removed, and the mine has long been idle, the ore being too low grade to afford a profit. I was also told that the orebody was cut by a fault and not rediscovered. The workings are now caved. There are a number of small mines about Telluride which with sufficient capital and experienced management would undoubtedly become profitable. The pioneering has all been done, the methods of metallurgical treatment worked out, and there is no longer any unusual risk attending mining operations in the San Juan region.

Potash is an abundant constituent of many rocks and minerals found in the United States, and experiments have lately been made to devise means of profitably extracting it from the rocks. The waters of some Western lakes, as Owens and Mono lakes, California, also contain potash and indicate that the beds of evaporated lakes in the desert regions of California and other States may include large amounts of potash. Potassium nitrate has been found in the desert region northeast of Salton, California. Congress has just appropriated money for a special investigation of potash deposits, to be made by the Geological Survey.

Dome Mines Mill

*The following is a general outline of the plant which is being built by the Dome Mines Syndicate at Porcupine, Ontario. The ore, which is essentially quartz and greenstone schist, carrying free gold and iron pyrite, was at first considered to be an ideal concentrating ore. The gold was closely associated with the iron pyrite, and a high-grade concentrate could be obtained. The tailing, however, was sufficiently valuable to warrant cyaniding. By regrinding the concentrate, it was found that a large percentage of the gold could be recovered by amalgamation. The idea of concentration was then abandoned and experimental work was confined to sliming the whole product by two-stage crushing, amalgamating after each, and cyaniding the tailing. By grinding to 90% through a 200-mesh screen, 84% of the gold was recovered by amalgamation. The ore was particularly free from cyanicides, the only difficulty arising from the presence of a small amount of carbonaceous material which caused a secondary precipitation. This was overcome by lengthening the period of agitation.

The mill, which was designed by the Merrill Metallurgical Co., is to be electrically driven and will be built in units of ten stamps each; four units being installed at once. A gravity plant will be obtained by making four drops from crusher to tailing discharge. Preliminary crushing will be done in two stages, using No. 7½ and No. 5 Kennedy gyratory crushers. Belt-conveyors will carry the ore to the stamp-feed bins. Chalmers & Williams 1250-lb. gravity stamps will be used with straight-back, rapid-discharge type mortars, screen 18-mesh or coarser. The foundations will be reinforced concrete. Outside amalgamation will be adopted. Superimposed Dorr drag-classifiers will be installed over tube-mills of the El Oro type, which will be followed by a second set of amalgamating plates. Hydraulic cone-classifiers will discharge back to tube-mills and overflow to Dorr thickeners. Agitation will be accomplished in a series of continuous Pachucas. Combined thickeners and press tanks will feed to Merrill slime-presses which will discharge through automatic tailing samplers.

The gold will be precipitated by the Merrill zinc-dust process. The zinc-dust will be fed to a short conveyor-belt, operated by means of floats and counter-weights, at a rate proportional to the volume of solution pumped from the tank. The zinc-dust will be discharged into a mixing cone and the emulsion agitated by a jet of air. A small stream of barren solution will provide a constant overflow which will carry the emulsion down a pipe to the suction of the pump. The solution will be pumped to triangular precipitating presses, precipitation taking place entirely during the passage of the solution through the pump, pump-column, and presses. The precipitates will be acid-treated, fluxed, and smelted.

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*Abstract from the *Canadian Mining Journal.*

Silver in Sulphocyanate Determinations

By E. M. Hamilton

The following notes deal with facts that are no doubt well known in general chemistry, but their relation to some of the standard methods recommended for analysis of cyanide plant solutions is apt to be overlooked; therefore, a short account of a recent personal experience may be useful to others, especially since most writers on the chemistry of cyanide solutions have not mentioned these points.

In the course of an examination of some solution resulting from the treatment of concentrate, I used the method most commonly given for the determination of sulphocyanate; that of titrating with permanganate after removal of the ferrocyanide by precipitation as prussian blue. The solution contained 0.5% free cyanide, 0.1% free alkali (in terms of CaO), no zinc, and about 80 oz. of silver per ton. Acidifying with sulphuric acid produced a heavy precipitate of silver which was filtered out before proceeding farther. On addition of ferric chloride to the filtrate, no prussian blue was formed, and there was no indication of sulphocyanate. The operation was then repeated, using hydrochloric acid instead of sulphuric, with the result that 0.1% KCNS was indicated on titration with permanganate, but prussian blue remained absent.

After trying a number of experiments with made-up solutions I concluded that in the case of the sulphuric acid the sulphocyanate was taken up by the silver and filtered out in the precipitate. To test this, 50 c.c. of the made-up solution, containing 0.044% KCNS, was acidified with H_2SO_4 and filtered; the precipitate and filter paper were well washed with hot water and the washings added to the filtrate, which was then titrated and gave 0.001% KCNS. The precipitate was redissolved in 100 c.c. of 0.5% cyanide solution, agitated with zinc-dust, filtered, the filtrate acidified with H_2SO_4 and titrated, giving 0.0432% KCNS. This, added to what was found in the filtrate, made a total of 0.0442% KCNS. and showed that the deficiency (amounting to almost the whole of the KCNS originally present) was held in the silver precipitate. The experiment was repeated, using HCl instead of H_2SO_4, with the result that there was obtained in the filtrate 0.042%; obtained by redissolving precipitate 0.002%; or a total of 0.044% KCNS. It would thus seem that the results of acidifying with sulphuric acid are only produced to a very slight extent with hydrochloric.

Following this, experiments were made by adding previously prepared and well washed precipiates of AgCN and AgCl separately to a solution of KCNS in distilled water. In the case of AgCN only a trace of sulphocyanate was found in the filtrate while the parallel test with AgCl showed 0.011% KCNS out of a total of 0.0537%. It was thus evident that silver in both these forms would combine with sulphocyanate in solution, and the question arose, why was this result apparent to such a slight extent in the original tests on the made-up solution when HCl was used for acidification? The only difference seemed to lie in the presence or absence of free HCl, so to the previously prepared silver chloride precipitate a little HCl was added before agitating with the KCNS solution (0.049% by titration). The filtrate from the above agitation gave 0.05% KCNS, and showed that the presence of free HCl had prevented the AgCl from reacting with the sulphocyanate.

The conclusions to be drawn would seem to be: (1) When acidifying a cyanide solution containing silver with sulphuric acid, preparatory to titration with permanganate for potassium sulphocyanate, the silver reacts with any KCNS present, converting it into sulphocyanate of silver, which is filtered out and thus removed from the sphere of titration. (2) Although silver chloride will also react with KCNS to form AgCNS, yet this interference is almost entirely prevented by having free HCl present, so that if the permanganate method be chosen practically accurate results may be obtained by using hydrochloric acid instead of sulphuric.* (3) Correct results may be obtained with sulphuric acid after first removing the silver from the solution by precipitation with zinc-dust.

In regard to the latter method, however, there is a point to be observed. When ferrocyanide is present and it is desired to estimate this by separation as prussian blue, the zinc taken up in the precipitation will throw down the ferrocyanogen as zinc ferrocyanide on acidifying the solution, so that on addition of a ferric salt no prussian blue will be formed. This result can probably be minimized by pouring the solution to be tested into a previously acidified solution of ferric salt, as explained by Clennell ('Chemistry of Cyanide Solutions'). A similar reaction takes place, only in a less degree, in the presence of silver, for on taking a made-up solution containing about 80 oz. of silver per ton, 0.1% KCNS, 0.04% $K_4Fe(CN)_6$, 0.5% free cyanide, and 0.1% CaO, and precipitating the silver with HCl, not a trace of prussian blue was formed on addition of ferric chloride to the filtrate. When the percentage of $K_4Fe(CN)_6$ in this solution was increased above 0.04% and the operation repeated, some prussian blue was thrown down. For sulphocyanate determinations alone, I have found the permanganate method gives concordant results, and when ferrocyanide is present it appears to make no difference whether this is eliminated as prussian blue, or as zinc or silver ferrocyanide, provided that the precipitate and filter paper are thoroughly washed. But if, at the same time, indications of ferrocyanides are being watched for, and if silver is present or if zinc-dust has been used to remove the silver, the absence of prussian blue in the filtrate on adding

*Sutton, Volumetric Analysis, 'Precautions in titrating with permanganate', points out that if HCl be used it should be very dilute to avoid vitiating the result by liberation of chlorine.

a ferric salt can not be taken as evidence that there was no $K_4Fe(CN)_6$ originally present in that solution.

To sum up, it would appear that the simplest procedure for determining sulphocyanate in presence of silver is by acidifying with hydrochloric acid. It should be first ascertained by preliminary trial about how many cubic centimetres of HCl are needed to precipitate the silver and to leave a small excess of acid to act as a protective for the KCNS. Then the necessary quantity should be placed in a beaker and a measured amount of the solution to be tested added to it, and the silver precipitate filtered out. An aliquot portion of the filtrate may then be taken, and ferrocyanide (if still present) removed by addition of ferric chloride, care being taken that the precipitate and filter paper are thoroughly washed. The filtrate and washings should then be further acidified, if not already sufficiently acid for purposes of the titration (avoiding an unnecessary excess), and the permanganate test proceeded with in the usual way.

SAN JUAN OILFIELD, UTAH

Nearly 10,000 claims have been filed for locations in the San Juan oilfield, Utah, during the last few years. Development has not, however, kept pace with the filing of the claims, for although a great deal of drilling has been done, most of it has been unskilful and strings of tools have been lost in many of the drill-holes sunk. As a result, although 25 wells have been drilled, none are yet producing commercially. Oil was found, however, in nearly every place where drilling was attempted, and in the opinion of H. E. Gregory, of the United States Geological Survey, whose report on the field is published as a part of the Survey's Bulletin 431-A, now available for distribution, several of the wells already sunk are likely to prove profitable.

The field is promising, according to the report, although the task of providing labor, fuel, and transportation is difficult. The region is arid. The nearest coal beds are in the Durango field, in Colorado, 100 miles to the east, and in the Navajo Reservation, 60 miles south. Labor will probably have to be brought in, though the Navajo Indians are intelligent and efficient workmen. As a solution of the transportation problem the report suggests a pipeline along the Chinlee Wash to Ganado, thence to Holbrook and the railroads. Over this route oil would flow by gravity for half the distance. It is not likely that there will be a market for the oil near the field. Most of the drilling has been done along Limestone creek. Prospectors have found eight distinct oil-bearing sands, but in no place where drilling has been attempted have the three lowest sands been touched as yet. Oil-seeps along the San Juan river have been known for years. The first well was sunk in 1907 and oil was struck in March 1908, and development since then has been rapid. In 20 of the 25 wells sunk oil of good quality has been found, but as yet there has been no commercial production. The public land in that part of the field that lies north of San Juan river was withdrawn from entry in October 1909.

Mohave County, Arizona

By R. H. Toll

Mohave county is again attracting attention as a metal-producer, and the several camps are entertaining engineers and investors, though not yet in sufficient numbers to crowd the county, for it is very large and much of its space is still given over to jack-rabbits and rattlers.

The mining camps are reached by way of Kingman, a thriving town of 800 inhabitants, on the main line of the Santa Fé railroad, near the western border of Arizona. The principal business of this little city is being the county seat; a distinction which it enjoys for the reason that there is no other town in the county to contend for the honor, the only other communities being mining camps that are too busy for politics. Aside from politicians, Kingman produces nothing, the surrounding district being rough, rugged, and rocky, and the only vegetation such thorny stuff as a boulder-strewn desert will produce. But, in the hills, at a distance of 12 to 60 miles to the west and north, are many mines of many metals, and the county seat has one characteristic in common with ancient Rome, for all roads lead to Kingman. Hence it is the supply-point of the entire county, through which advantage it naturally derives much revenue. Recently Kingman has taken to supplying even the power for the mines, and its electric-power lines have been quite a factor in stimulating activity in the gold-mining belt by greatly reducing the cost of power. It is said that formerly the Gold Road mine alone expended annually $90,000 to $120,000 for power generated by gasoline engines.

The county is not booming, by any means, and some of its camps have lost in population; for instance, Chloride, which ten years ago boasted 2000 inhabitants, who have gradually faded away until now barely one hundred souls and two Chinamen remain. When, however, a district possesses a mine as rich as the Gold Road, and another which produces approximately $50,000 per month with a 10-stamp mill, as the Tom Reed has been doing, mining men begin to 'sit up and take notice'; and the success of these two gold mines has led to renewed efforts in their vicinity which may be expected to result in further interesting developments, for there are other properties on which the showing is probably equally as good as on the two mines mentioned, at the same stage of development.

A brief description of the Gold Road mine will suffice, as others have already appeared. It is situated on the western slope of the River range, also called the Gold range, about 24 miles southwest of Kingman. Tertiary volcanic rocks prevail, practically constituting the range, though overlain in places by rhyolite and younger basalt. The veins are of two main types, those in which the vein filling is chiefly quartz and adularia, and those in which it is chiefly calcite. According to F. C. Schrader, to whose report I am indebted for much of

this information regarding the geology of the county, the former type seems to be the older and to carry the better ore, occurring mostly in undifferentiated volcanic rocks. Veins of the latter type occur chiefly in green chloritic andesite and trend nearly north. The vein is wide and may be followed on the surface for a distance of a mile and a quarter. It has been developed underground for a distance of about 2200 ft., of which 1700 ft. is said to be ore, of an average value of over $9 per ton. Though gold was discovered in this district in the early '60s, little was done until the discovery of the Gold Road by a Mexican prospector in 1902. This mine is now 800 ft. deep, with about 5000 ft. of drifts, and is equipped with a modernized ancient cyanide plant

Mohave County Mining Districts.
(After F. C. Schrader, U. S. Geol. Survey.)

of rather clumsy appearance but of high efficiency, a description of which appeared in the *Mining and Scientific Press* of November 12, 1910. This mine is under option to the United States Smelting, Refining & Mining Co., which has a corps of engineers engaged in sampling.

The Tom Reed mine is situated about a mile and a half southeast of the Gold Road, on a nearly parallel vein in andesite, the filling of which is andesite-breccia and fine-grained quartz, mingled with adularia. The shaft is 450 ft. deep, and, though the upper workings in the vicinity of the shaft are said to have been lean, more recent developments have disclosed bodies of ore 20 ft. in width, of excellent grade. At the time of my visit, the value of the ore going to the mill was about $50 per ton, the recovery said to be 97 to 98%. The ore was formerly treated by amalgamation alone, but early last year a thoroughly modern cyanide plant was erected, using the 10 stamps of the old mill as the first unit, foundations being put in, however, for 20 additional stamps. The stamps weigh 1050 lb., and the duty is about five tons of ore per stamp per 24 hours. In December, 10 more stamps were placed in commission, handling the tailing from the old mill. The ore is broken at the shaft by an Austin gyratory crusher, and falls upon a belt-conveyor which delivers it to a distributing-belt above the battery bins, about 100 ft. distant. Suspended feeders, of the Challenge type, feed the stamps, and 12-mesh screens are used, the pulp passing over amalgamating-plates into a Callow pulp settler, from which the sand is delivered to a 5 by 22-ft. tube-mill with spiral feed, driven by a 70-hp. motor; the overflow from the settlers joining the discharge from the tube-mill and passing over another set of amalgamating-plates and blankets. The small amount of rich concentrate which is caught upon the blankets is reground in a 3-ft. pan and the gold amalgamated.

The tailing from the blankets is pumped to a 3-ft. Callow settler, from which the slime passes by gravity to a 10-ft. settling-cone, the sand being returned to the tube-mill. The overflow from the large cone goes to two 10-in. cones, and the underflow to an Oliver filter, for de-watering; after which, with the pulp from the smaller cones, it is mixed with the solution, of 0.10% KCN, in a cone mixer, and delivered to a steel tank 20 ft. in diameter by 6 ft. high, whence it is pumped as required to the top of the Pachuca agitators. The Oliver filter was installed as a slime-filter, but when, after a few weeks use, holes appeared in the filtering medium where it bears on the frame, the management found it expedient to use the machine for de-watering, rather than to unwrap the thousand and one miles of wire which hold the filtering medium in place, replace it, and perform the rather delicate task of re-winding the wire. This is one of the weak points of the Oliver, and when the makers adopt some other means of holding the filtering medium, the machine will be more popular. The Portland mill, in the Cripple Creek district, has machines of this type, which seem to be giving entire satisfaction.

To return to the Tom Reed. There are three Pachuca agitators, 10 ft. in diameter by 38 high, and one tank is filled and one discharged each day. The charge is agitated 24 hours with air under 20 to 25 lb. pressure. The content is then discharged into a steel tank 20 ft. in diameter by 5 in height, equipped with stirring-gear, from which it flows to a Butters filter, of 48 leaves. The dissolved gold is precipitated on zinc-shavings and the precipitate melted, with a little flux, in a tilting-furnace using oil fuel.

At the Ruth mine, about five miles west of Gold Road, a 10-stamp cyanide mill is being installed which is expected to be in operation in March. The workings are not extensive, the shaft being but 150 ft. deep, but the ore exposed is of such grade that the revenue from the mill is expected to more than pay for development of the mine.

Near Union Pass, about 10 miles northwest of Gold Road, another cyanide plant is being completed

by the Gold Crown M. Co., in which no old-fashioned machinery has found a place, and its results will be watched with interest by local mining men. The Hardinge system of 'step reduction' is being installed, following a McCully crusher, with Merrill presses for both filtration and precipitation. The orebody at this mine is red andesite, occurring near the top of a low butte which has been formed by the erosion of the surrounding country. Locally the andesite is brecciated and highly silicified. It is 20 to 30 ft. in thickness, and dips about 15° northeast, lying upon a gray rhyolite and being capped by comparatively soft white rhyolite. The gold-bearing andesite shades into the rhyolite above and below, with no sharp line of contact. The andesite is said to carry more than ½ oz. of free gold per ton, in which case it will no doubt return a satisfactory profit. The cost of mining this orebody will be small, the ore being quarried out and dropped through chutes to the tunnel, through which it is trammed to the mill. Abundant good water is piped from a canyon three miles away, and conditions are favorable for cheap operation.

Across the Sacramento valley, to the north and east of the River range, a totally different formation obtains, and the character of the ores differs as greatly as that of the country-rock. In the River range, as stated above, the younger volcanic rocks—chiefly andesite and rhyolite—prevail; while, across the valley the rock is a pre-Cambrian crystalline complex, consisting mainly of gneisses, schists, and gneissoid granite. The ores, while usually carrying gold and silver in appreciable quantities, are base, being essentially lead-zinc ores, with considerable iron and some manganese and other metals. Locally the orebodies contain much gold and silver, especially the latter; and practically all the known orebodies were worked in the early days of the district, the rich surface ore having been gouged out by 'chloriders', leaving the leaner oxidized ore and practically all the sulphide ore below the water-level, which is usually only 75 to 100 ft. below the surface. The country is broken owing to intrusions of granite-porphyry and dikes of rhyolite and diabasic rocks. Consequently, erosion has created a rugged topography, though many of the mines are situated at or near the base of the mountains, and some of them within the valley. Present activity in this region is due principally to treatment facilities now afforded by the Needles smelter for this class of ore, and the reduction in freight and smelting charges. The U. S. S. R. & M. Co. has also promoted the welfare of the district by taking an active part in mining operations. For more than a year this company has been engaged in exploiting the field, but is now confining its efforts to re-opening the Tennessee, a former large producer, situated about a mile from the town of Chloride and 25 miles from Kingman. This mine had a big mill in operation a few years ago and shipped a large amount of high-grade ore, being worked to a depth of 600 ft., when operations were discontinued, presumably because of the volume of water to be handled. The old shaft has caved in and a new one is being sunk to a depth of 700 feet.

Numerous other lead-zinc properties in the vicinity of Chloride are being worked on a small scale, and there are some very good showings at shallow depths. Occasional shipments are being made which bring very good returns. The Juno mine, which is situated in the low foothills close to the town of Chloride, is being cleaned out by Los Angeles men who have a long-term lease on the property. This mine was developed in the early days to a depth of 600 ft., and made a large production. It has three old shafts and a steam-hoist, and the vein, which is 4 to 12 ft. in width, is exposed for more than a mile. The dumps and the oxidized ore in the old stopes of the Juno are said to average between $7 and $8 per ton in gold and silver, sufficient to yield a good profit by cyanidation; and it is the intention of the operators to erect a small mill to treat this ore and the tailing from the lixiviation plant which treated the higher-grade silver ore in the palmy days of the mine.

The Champion mine, just over the range from Cerbat, is making a steady and apparently profitable output of base ore; and the Golconda, conspicuously situated high on the western slope of the mountains two miles northwest of Cerbat, employs 75 men; and the many new buildings and score or more of housetents which perch on the mountain side, below the shaft and the mill, denote activity and prosperity which are in quite pleasing contrast to the general dullness prevailing in other parts of the base-metal region. The Golconda was opened by the present operators about three years ago, and has shipped about 18,000 tons of ore carrying as high as 50% zinc, with considerable gold and silver. A mill has recently been erected, consisting of a trommel, two sets of Harz jigs, and two Wilfley tables, for the purpose of handling the fine material in the dumps. Two reciprocating surface tramways deliver the ore and concentrate to bins at the foot of the hill, where wagons have easy access.

On the whole, the mining industry in Mohave county is on a decidedly substantial basis. Copper, molybdenum, and other metals and minerals besides those mentioned, occur in quantities which will render them commercially valuable not very far in the future. Along the River range, northwest of Chloride, are profitable gold mines which have not been mentioned, and interesting developments are in progress. North of the Colorado river and remote from transportation facilities lies nearly one-half of the county—an immense undeveloped territory rich in minerals and containing large tracts of fine timber, much of which, in due course of time, must find its way to the market.

California petroleum stocks, January 31, amounted to 27,460,000 bbl., an increase of 450,000 for the month, according to the *Oil World*. Consumption, exclusive of oil burned in the field, was 5,292,325 bbl. for the month, a daily average of 170,720 bbl. The production amounted to 197,155 bbl. per day.

Superstition in Mining

By T. Lane Carter

Mining men who have studied the early volumes of the *Transactions* of the American Institute of Mining Engineers, have read the fascinating paper by Dr. R. W. Raymond* on the 'Divining-Rod.' In it he traces the influence this superstition has had on the human race for centuries past. In ancient times much dependence was put on the divining-rod. Mining can not lay claim to the first use of this instrument. In olden time it had a moral use and was in evidence whenever guilt was to be discovered or predictions of future events were to be made. There was a mixture of demonology in the belief in the divining-rod, especially in the Middle Ages. Before the rod was used there were many incantations, and frequently the rod was baptized by a bishop, being laid for this purpose in the bed with a newly-baptized child. Those of us who have had much experience with the uncivilized natives of Africa, realize that the superstition of earlier times remains among them, in the 'smelling out' by the 'witch doctors' and the use of twigs and branches for divination.

The divining-rod has played an important part in the history of engineering. Claimants by the thousand have announced to the world their power of finding water or ores by the use of this instrument. A few hundred years ago the possessor of such a secret had to be careful how he announced his accomplishment, for if he were not cautious, there was a chance of being accused of sorcery by the rabble and being burnt at the stake as a co-worker with the Evil One. But all that danger is past now, and the large numbers of believers in the divining-rod scattered over the world are no longer considered suspicious characters. Along with each science there grew up a pseudo-science. Astronomy had astrology; chemistry, alchemy; and mining, the divining-rod. The contributions of astrology were not all negative, and alchemy did a great service for chemistry. Along with the jargon of the users of the divining-rod we read some astute remarks about rocks and springs. The use of this instrument was common in Cornwall and Germany. In the United States the divining-rod has been extolled by engineers. Dr. Raymond mentions the case of a gold mining company in California that employed one of these diviners to point out where a lost vein was to be found. After many incantations, the gentleman showed the management where to look for the vein. They set to work in good faith in the firm belief that the vein would be found, but after spending thousands of dollars they came to the conclusion that the diviner must have had an 'off day' and that his rod was not working when he located the vein.

My experience with the divining-rod has been limited, but I have seen enough to know that the belief in its efficacy has not passed away. At a mine in Africa a few years ago, we were short of water, and I decided to sink a well. The engineer came in one morning and asked if I had decided on the location. I told him I had not. Then he mentioned that a water-diviner, a long-bearded Boer patriarch, had arrived on the property with his Y-stick and would find water for us, provided we gave him £2. If we sank a well at the place he pointed out and did not find water, he would not ask for any money. I told them to go ahead. In a half-hour the engineer ran up, greatly excited, stating that they had found water. I asked if they had already sunk the well. He said the Y-stick was behaving in the most extraordinary manner, and asked me to come and see for myself. I walked over the place with the stick held out in front of me, one end of the Y in each hand, but my faith was small and the thing did not budge. When the engineer walked over the point selected by the Boer the branch twisted and turned as if a rope were pulling it. It was a case of minute unconscious muscular movements, caused by the imagination of the operator. The old Boer had mesmerized him, I think. We sank the well and got a fine flow of water, and the patriarch got his £2. Months later I found that this part of the property had been disturbed by a fault. I put down this lucky find of water to shrewd geological observations on the part of the Boer rather than to any power of the divining-rod.

The next place I ran across the instrument was in Chicago. A well dressed young man came in one day and stated that he wanted to see the operator of the divining-rod. His mother had told him to see such a man the next time he went to the city. It appears that the old lady had had two sittings with a clairvoyant and that on both occasions the medium had told her the same story about a Spaniard of the adventuresome days of 1720 burying a chest of gold at some place on her farm. The young man asked what the charge would be to take the divining-rod and find the treasure. I told him I thought he had gotten into the wrong pew, and that he would save money by making the business proposition to the clairvoyant of giving her half the treasure if she would point out the exact spot where the gold lay.

There is something about mines that appeals to the superstitions of mankind. In ancient times the life of the miner was the lowest and hardest of all. The Romans sacrificed thousands of slaves every year in digging for mineral wealth all over the empire. On account of the lack of ventilation, and the CO_2 and CO given off by the burning wicks and wood, the life of the miner was short. No wonder that among freedmen the mining regions were held in terror, and that none save slaves would work underground. With such a high death rate it is natural that superstition spread among the people, and that they pictured the mines as the abode of evil spirits. In the Middle Ages there are

*'The Divining-Rod', by R. W. Raymond; *Trans.* Am. Inst. Min. Eng., Vol. II, p. 411.

innumerable references to mines and the ghouls who were supposed to live in the shafts.

The Chinese are naturally superstitious, but I believe that mine work makes them more so. Whenever there was an accident in the mine and one or two of the Celestials were killed, they would frequently shoot off firecrackers near the place of the accident, and burn candles to propitiate the spirits of the departed. I have had Chinese who would not work underground on account of their strong superstitions. The Kaffirs are far more phlegmatic than the Chinese, and yet they have their mining superstitions. It is almost impossible to get a Kaffir to work in a quiet part of the mine entirely alone. I have seen it tried several times, but the native would stay a few hours and then run out, saying he had "seen things" in the darkness. It is customary to have two or more Kaffirs at work together. I must myself confess to one mine superstition, and that is that when you have one fatal accident in a mine you will have three. In my observations mining accidents come in cycles. The work goes along for months at a time without an accident. Then some one gets seriously hurt or killed, and troubles come fast for a while.

One of the strongest superstitions I have noticed in men who have spent most of their life in mining, is a sense of danger that suddenly comes over them. Some would call this faculty the 'sixth sense.' If you asked the miner how he knows there is something wrong, he will reply that he "feels" it. I had a remarkable illustration of this a few years ago. I was walking along a main drift with a mine captain, a man who had been working in mines for over forty years, having started as a lad in the mines of Cornwall. Suddenly he stopped and exclaimed that something was wrong. For the life of me I could not see a thing amiss. The timbers seemed solid, and the drive pillars looked secure. But the captain was not satisfied, and insisted on climbing into the stope to investigate. There he found a large crack, running for hundreds of feet, indicating a movement of the strata of serious proportions. Had this discovery not been made in time there would have been a serious accident in the mine with a probable loss of life. I dare say the years of experience in the mine had developed a power in him which the men called 'superstition,' but was really the faculty of accurate observation, which to him seemed unconscious.

One constantly sees instances of superstition in the mining districts of Mexico and the other Spanish-American republics. It is probable that the many shrines of the Virgin one finds in the underground workings are monuments to superstition rather than religion. If you watch the peons pass by a place in the mine where a miner has been killed, you will see that they cross themselves furtively and hurry along. Volumes could be written about the legends and superstitions of the old mines or *antiguas* that abound in Mexico. About seventy-five years ago a sad fatality happened at one of these old mines. Rich ore had been struck and the Mexicans were straining every nerve to get out the valuable stuff. The workings were down nearly 300 feet and the high-grade ore was carried to the surface by peons. It was 12 o'clock, and the boss of the laborers told his young son to fetch some water from a spring at the bottom of the mountain. When the lad returned he found that the mine had caved in, burying every man. Rushing to the village he summoned all the people, but they were never able to rescue the bodies, and the *padre* said prayers over the dead, and left them there to this day. Needless to say, around that mine there are many tales and superstitions. The peons say that the spirits come out once a year and travel around the mountains. If one tells you the story at midnight and a branch of a tree rubs against the roof of the shanty, the Mexican will say, "There goes one of the spirits now"!

One of the oldest superstitions connected with mining and metallurgy is the dream of the transmutation of metals; the turning of the base metals, such as lead, into gold. Until chemistry became established, this dream was universal. It has by no means vanished. Ever since the discovery of radium some people have declared that the secret of making gold would soon be found. They declare that radium has completely disturbed the established views regarding the ultimate constitution of matter. To my knowledge no great physicist has yet claimed that radium has upset our hypotheses, nor has any chemist of note yet promised us that ere long we would be turning out gold from lead. It remained for an electrician, Thomas A. Edison, to tell us in a recent sensational article that before long gold would be dethroned, and would be made cheap in two ways. First, by finding out how to make it from some other substance, and secondly, by mining the clay which occurs in millions of tons under one of our Eastern cities, and which assays 30 to 40c. per ton. After reading this lurid article all I can say is that mining is not the only line where one finds superstition, but that electricians also suffer from this weakness.

Official records of mineral exports from Western Australia commence in 1850, when a small quantity of lead ore was exported from the Northampton mineral field, and three years later a small amount of copper ore is found among the exports. Ores of these metals continued to be the principal mineral production for many years, copper mining at Northampton reaching its zenith in 1864 and lead mining in 1877. Exports of gold are first recorded from Kimberley in 1886, followed by Pilbara and Yilgarn in 1889; Ashburton and Murchison in 1891; Dundas in 1893; Coolgardie in 1894; North Coolgardie, Northeast Coolgardie, and East Coolgardie in 1896; Peak Hill, Yalgoo, East Murchison, Mount Margaret, and Broad Arrow in 1897; Gascoyne and Donnybrook in 1899; and Phillips River in 1902. Exports of tin ore from the Greenbushes mineral field first appear in 1889, and from Pilbara in 1893. Coal is shown for the first time in 1898; mica in 1892.

Amalgamation in Slow-Speed Chilean Mills

By E. E. Carter

With a view to increasing the capacity and also the amalgamating efficiency of the Gold Hill mill, of the Gold Hill & Iowa Mines Co., operating near Quartzburg, Idaho, careful tests have recently been made along the lines suggested below. The changes made as a result of these tests have enabled the elimination of concentration and cyanidation; the whole treatment being now by simple amalgamation.

The ore is a comparatively soft quartz, carrying less than 5% sulphides, iron pyrite being the most important, lead and antimony sulphides constituting a very small percentage. Gold is the chief source of value, and this is found to be closely associated with the antimony. Very little shows in the pan without first briskly rubbing it. Crushing is done through a 9 by 15 in. Blake crusher which crushes to approximately 1½-in. ring. The ore then goes to 1000-lb. stamps, having a rapid drop, but falling not over 5 in. The discharge is set even with the die and ¼-in. screens are used. No amalgamation is attempted within the battery, the sole object being to get capacity.

At first an attempt was made to run the pulp from the stamps into a cone classifier, allowing the overflow to pass directly over the plates and the underflow to go into the roller mill to be recrushed. This scheme was abandoned, as the gold passed over the plates with the slime from the overflow. The entire pulp was then fed into the roller mill and surprising results followed. Special attention has been given this Chilean mill, and in order that it may be understood by those not already familiar with it I will briefly describe it.

The mill is known as the Lane slow-speed Chilean mill. It is 10 ft. diam. and has six wheels instead of three, as have most Chilean mills. In order to provide for the excessive weight required, the wheels are not made solid, but are weighted by means of a large tank filled with scrap-iron or rock. This is also a consideration in transportation. This tank is directly over all the wheels and is loaded with at least 12,000 lb., which, together with the wheels, gives a crushing weight of about 25,000 lb. The mill runs very slowly, not over 8 revolutions per minute. This allows the resultant of weight to act downward instead of outward, as in high-speed mills. It has also an important influence on repairs. The wheels are set at a slight tangent, which gives a dragging or grinding action similar to that of the old and efficient arrastre. The outside copings or sides are set at a slight angle (possibly 60°). As the pulp flows around this side the centrifugal force tends to throw particles upward as well as outward. The whole action is one of classification. This action tends to allow any mercury that is inclined to flour to settle, while the heavy particles accumulate and are crushed by the passing wheels. As the circumference of the pan is somewhat over 30 ft. it gives an excellent opportunity for the mercury to unite with the particles carrying gold which has been brightened by abrasion. Once amalgam is formed it settles down around the dies and has very little opportunity to escape.

The mill is driven by a large gear which entirely surrounds the mill, and which in turn is driven by a pinion and bevel gear similar to those employed in the construction of a winch. Ammeter tests have shown that about 5 hp. is required to run the mill while crushing, but the builders claim that 12 is required. Experiments were made in feeding a 6-mesh product, but it was found that the capacity was not increased proportionately, as the particles simply followed the wheels. The discharge of the roller mill was set so that with a 10-mesh screen a 30-mesh product was obtained. It has since been found advantageous to do away with the screen entirely and depend upon an overflow discharge. With this discharge arranged so that it is slightly higher at the end toward the approaching wheels a very even flow can be maintained. Screen tests with the discharge set at 6 in. show that 80% will pass 100 mesh and 90% will pass 80 mesh, while over one-half will pass 200 mesh.

A great advantage which the overflow discharge offers in treatment of this ore, is that in working ore from old filling the chips and fuse pass the mill unobstructed, or are easily removed. The cost of screens is also an item in its favor. A slight wave is made ahead of each wheel and a corresponding depression behind it. Into this is fed the pulp from the stamps through six pipes, which are carried around with the wheels. Each particle is carried around many times and it is constantly being dragged over the mercury or amalgam formed around the outside of the die. The finer it gets the higher in suspension it is carried until it reaches a fineness which allows it to overflow. It has been found beneficial to obstruct the free flow of the pulp somewhat, and baffles have been fastened to the outer curbing, which tend to retard the rapid flow and allow the wheels to catch up. A narrow space is left around the outside of the die and in this most of the mercury and amalgam accumulate, as well as a rich concentrate.

Although a great excess of mercury is fed, very little is shown in the discharged product, and a careful account has shown that most of it is recovered in the clean-up. The last mill run where amalgamation in the mill averaged $7.10, did not show enough amalgam on the outside plates to warrant trying to remove it. Twenty stamps are in operation in the same mill and 50 to 55% has been as high an extraction as it has been found possible to make by amalgamation on plates, while on the same ore the Chilean mill has done better than 81%, and 85% is hoped for. On reaching this figure it will be possible to omit the cyanide treatment which has followed stamp-milling. The stamps crush through fine screens and it is found that the gold is not saved, screens are very expensive, the mercury flours badly, and the final product is not in as good a condition for subsequent treatment. The above suggestions are offered believing that this subject is worthy of further discussion.

Discussion

Readers of the MINING AND SCIENTIFIC PRESS are invited to use this department for the discussion of technical and other matters pertaining to mining and metallurgy. The Editor welcomes the expression of views contrary to his own, believing that careful criticism is more valuable than casual compliment. Insertion of any contribution is determined by its probable interest to the readers of this journal.

Oliver Filters

The Editor:

Sir—In Philip Argall's article entitled 'Review of Cyanidation in 1910', published in the *Engineering & Mining Journal*, January 7, 1911, he states: "The drum form of continuous filter, of which we may take the Oliver as a type, appears to be coming into use in the United States and Mexico; they all leave much to be desired; the complication of automatic valves on vacuum, pressure air, and wash-water prove troublesome." I do not intend to discuss here the relative merits and demerits of various types of filters, but wish to take exception to statements by an engineer of such high standing as Mr. Argall that are evidently based, not on the observation of the operation of an Oliver filter, which has never had "valve troubles", but upon the difficulties experienced by a rank imitation of the Oliver filter which has lately been built in Denver and which filter has necessarily had to omit the vital features incorporated in the Oliver. While I do not object to having the Oliver referred to as a type, I do most strenuously object to having the filter blamed for the deficiencies of inferior imitations. In substantiation of the fact that the Oliver does not have "valve troubles", I beg to state that in the four years that I have been building these filters, no changes have been made in mechanical principle or general design of the valve.

EDWIN LETTS OLIVER.

San Francisco, February 25.

Thin Rock-Sections

The Editor:

Sir—Replying to 'Inquirer' in your issue of February 4, I take pleasure in offering the following suggestions for making thin rock-sections. Apparatus required: An ordinary jewelers' polishing lathe to be worked by treadle may be used, but if any considerable amount of work is to be done, it will pay to purchase a properly equipped cutting and grinding machine. G. D. Julien, Bloomfield street, Hoboken, New Jersey, makes these machines complete, and they cost from $100 to $300, according to whether they are for foot-power or equipped with an electric motor. If an ordinary polishing lathe is to be used, these mounted on a stand, operated by a foot-tread, cost about $12. A diamond-edged saw of about 8 in. diam., sold by Elisha T. Jenks, Middlesboro, Massachusetts, is almost indispensable, and must be ordered with the centre hole of the right size to fit the mandrel of the lathe. These cost about $1 per inch of diameter. I use in addition several carborundum discs of the same diameter, having for general use one each of No. 60, No. 120, and No. 220. For final polishing and grinding I find that copper discs, made with slightly convex surface, have about the right degree of hardness to hold flour carborundum, or rouge, as the case may be. It is well to have at least two of these, one for the medium or preliminary polishing, and the other for polishing. Several pieces of plate-glass about 2½ in. square, two ounces Canada balsam, mounting slides, cover glasses, various grades of carborundum, from F to the finest hand washed, besides some infusorial earth and jewelers' rouge for final polishing.

The modus operandi is as follows: Select a typical portion of the specimen, as free from fracture as possible, and with the saw in place hold a piece of rock gently against the saw edge, being sure to keep a small but steady drip of water to lubricate the cutting edge. If the saw has been carefully adjusted this first cut will leave two pieces of rock with comparatively plane surfaces, which will need but little further grinding and polishing to become absolutely flat surfaced. When the sawed surface has been polished and is quite free from scratches, which must be proved by inspection with a low-power lens, it is ready for the next step. This polished surface is then cemented with Canada balsam to one of the plate-glass squares, and when set, another cut is made with the diamond saw, leaving a fairly thin section on the plate-glass. This is then ground down on the carborundum discs, with constant inspection, and extreme caution toward the final reduction in thickness; the section is reduced to a finely plane polished surface, and when thin enough so that all the darker minerals are transparent, and all scratches have been removed, the section is ready for transfer to its permanent slide. Before doing this it should be carefully washed with water, then with a little spirits of turpentine, or alcohol, using a camels-hair brush or piece of clean linen rag. The glass slide is then heated on a hot plate, and a drop of balsam placed thereon, and heated so as to drive off any bubbles; at the same time the plate-glass on which the grinding has been done is also heated so as to make the removal of the section easy, then, with a long needle mounted in a handle the section is gently removed from the one to the other, Canada balsam placed on top of the section, and a cover glass put over it, and pressure applied so as to exclude all bubbles, and leave a uniform film of the balsam on the surfaces of the section. I find that a good way to hold the cover glass and section in place while the balsam is setting is by means of a stiff spring clip, with cork mounted on the ends.

I would recommend 'Inquirer' to get Luquer's 'Minerals in Rock Sections,' Rutley's 'The Study of Rocks,' or 'Rock Minerals,' by Joseph P. Iddings. On delicate, and in fact on almost all sections I find it safest to do the final finishing of the polish by hand, using a piece of plate-glass with a little thin oil and rouge. This is better than attempting to put the finishing touches with a rapidly revolving disc, which frequently causes the loss of the entire thin section, when the bulk of the labor is at an end. For a large amount of work I recommend a motor-driven machine, and the cutting and grinding outfit especially

made for this purpose, as recommended at the commencement of this article. Anyone mechanically inclined can make the necessary guides and carriers for the rock, both for the cutting and later the polishing operations. I believe with the above description, which is merely an outline, 'Inquirer' can get the desired results without much difficulty.

H. Vincent Wallace.

El Paso, Texas, February 9.

The Editor:

Sir—Replying to 'Inquirer,' in your issue of February 4, I may mention that Bulletin 150 of the U. S. Geological Survey gives good suggestions on the preparation of microscopic sections of rocks, as does J. P. Iddings in his book entitled 'Rock Minerals.' I have, while away from the usual apparatus, made sections by grinding down a chunk of rock on an emery wheel in a machine shop until it was too thin to hold and then finishing it off in emery sand with sweet oil, using finer sands as the section becomes thinner.

LeRoy A. Palmer.

Salt Lake, Utah, February 12.

Protection of Investors

The Editor:

Sir—Notwithstanding all of the discussion in recent periodicals regarding the protecting of the public from investing in 'wild cat' concerns, both mining and industrial, I have not seen a definite plan of action proposed that would effect a solution of the problem. The Government has been active lately in closing a number of the 'get rich quick' concerns, but in each and every case the damage had already been done and millions of dollars extracted from the gullible public, that can never be returned. It seems to me that what we want is prevention.

Although the vendors of bogus stocks do not confine their operations to the mining industry alone, it is that we have to deal with, and an obligation rests on the legitimate operators, mining engineers, and honest mining men in general to devise some means whereby the public can be protected in a large measure when dealing in mines and mining stocks. The large operator or investor needs no protection; he can look out for himself. Of course I recognize the fact that no scheme could be advanced that would guarantee absolute protection, for as long as the idea of getting something for nothing prevails in a majority of the human race there will always be 'suckers' for every scheme advanced.

At the present time a number of the States have laws designed to protect the investor after his money is up, but none of them is very effective. I believe that the whole matter could be handled by the new Bureau of Mines in a way that would be much more satisfactory. Establish a general bureau of information in Washington and divide the country into districts with a competent inspector in charge of each district. When the incorporation papers of a new mining company are filed, make it compulsory for the incorporators to file a statement with the district inspector giving the names of the officers of the company, amount and location of the ground, capitalization, amount of promotion and treasury stock, and other facts pertinent. Make it compulsory that time enough elapse after the filing of this document to allow the inspector to substantiate the statements made and file his report in Washington. If the whole scheme is an obvious swindle, publicity can immediately be given in the papers by the Bureau. If the intentions of the company are honest the report is on file, and those contemplating investment can secure the facts by writing the Bureau. The inspector of the district can follow up his first report by supplementary reports so that if anything crooked develops later, action can be taken at once. If the public can be assured that the officials of the company are reputable men, that the company has the ground claimed, that it is in mineral-bearing territory, that their money will be spent in legitimate mining operations, and that the statements in the prospectus are not gross exaggerations, I believe that investors would be protected as well as can be done. There is no doubt that such a course of action would be of great benefit to the whole mining industry and save millions of dollars now squandered on bogus concerns.

In connection with this I also believe that it would be of great benefit if the U. S. Geological Survey had several men on skirmish duty, as it were. Whenever a new camp or district is discovered and has advanced so that it shows promise, let one of these geologists make a preliminary survey of the district at once and publish his report immediately. It would be of incalculable value in planning development in the district. In advancing this idea I have special reference at the present time to the National mining district in Nevada. Here is a district at least two years old that has produced over $1,500,000 and has not as yet been visited, so far as I know, by any member of the Survey. A preliminary survey here might have saved many thousands of dollars spent in useless work, and the same is true of many other camps.

Reno, Nevada, January 9. H. C. Cutler.

The Cape to Cairo railway continues to progress, nearly 1500 miles having been completed from Cairo southward, and nearly 2500 miles from Cape Town northward. The terminus of the northern section, lately at Senaar, 160 miles southeast of Khartoum, is now at El Obeid, the capital of Kordofan. The end of the southern section, lately at Broken Hill, is now at the frontier of independent Congo, 400 miles north of Broken Hill. The wealth of the 30,000,000 Congo State natives influenced the managers to change their original plan and steer straight for that territory. The railway line which runs from the mouth of the Congo river, on the Atlantic coast, to Stanley Pool, and which will soon be extended eastward, was another attraction. From the Congo frontier at Kassanshi the line will be continued 120 miles northward to Katanga by the French Katanga railway. Again, from Kassanshi the Cape to Cairo main line will run northwestwardly another 400 miles to Lake Tanganyika.

Concentrates

Most of these are in reply to questions received by mail. Our readers are invited to ask questions and give information dealing with the practice of mining, milling, and smelting.

Osmium is used to a small extent in some kinds of incandescent lamps. It is quoted at $33.70 per troy ounce.

Palladium, which is well adapted for parts of astronomical instruments and certain dental work, sells at $34 per ounce.

Rhodium, which is of considerable value in making high temperature determinations, is quoted, when pure, at $155 per ounce.

Potash salts come principally from an enormous deposit at Stassfurt, Germany, which, at the present rate of exploitation, will last, it has been estimated, about 600,000 years.

Fuller's earth has been largely used for cleaning grease from cloth and furs, but it is now chiefly used in this country for clarifying oils. A recent report by the U. S. Geological Survey discusses the chemical composition of the material and presents theories to account for its peculiar properties.

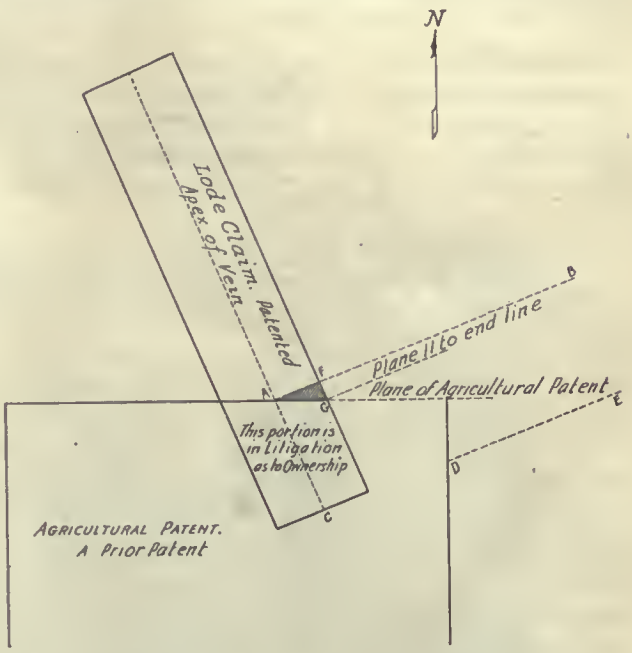
Iridium is used principally for hardening platinum alloys. In 1909, according to the U. S. Geological Survey, the imports of iridium amounted to 341 lb., valued at $135,878, the average cost being about $33 per troy ounce. The cost is rapidly advancing and was quoted at $60 per troy ounce in October 1910.

Rock salt deposits in Michigan are of interest in connection with the current discussion of possible sources of potash. The red beds of the southwestern United States contain deposits of gypsum and rock salt and may be possible sources of potash salts. These beds might profitably be explored in places where conditions favor the accumulation of such salts.

Hornblende rocks alter in different directions, according to the condition of metamorphism. The same rock might well give rise to a mica schist and to something roughly classified as slate. Under weathering conditions hornblende ordinarily changes to chlorite, which is often accompanied by epidote, calcite, quartz, iron oxides, and siderite. Under deep-seated conditions biotite is frequently formed from hornblende. Occasionally epidote forms at the same time.

Gouge is finely ground rock found along vein walls. It is a product of pressure during faulting, modified often by the later action of circulating water. It is not always equally developed on both walls. If in a given case the hanging wall be thought of as remaining fixed and the foot-wall as rising along it, the foot may be conceived as raveling off against the hanging, and the natural result would be a well developed gouge along the hanging, one that was sporadic only along the foot, and a vein filling which may include at any given level, fragments of any of the rocks in that part of the foot-wall that has been raised to or above the level chosen.

Where the lines of a lode location are laid out so as to extend over on prior patented agricultural land, a serious question arises as to whether the lode claimant is entitled to an extralateral right for that segment of the apex of the vein which is included in the agricultural land. There are no authorities, so far as we are aware, deciding this question, as far as agricultural conflicts are concerned. In the case of conflicting lode claims, one line of cases holds that the junior locator is entitled for the full length of the claim after eliminating the extralateral right of the senior claim. Another line of cases holds that the junior locator is only entitled



to an extralateral right based on the segment of apex that exists within 'free ground' (that is, within surface area of his claim to which he is entitled). Applying the first rule to the case below, the extralateral right of the lode claimant would be bounded in a southerly direction by the vertical plane C D E passed through the southerly end line but eliminating all that portion of the vein lying beneath the surface of the agricultural grant. The second line of cases would be authority for limiting the extralateral right in a southerly direction by a vertical plane A B passed through the point where the apex of the vein leaves the free ground of the location and parallel to the end lines. Of course the lode locator would be entitled to the segment of the vein lying vertically beneath the surface triangle A F G by virtue of his ownership of the surface. The Land Department a few years ago intimated that no lode location might have a 'theoretical apex' along the boundary of the agricultural grant, but this doctrine has not been received with much favor. Until the United States Supreme Court has passed on this extralateral right matter, it will be involved in doubt. Whatever principle is applicable to agricultural conflict would seem to apply to conflicts of lode locations with millsites or placers. 'Known lodes' in placers would, of course, be an exception.

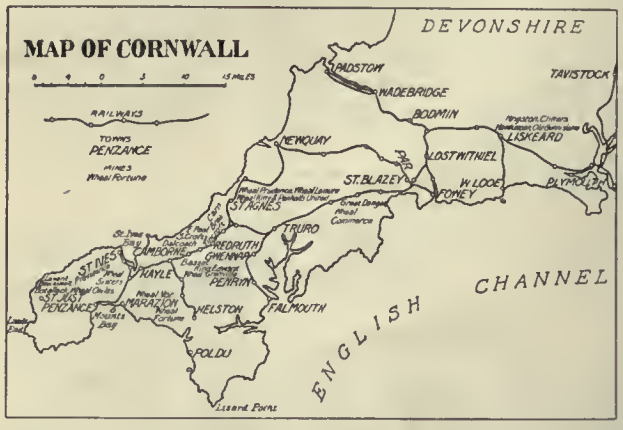
Special Correspondence

LONDON

J. H. Collins Reports on Cornwall Tin Mines. — Favors Continuing Operations.—Pitchblende at St. Ives.—Derbyshire Lead Mines.—Demand for Fluorspar.

There was never so optimistic a mining engineer as J. H. Collins, nor so devoted a believer in the resources of Cornwall. Mr. Collins is not a young man; many of us are contemporaries of his sons. But in spite of his years, his spirit is as buoyant as ever. Probably no one has so great a knowledge of the tin lodes of Cornwall as he; he knows all sorts of details of long-closed mines, and is doing fine service in recording his recollections and in perpetuating in published form the information he has relating to old properties.

Mr. Collins has just contributed a paper to the Records of the West Country Chamber of Mines, that should en-



courage others in this or in future generations to try their hands at winning some of the tin that is still there. He begins by saying that the drop in the production of tin during the last 15 years has not been due so much to the decrease in the production of mines continuing in operation as to the abandonment of mining in many districts that used to be of importance. The production is now centred round Carn Brea hill, and the only other regular producers that have much to sell are found in the St. Just and St. Agnes districts. The Calstock district in East Cornwall promised a few years ago to show a revival, but the mines on which so much energy and money were spent, Hingston and Clitters, have once more been closed. With the above exceptions, it has to be admitted that all the districts once famous as producers have been practically abandoned. It is true that mining operations are being continued at St. Ives, Wendron, Chacewater, and Liskeard by isolated companies, but these districts generally, as well as those of Breage, Gwennap, Perran, St. Austell, Callington, and Tavistock are now quite neglected. Mr. Collins sees no scientific reason to account for this widespread abandonment, and considers that with capital and perseverance they should once more become important producers of tin. He does not advocate the re-opening of old, deep mines full of water, but there are many districts where shallow levels contain ore that would pay nowadays without much sinking and pumping. For instance, at Wheal Kitty, at St. Agnes, many hundreds of tons of tin concentrate have been raised during the last four years from ground between the 300 and 500-ft. levels, in spite of the fact that the mine has been worked continuously for over 100 years. Mr. Collins describes the several districts in the west of Cornwall and commences with St. Just near Land's End. This was once and may be again one of the great producers. Levant and Botallack have been working for over a century, and though the present position is unfavorable, there is no good reason why operations should not be profitable. The St. Just district is a strip of country on the coast line consisting of greenstone and metamorphosed slate (locally, 'killas'), averaging ⅛ mile wide and 4½ miles long. He considers that it is probably unsurpassed in mineralogical and geological interest by any region of equal size in any part of the world. At least 50 lodes are known and many are visible on the cliffs.

In the St. Ives district there are two separate groups of mines. One stretches along the valley southwest from the town of St. Ives toward Towednack, and is contained in a belt 2 miles long and ½ mile wide. The other is farther to the south between Trink and Trencrom Hills extending to the east toward Carbis Bay, the whole area measuring 4 by 2 miles. The average character of the lodes in this district is much the same as that of the lodes in St. Just district. The presence of pitchblende makes the similarity especially notable. The St. Ives Consols is the most important mine in the district and was started in 1816. It yielded much tin and copper, and was notable for beautiful crystals of chalcocite and for rich specimens of pitchblende. During the last two years much money has been spent in re-opening this mine, and in the Giew section, toward the northwest, profitable orebodies appear to have been found. Wheal Trenwith adjoins St. Ives Consols, and its dumps have recently become of interest owing to the large amount of pitchblende found in them.

The Providence group of mines is at the east end of the southern St. Ives district and is close to Carbis Bay. These mines were worked from 1832, and yielded much copper and tin; pitchblende is also found here. During the last four years the Tasmanian Exploration Co. has re-opened some of them and has erected a 10-stamp mill. Unfortunately most of the money has been spent on surface equipment, and too little underground development has been done. As the mines were worked by the old owners to only a comparatively shallow level below adit, Mr. Collins feels confident that systematic underground exploration and development would be justified. Another district worth examination includes Breage, Marazion, and Newlyn. It is often included in one district with Hayle and Gwinear farther to the north and east, but the geological conditions are different, as the slate is softer and contains many greenstone intrusions. More copper has been raised than tin, which is believed to be due to the fact that the workings are shallow and have not gone down to the tin. He instances several old mines on the shores of Mount's Bay which had not been worked to any great depth, but which were troubled with water in the early days. Mr. Collins deserves the thanks of all mining men for these records founded on personal knowledge.

Lead has been worked in Derbyshire from time immemorial, but in modern times, the old laws still extant, the troubles with owners of river rights, and the cost of transport of ore to smelters have combined to restrict operations. There are several lead-mining companies making a fair production in Derbyshire, but as they are owned privately, no information is available as to their methods of mining and treatment. A new company called Derbyshire Minerals, Ltd., has been formed with a capital of £45,000, to acquire a number of properties in several parts of Derbyshire. The most interesting are the old mines in Smalldale and Pindale near Castleton. These are, no doubt, the mines referred to by Sir Walter Scott in 'Peveril of the Peak,' in which story he used the classical expression, "Now you drift drivers!", thus accentuating the difference between the words 'drift' and 'drive'. Other properties are farther to the east and south, including some on Longstone Edge and others at Eyam and Stony Middleton. As is well known, these Derbyshire lead mines contain large amounts of fluorspar which until recent years was a drug on the market. Owing to the great demand for fluorspar from steelmakers, who use it in the basic open-hearth furnace for the purpose of increasing fluidity, many of these lead mines in Derbyshire have been re-opened and the old dumps exploited. In fact, this industry has been most profitable during the last few years.

DENVER, COLORADO

Committee on Mines and Mining.—Cripple Creek Items.—Conditions in the San Juan District.—Gilpin County News.

The Denver Chamber of Commerce is to be congratulated on its selection of a committee on mines and mining for 1911. This committee is already at work in behalf of the metal-mining industry of the State. In conjunction with the Denver branch of the American Mining Congress, the Chamber of Commerce is strongly opposing the present House bill No. 306, which seeks to raise the general taxation on mining property throughout the State. The proposed increase in valuation is the modest sum of $39,000,000. What logic there is for such an increase is hard to see when one considers the steadily declining metal production of Colorado. The present system is certainly not just. It seems as if some equitable basis of taxation could be devised if a little common sense, instead of political expediency, were applied to the problem. The bill providing for the tunneling of the Continental Divide is still in doubt and probably will fail to pass, although all the Denver organizations and the local press have worked for it.

The production of the Cripple Creek district for February was 70,170 tons of ore, of a gross value of $1,273,570. The Blue Flag, Anaconda, and Wild Horse mills are in operation, and this circumstance runs up the tonnage and decreases the average value. The Elkton and Golden Cycle companies have announced dividends of $37,500 and $30,000, respectively. Prospecting on the surface has received considerable attention recently, and four promising veins have been opened in different parts of the camp. The cross-cut from the Deep Drainage tunnel to the C. K. & N. vein has tapped little water as yet. Meanwhile, that in the deeper mines of the district continues to lower at a satisfactory rate. The tenth level of the Anchoria Leland, on Gold Hill, is dry, and filled with foul air. While prospecting these old workings on February 25, two miners were smothered. At the time of the explosion, which wrecked the upper Granite shaft-house, the Portland company was forced to protect its buildings from the resulting fire. This company has put in a bill to the insurance companies for the money spent at that time. The case is of interest, as it involves one of the fundamental principles of insurance and promises to be hotly contested.

The deep snows and frequent slides are bothering the operators in the San Juan district. The boosters at Telluride are hopeful that a smelter will be established in that town. The Newmire mine of the Primos Chemical Co. has resumed operating after two months of idleness. Several other prospects and small producers of vanadium ore on the San Miguel river are being worked in anticipation of the erection of a local treatment-plant when the season opens. The restraining order against the Valley View Consolidated Mining Co. of La Plata county has been refused by the Federal court. The Pay Day Gold Mining Co. alleged trespass and claimed that the defendant was removing ore of value from its property. The case was disposed of quickly when the defendant introduced a glass model showing the facts as they appear on the properties.

The Sadie A. mine, in the business district of Central City, is now in litigation. The claim originally belonged to the St. Louis No. 2 Co., which spent considerable money in developing the property, but, being rather unsuccessful, did not have the claim patented. A rich outcrop was discovered on the property last summer, and when the discoverer tried to get a lease on the property the faulty nature of the title was disclosed. The recent discoverers have bought a small plot on the outcrop and are sinking a shaft on the vein. The War Dance, and War Dance Extension claims, in the Russell district, have been sold to H. C. Eastman of Denver for $100,000. This is the largest deal in Gilpin county mining property for some time.

The 'Patch,' a Typical Bit of Gilpin County.

NEW YORK

Significance of Interstate Commerce Decision. — Outlook for Mining Markets. — New Mines Ready for Production.—Utah Copper. — Barnes-King.—Ray Central.

All the usual influences and factors in the making of market sentiment have become insignificant compared to the effect of the late decision of the Interstate Commerce Commission. It is considered to mark an epoch in the financing and in the financial management of railroad corporations; and is the portent of further regulation to come, for railway companies and corporations in general. The Standard Oil and Tobacco Trust cases now loom larger than they did a few weeks ago, while the practical certainty of a special session of Congress means a period of business stagnation. The opportunity to change tariff schedules cannot be overlooked by busy politicians, and even if nothing is done in this regard, the fear that it may be attempted will be sufficient to postpone many commitments. So far as the mining markets are affected, the only result is stagnation. The best-informed people in Wall Street regard the situation as certain to result in stimulating both the industry and the markets in time, for the reason that, in most part, mining and mining products are not affected by tariff schedules, nor by legislation relating to corporations. With several large combinations running the gauntlet of Federal investigation, and others marked for like procedure, the copper merger seems farther away than ever. Some of the preliminary mergers may not prove able to stand inspection. The opposition to the Calumet & Hecla consolidation has resulted in the filing of a bill for an injunction in the United States

Circuit Court, in Michigan, before Judge Swann, who has granted a temporary injunction against the merger. The chief allegation of the bill is that the proposed action is an attempt to form a monopoly and will create an unlawful combination of capital in restraint of trade. There is a late rumor that some of the banking interests involved in the consolidation are inclined to go no further with the matter, contending that the delay necessary to take the case to the United States Supreme Court will render present plans useless and that the ratios as now determined would all have to be readjusted. The copper situation seems not improving. Although the foreign visible supply shows a decrease of 422 tons, and curtailment of production is more in evidence now than it has ever been at any time since the so-called agreement was announced late last summer, the fact remains that there are several large companies getting ready for initial production, including the Ray Consolidated, Miami, Chino, Giroux, Mason Valley, Inspiration, and others. The operators of those properties cannot do things by halves, as the vast amounts expended in development and equipment compel production on a large scale. The weight of these factors and the low price of copper metal, with buyers indifferent, have dampened the enthusiasm for copper shares here. Utah Copper has been generally supposed to be fully financed and the stock distributed; nevertheless, the shares have been introduced to the French public, and it is reported that there is more activity in the issue in the Paris Coulisse than there is in the New York Stock Exchange. The Coulisse is the Parisian outside, resembling the New York Curb, but to a certain extent under the protection of the Paris Bourse. It is said that some 150,000 shares of Utah have been sold to the French public, in lots averaging between four and five shares to the stockholder. One of the characteristic phases of French frugality is the investment in small lots of stocks and bonds. Bonds prepared for the French market are always issued in denominations which bankers in this country would not handle, being too small to suit our ideas of finance. On the other hand, such odd lots rarely come back into the market, but are permanently held as investments.

The chain of Guggenheim dividends is to be distributed as usual. In regard to the Guggenheim Exploration Co., there has been no plan definitely accepted as yet for the reorganization of the company. One of the insiders said that "Eventually something will be done in the matter, for, although copper is selling at panic prices, and the Utah Copper Co. is not operating to capacity, while the Yukon Gold Co. ran at only 60% of capacity last year, the Exploration company is now earning at the rate of 18½% on its outstanding present capital." The company has a capital of $22,000,000, all issued save $1,206,700. Last year the earnings were 16.1%; for the year previous, 14.7%. The shareholders of the Live Oak Development Co. are to be given the right to subscribe for new stock at $20 per share on the basis of one share for each four shares they now hold. The new stock issue is underwritten by Hayden, Stone & Co. A contest waged for the control of the Barnes-King Development Co. resulted in a defeat for the present management, the control passing to Western men. At the present time the property is not being worked, but the company has some $270,000 in cash in its treasury, and Charles W. Goodale, general manager for the Boston & Montana, is to be elected to the presidency. Among the larger stockholders in the Barnes-King are Justice Gerard of the Supreme Court of New York, and H. Carroll Brown, a member of the New York Stock Exchange, both of whom are sons-in-law of the late Marcus Daly; John D. Ryan of the Amalgamated, and other officials of the same company. The present management stands accused of trying to acquire the present cash surplus of the Barnes-King by selling property to the company in which they or their friends are personally interested.

The report of Weed & Probert on the Ray Central property has just been made public, and is a little disappointing as to the ore available, estimated at 7,000,000 tons, averaging 2.15% copper. The cost-sheet showing 10.38c. per pound is a rather high cost for porphyry property, especially where there is no greater tonnage available. The engineers estimate that a plant of 1000 tons daily capacity can produce 9,155,000 lb. copper annually and earn dividends of $244,000, which would be 30.5c. per share on 800,000 shares, or equivalent to 20% on $1.50 per share. On this basis Ray Central hardly compares favorably with others developing porphyries.

JOHANNESBURG, TRANSVAAL

Output, Yield per Ton, Costs and Profits of the Witwatersrand Mining Co. in 1910.—Copper Field in Northeastern Transvaal.

The output analysis sheet issued by the Transvaal Chamber of Mines for December 1910 shows that during that month there was mined and milled in the Witwatersrand district 1,827,423 tons of ore, on which there was a profit of £952,574, being at the rate of 10s. 6d. per ton treated. For the 12 months of 1910, in the same district, 21,432,541 tons of ore was milled, the recovery per ton having been 28s. 6d. Working costs were maintained at an average of 17s. 7d. per ton, and the total resultant profit was, therefore, £11,216,105. It is interesting to observe that, in spite of the expansion of mining operations along the Main Reef, the aggregate profit earned by the Rand mining industry has of late declined. The grade of ore milled has dropped, and, despite working on a larger scale than ever hitherto, and despite economies and increased efficiency in details, which until lately were not much heeded, the profit for 1909 was less than that of 1908, and the 1910 aggregate in turn falls substantially below the 1909 figures. The following is a summary of the results obtained in the three years under review:

Year.	Costs per ton.	Profit per ton.	Total Profit.
1908	18s.	13.5s.	£12,011,227
1909	17.1s.	11.6s.	11,794,376
1910	17.7s.	10.6s.	11,216,105

An important copper field is now being explored in the northeast corner of the Transvaal, about 160 miles

Map of South Africa.

northeast of Pietersburg. The area in question, which is intersected by the Motale river, lies considerably to the east of the well known Messina mine, and the indications point to the probability of a big field being developed almost without interruption from the vicinity of the Seta mine, on the Limpopo river, to the Portuguese border. The geology of those new Motale fields differs essentially from that of the Messina area. In the latter the cupriferous areas, which are for the greater part chalcocite and malachite, occur in association with granite and gneiss, whereas at Motale the copper occurs in sandstones of the lower Waterberg age. Another feature of difference is that at Motale rich outcrops of both carbonate

and sulphide ore are found at the surface, but at Messina this is not the case. It is also worthy of remark that the extensive ancient workings so much in evidence at Messina are not to be observed in the Motale district, which seemingly indicates that the 'ancients' (whoever those estimable people may have been) and the natives knew nothing of the Motale field. The great handicap to the district now is the lack of efficient and economical means of transportation, but lines are being constructed from Pietersburg, and along the Selati route to the north, which will converge in the copper districts. When these projects are achieved, the northern portions of the Zoutpansberg district will be in a position to put large quantities of copper on the market at a reasonable cost of production. In connection with the Motale fields it is important to learn that a coalfield has been discovered

Motale Copper Field.

about 10 miles from the Malgo Syndicate's property. Other natural advantages of Motale fields are that they are in the heart of an area that is densely populated by native people, and that there is abundant timber and an ample supply of water in that region. Advantage is being taken of the present arrangements with regard to transport to send back return-loads of copper glance on the wagons. This ore, which averages between 40 and 45% of copper, is being accumulated at rail head (for the present, Pietersburg) and will be shipped to Swansea for smelting. Taken altogether, it appears that in this extreme northern portion of the Transvaal a copper field of considerable magnitude and value is being explored, of which a good deal more is to be heard in the near future.

BRITISH COLUMBIA

Railroad Building in Similkameen and Tulameen Country.— Platinum Placers.—Camp Hedley, Steamboat Mountain, and Sheep Creek.

Now that the winter is breaking, more men are being put to work on the Kettle Valley railway; about 15 miles of steel has been laid along the Coldwater river from Merritt, and about 30 miles of grading has been completed toward the summit and near the headwaters of the Coldwater. This line of railway is controlled by the C. P. R., and will connect with its Columbia and western branch at Midway, in the Boundary country, and when completed the rich copper camps of the Similkameen and Aspen Grove will have direct transportation to the Pacific Coast, and most of the Boundary and interior smelters will be supplied with coke, from both the Nicola valley and Tulameen coalfields, which will obviate the present long haul from the Crows Nest collieries. Early this spring railway construction will be pushed through this district by both the Victoria, Vancouver & Eastern (Great Northern) and the Kettle Valley (C. P. R.); both these railways should be completed within the year, and be in operation before the close of 1912. About 14 miles up the Tulameen river from Princeton, the new town of Coalmont is being established by the Columbia Coal & Coke Co., where home-seeking miners may reside when the production of coal and coke is begun. Coalmont takes its name from the mountain in which the 7 by 11-ft. tunnel is being driven to the measures of bituminous coal. Analyses have shown this coal to have excellent fuel and coking qualities. This company will erect 50 cottages on its townsite for the accommodation of its workingmen. In the tunnel good progress is made with three shifts. Andrew Laidlaw, of Spokane, recently closed two deals involving property in the Crows Nest Pass country, and a large area of coal land at Princeton, in the Similkameen coal basin, the latter known as the Princeton collieries which owns 18,000 to 20,000 acres of coal lands, including the surface rights to some 10,000 acres. The treasury stock of the company has been underwritten by the British Canadian Securities, Ltd., of Vancouver, B. C., assuring sufficient capital to equip and develop the property to a stage making it capable of producing 500 tons of coal per day.

With the price of platinum still on the advance, British and American investors are looking into the undeveloped platinum deposits of the Tulameen and Similkameen rivers, where in the early placer days platinum in commercial quantities was found in the sluice-boxes in a ratio of one to one with gold. In the last few years some of the most important deposits have been tied up by Government leases, and no development work to speak of has been done. Now, however, with the building of the V. V. & E. railway (Great Northern) up the Tulameen river, these platinum deposits will be developed by people having capital. No British Columbia mining camps have attracted more attention the past year than Sheep Creek camp, situated between Nelson and the international boundary line; Camp Hedley, situated in the centre of the Similkameen; and the gold discoveries on Steamboat mountain, and Siwash creek, situated in the Hope mountains. Steamboat mountain is situated on the Skagit river near the headwaters of the Tulameen river; and Siwash creek heads in the Coquihalla mountains, about 60 miles north of Steamboat, and flows into the Fraser at Yale. The distributing points for Steamboat region are Hope

Nickel Plate Mine, Hedley, B. C.

and Princeton. In the Sheep Creek camp, the Queen mine, operated by a Wisconsin company, ran its 20-stamp mill last year without a shut-down. The Nugget mine at the summit of Dominion mountain, owned and operated by the Nugget Gold Mines, Ltd., operated its 4-stamp mill throughout last year, producing concentrates, which were rawhided out this winter. After about three years of steady development work, the Mother Lode mine has changed hands and is now the property of John McMartin of Cobalt and his associates. A new mill is being erected, and ore shipments are expected to be made this season. The Kootenay Belle mine, which was purchased last year by the Rogers syndicate, will probably enter the shipping list this season; it is situated on Yellowstone mountain, across from the Mother Lode, but farther down Sheep creek. Some promising properties have lately been bonded, and many new companies have been formed to develop claims in the Sheep Creek district.

Camp Hedley still leads in the gold production of southern British Columbia, the Nickel Plate mine having produced more gold than any other gold mine in Canada. The Pollock Mines, Ltd., has a deal pending with London investors. The Brown Mines Development Co. recently was organized to develop the Bull Dog group which ad-

joins the Crown Point group. Hedley is not a poor man's mining camp, owing to its hard formation, the thorough development of the majority of the promising prospects requiring a considerable expenditure of money. The Hedley Gold M. Co. has a 40-stamp mill and cyanide plant; it also boasts of owning and operating the longest gravity tramway in the world. No doubt, when outside capital becomes interested in the Similkameen, Camp Hedley will have many gold mines as good as the present producers. The recent rich gold finds on Steamboat mountain and the discovery of free-milling gold ore on Siwash creek have attracted attention in Vancouver where people are interested. With the development work laid out for this summer on both Steamboat mountain and Siwash creek, those camps may show many more producing mines to the credit of Yale district, and it is hoped that the wild-catting which so hampered the legitimate development of the Rossland and Trail creek camps some fifteen years ago will be entirely suppressed by the different mining journals of Canada and the United States, and by the co-operation of investors in legitimate mining throughout the entire province. The Provincial Government last week sent a party of surveyors to lay out a new road from Hope to Steamboat mountain, and from the new mines down the Similkameen to Princeton.

REPUBLIC, WASHINGTON

Spirited Contest Between Factions of the New Republic Mines Co. — Transfer to Rathfon Reduction Works.—The Black Tail Mine.

The annual meeting of the New Republic Mines Co. was held at Republic March 1. Of the capital stock of 2,000,000 shares, 1,920,000 shares were represented in person and by proxies. A contest took place between the majority and minority factions for supremacy, occasioned by the issue of 114,500 shares of the treasury stock to John De Young, four days previous to the meeting, for the purpose, it was claimed, of controlling said meeting. A fierce debate ensued when the minority report came up for consideration, which lasted from the middle of the afternoon until nearly midnight, when the minority faction, headed by J. L. Harper, J. E. McFarland, and G. M. Fripp, bolted the meeting. The debate related to the transfer of the company's property to the Rathfon Reduction Works, a corporation in which some of the directors were alleged to have been interested. The minority leaders made charges of fraud and bad faith on the part of the officers, claiming that in the matter of this transfer they had served their own interests instead of those of the company. Several of the 35 members present called on the officers to answer the charges against them, and the trustees' attorney said they would not report to the meeting, but would defend themselves in the Superior Court of Ferry county, where an action is pending for the annulment of the transfer of the company's property. A crisis was precipitated when Mr. McFarland, addressing himself, as a stockholder, to F. B. Babcock, as the president of the company, asked: "Did you, at the time you entered into this deal, last September, or did you not, favor your own private interests by being interested in the Rathfon company and exacting terms from me, as a stockholder, on a basis unequal to your own? In other words, did you not have an ulterior motive to my detriment in the transaction?" Mr. Babcock refused to answer the question. The meeting voted in favor of passing the annual reports of the officers and having them filed with the secretary and held accessible to the stockholders. A resolution was adopted approving and ratifying the contract for the sale and transfer of the company's lease of the Republic mine and personal property to the Rathfon Reduction Works. The following were elected to serve as directors for the ensuing year: F. B. Babcock, R. J. Howard, John De Young, A. Babcock, F. W. Bewley, O. B. Hollis, W. J. Burns, F. Kienbaum, and W. B. Parker.

The frame-work of the North Washington Power & Reduction Co.'s mill building will be ready for the installation of the machinery by March 10. The Black Tail mine, owned by the Hope company, looks better than at any time since it was purchased, last July. The winze on the Black Tail vein is down 60 ft. below the adit-level. The company has arranged for the installation of an air-compressor and hoist, good for a depth of several hundred feet. At the bottom of the winze a pay-streak over 30 in. wide has been developed which assays from $50 to $70 per ton. From a point 462 ft. in from the portal of the adit a drift has been driven northwesterly about 300 ft. From the end of the drift a cross-cut will be started toward the Black Tail vein, with the expectation of intersecting it within a distance of 50 ft. The company has ordered 1400 ft. of T-rails for new trackage.

TORONTO, CANADA

Deputation of Mining Men Ask for Railroad to Gowganda District. — Bewick-Moreing Representatives Invest in Porcupine.

Premier Whitney and other members of the Ontario Government were interviewed Feb. 15 by a delegation of about 500 mining men and others interested in the development of the Gowganda silver area, urging the building by the Government of a railway to open that district, and the intervening Elk Lake area, and connecting them with the Temiskaming & Northern Ontario. The argument presented was that a large amount of money had been invested in mining development, but that the ore extracted, being mostly low grade, could not be profitably shipped without railway facilities. It was represented that by the construction of the projected road a great impetus would be given to mining development and production. While the tone of the replies given by the Premier and the Minister of Mines was favorable, no definite promises were made, and it was intimated that before a decisive answer was given the Government would require to be furnished with more precise information as to the tonnage of ore that might be shipped from the mines. As an alternative proposition, should the Government not see its way to construct the branch as a public work, the deputation asked for the issue of a charter to a private company, coupled with an agreement on the part of the Government that it would not in the future build a competing line. The general feeling is that the Government, before long will either build the road or grant the required charter.

The representatives of the Bewick-Moreing company of England who visited Porcupine have taken over for development 50 claims belonging to the Timmis-McMartin-Dunlop syndicate, on which they will expend $500,000 during the coming season. These locations do not include the Hollinger or the Miller-Middleton groups of claims. This has considerably stimulated activity on the part of others, and the camp is active. Reports from the Hollinger are encouraging. The orebody is stated to have been proved down to 200 ft. and for a length of 1200 ft. on one vein. A portion of the machinery for the 30-stamp mill is on the ground, and it is expected that it will be in operation by July 1. In the meantime the stock has advanced and is now selling around $6. On the Rea mines, operated by the Consolidated Gold Fields, the diamond-drill shows free gold at a depth of 200 ft. The Standard Mining Co. has good showings at the bottom of a 20-ft. shaft and will start diamond-drilling to prove the property at depth. The Preston East Dome Co. has let contracts for sinking four shafts and has ordered a 30-stamp mill. Notwithstanding severe winter conditions, good progress is being made building the Porcupine branch of the railway, with a force of about 900 men. Snowshoe prospecting has been active during the winter in the district and a large number of claims has been staked on the chance of finding ore in the future. A syndicate including Fred Tiffany, of New York; Thomas E. Savage, Boston; John B. Barlow, Hartford, Conn.; Richard D. Isaacs, St. John, N. B.; and H. D. Hadley, New York, have purchased four Porcupine claims for $200,000, and will form a company capitalized at $1,500,000.

General Mining News

ALASKA

Road and trail-building, accomplished in Alaska up to the end of 1909, is stated in the Governor's report as follows: Wagon-roads, 720 miles; winter sled-roads for two horses, 472 miles; for single horse or dog-sled, 551 miles; trails, marked by permanent iron stakes, 85 miles; marked by temporary stakes, 670 miles. This work, with maintenance work, represents an expenditure of $1,487,911, most of which was derived from appropriations by Congress and from the Alaska fund, though $75,000 to $100,000 was local road-tax funds, and voluntary contributions. This road and trail-building has been done under direction of the Alaska Road Commission, acting under the authority of the Secretary of War. One of the most important road and trail routes is the one between Valdez and Fairbanks.

PRINCE WILLIAM SOUND

It is estimated that 500 people arrived at Valdez in February, attracted thither by the prospect of mining activity in that region during this season. The snow is not expected to begin to melt on the hills till May, and miners going there early are warned that work on the new properties will not begin till June or July. A rush of people to Valdez, however, is anticipated.

Ellamar Mine, Prince William Sound.

ARIZONA

COCHISE COUNTY

The Tombstone Con. Mines Co., which for the present ceased operating on its own account a few weeks ago, has let leases to 26 parties, assigning a certain place in its Tombstone mines to each lessee. The lessor allows these parties the use of its haulage levels, shafts, cages, hoists, boilers, cars, and other equipment, and is to receive as royalty 20% of net smelter returns from ore shipped by lessees. The company has reserved the right to terminate the leases at the end of six months, by giving 60 days notice. The Middlemarch Copper Co. is to resume operations on its property in the Dragoon mountains.

GILA COUNTY

Henry Krumb, consulting engineer for the Inspiration Copper Co., is reported as having stated that this company's demonstrated ore zone has a width of 1400 ft. and a length of 3400 ft., and that the work of four churn-drills is serving to enlarge this area. For the purpose of developing and mining the ore lying below the main transportation level, the Colorado and Joe Bush shafts are being sunk 220 ft. below that level.

(Special Correspondence.)—Because of delay in shipment of a minor piece of machinery needed at the power plant, the Miami Copper Co.'s concentrating plant did not begin its treatment of ore on March 1. It may be the 10th of this month before the mill begins its work. F. W. Solomon, until now with the Nevada Consolidated at McGill, Nevada, arrived at Miami, February 28, to assume charge of the Miami concentrator. Units No. 2 and 3 will be the first to be put in operation. They have been given a try-out and most of their stiffness has been eliminated. Because of the limited power furnished by the old generator used in construction of the plant, it has been impossible to operate more than a portion of a unit at one time. It was the intention of the management to make the preliminary run with units No. 3 and 4, but No. 4 is being equipped with the Burch fine rolls instead of the Chilean mills used in connection with the other units, and a portion of the rolls has not yet arrived. The pumping plant at Burch was given a trial run March 1 and found to be without any defect. The water-line from the pumps to the mill has been temporarily laid with 10-in. casing until arrival of the 14-in. pipe that will be used for the permanent main. The pipe-line that will be used to convey hot air between the power-house and heating-house at No. 4 shaft has been connected. One of the new hoisting engines also was tried March 1. It was found satisfactory, and will be operated daily to lessen frictional stiffness and familiarize the engineers with the machinery and shaft measurements. A transmission-line is being strung between the power-house and the concentrate tanks, situated in the canyon west of the concentrator, to operate the vacuum-pumps that will be employed to dry the concentrate before being stored in the bins. Three churn-drills are still being used by the Miami company. One is employed on the western end of the property for the purpose of determining the exact line of demarcation between the orebody and barren ground that all unnecessary underground work may be obviated. The other drills are engaged in exploration work, one drill sinking on the extreme northwestern portion of the property adjoining the Inspiration ground, the other drilling on the high ground of the Red Springs claim, having been moved recently from a point in the gulch on the same claim.

Globe, March 4.

MARICOPA COUNTY

The Arizona Bureau of Mines has been organized at Phoenix, the object of which is to compile statistics of Arizona mines, to collect specimen ores for exhibit, to maintain a publicity bureau as to mining progress, to establish a mining library, to outline and propose legislation in the interest of mining, to suppress wild-cat schemes, and to organize a Territorial bureau to co-operate with the Federal Bureau of Mines.

YAVAPAI COUNTY

The United Verde Extension Co., operating at Jerome, is to ship ore to the smelter at Swansea, Yuma county. It is estimated that the ore to be shipped will sample 5% copper and $8 per ton in gold. The Jerome-Durango Gold M. Co. recently held a meeting in Jerome, at which the 60 stockholders present raised the necessary money for the purchase and installation of a 5-stamp mill. The company has 600 tons of high-grade ore on the dump, and several thousand tons exposed in the mine. It is claimed this ore assays $140 to $150 per ton in gold and silver. The shaft of the Jerome Verde Copper Co. has a depth of 600 ft., and the intention is to sink 100 ft. deeper, then drive to the orebody at that depth.

CALIFORNIA

BUTTE COUNTY

According to data supplied by M. J. Cooney, one of the owners of the Gold Queen and Shakespeare mines, in the vicinity of Forbestown, the gold production of Butte county mines between 1849 and 1899 was $270,000,000. The Gold-

bank mine, at Forbestown, has been sold by H. S. Stowe to M. J. Cooney and F. J. Stoers, who have acquired other mining property in that district. The Goldbank has been one of the largest producing mines in the county.

CALAVERAS COUNTY

The Copa de Oro M. & M. Co., owner of the Blue Bell quartz mine, situated near Glencoe, has developed the property considerably and may erect a mill this season. The mine is on the south fork of the Mokelumne river, and its veins of ore are being opened by a cross-cut that was started in the river canyon. A mill can be operated by water-power, and the ore can be moved to the mill by gravity.

The farmers living in the vicinity of Campo Seco have formed an association to oppose the Penn Chemical Co. in the operation of its copper furnaces and roasters, claiming the fume emitted into the atmosphere is detrimental to plant-life and health.

ELDORADO COUNTY

Robert Waugh and A. A. Goldsberry, of Auburn and Sacramento, respectively, are opening a channel of auriferous gravel near Georgetown. This channel is reported to have a width of 600 feet.

INYO COUNTY

(Special Correspondence.)—The Skidoo Mines Co., for the month of January, milled 1070 tons of ore in 18½ days, recovering bullion of the value of $14,635.67. The operating expenses amounted to $6592.25; development work cost $813.31. The net profit for the month was $7230.11.

Skidoo, March 3.

KERN COUNTY

The Spangler mine, situated in Radamacher district, is being operated by a small force of miners, and ore assaying $125 per ton is being mined on the 125-ft. level. This is sacked and shipped to the smelter. Radamacher is the name of a station on the Southern Pacific's Mojave-Owen's Valley line. The Butte mine, at Randsburg, is active in the hands of lessees. Ed. Shipsey, principal lessee, has let a number of sub-leases, but is mining on the new vein, opened last September, with his own force, having installed a 12-hp. gasoline hoist for this work. A number of the sub-lessees are working in ground tributary to the main 600-ft. shaft. James Rice, to whom a lease was given on the King Solomon extension of the new Butte vein, has sold his interest therein to W. Halladay. Rice then obtained a lease on the old vein of the Butte.

MARIPOSA COUNTY

The Bullion Hill M. Co. has let a contract to the Jardine Machinery Co. of San Francisco for the erection of a 75-ton mill at the former's mine at Exchequer. The equipment is to include a Krogh tube-mill, Huntington grinders, and amalgamating-plates. The machinery is to be driven by two Union gas-engines.

NEVADA COUNTY

The *Grass Valley Union* states that the Rose Hill mine is to be put in operation again. This property, which was operated formerly, has a surface area of 1100 by 600 ft., and contains two defined, parallel veins, and the ground is patented. Development consists of an 860-ft. cross-cut by which the two veins are intersected, and by a 125-ft. incline, the latter connecting with the south drift on one of the veins. The Midas mine, situated near Randolph flat, which was developed to some extent by James brothers of Grass Valley, is to be unwatered, so that its workings may be examined. Money to pay the expenses of pumping has been provided. The sale of the property to San Francisco people is anticipated.

PLACER COUNTY

The Herman mine, situated at Westville, and controlled by Pittsburg men, is to be operated again this season under the superintendency of E. B. Quigley. This is a gold quartz mine and has paid dividends. The Haskel gold-gravel mine, near Auburn, is to be worked during this season by E. C. Gaylord and H. T. Power.

PLUMAS COUNTY

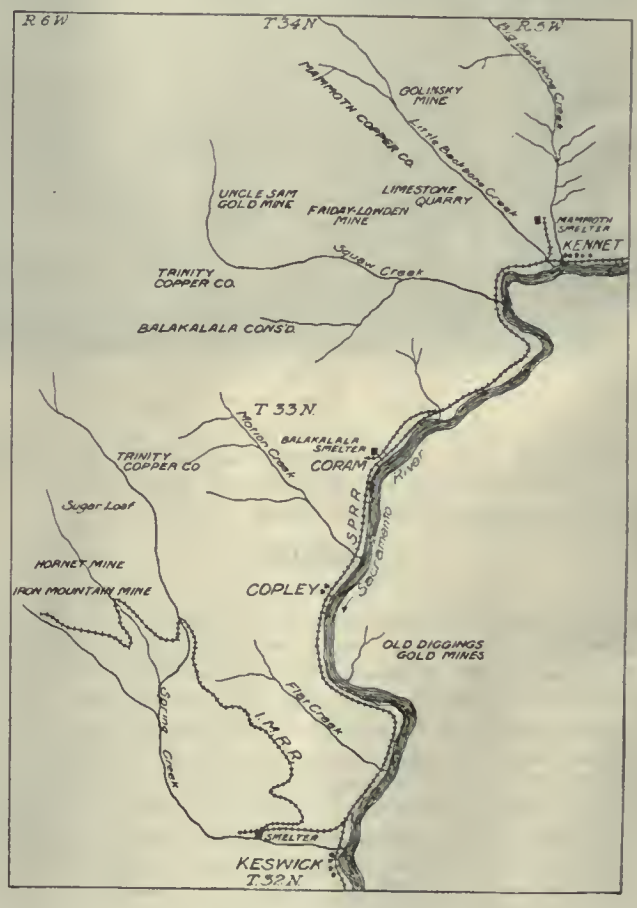
The discovery of a new vein of gold-bearing quartz in the Jamison mine is likely to give that property an extension of productiveness. It has been operated during the last 15 years, and just previous to this find it was thought its orebodies were nearly exhausted. There is a 20-stamp mill at the mine, and the building of a new mill may be considered. Its location is near Johnsville. The Plumas-Eureka mine is being operated under direction of J. Lawton, who is having a cross-cut driven from the Eureka tunnel to open the ore in the 'Seventy-six' workings. While this mine was formerly considered worked out, recent development is said to be demonstrating that it has sufficient ore to keep the 40-stamp mill operating for some time. The broken wire-cable of the tramway is being replaced by a new one.

SAN BERNARDINO COUNTY

The Saxony Mining & Development Co. has been incorporated to mine and market tungsten ore on a property which has been developed to some extent by George Reidrich, who is a stockholder in the company. The property is situated near Atolia.

SHASTA COUNTY

The Shasta Copper Exploration Co. has nearly 1000 acres of mineral land situated between the Balaklala and Iron Mountain mines. A consolidation of various properties,



Copper Region of Shasta County.

making up this group, was effected by M. E. Dittmar. The directors of the company are W. P. Hammon, M. E. Dittmar, Frank H. Buck, W. L. Leland, and O. Scribner. Extensive exploration with diamond-drills is to be undertaken. The company's office is to be in San Francisco. The Redding Engineering Works Co. has purchased a carload of pig iron turned out at the Heroult electric smelter, where the output amounts to 25 tons per day with one furnace in operation.

The First National Copper Co., owner of the Balaklala mine and smelter, at Coram, produced 9,911,451 lb. of copper, 456,487 oz. silver, and 10,389 oz. gold as the result

of its 1910 operations. It cost 11c. per pound to produce copper. The company expended over $100,000 in installing equipment for the Cottrell electric precipitating system, by the operation of which it is succeeding in eliminating 90 to 95% of the solids from the furnace fume. One blast-furnace and one reverberatory are being operated. Its January output amounted to 932,452 lb. copper, 41,232 oz. silver, 822 oz. gold. The result of last year's development was a gain on the ore reserve, now estimated at 2,000,000 tons. The average assay of the ore shows 2½% copper, $1 per ton in gold and silver.

SIERRA COUNTY

The Omega auriferous gravel mine, situated between Forest and Mountain House, is bonded to a company of which W. W. Clark is president. The gravel mill is not to be operated, as it has been supplanted by an electrical machine for recovering the fine gold, the coarser gold to be saved in sluice-boxes. This machine is said to have the capacity to handle 120 cars of gravel in 24 hours. The work is in charge of W. W. Casserly. The Monte Cristo Gravel Mines Co., of Oakland, is successfully operating on a property that it took under bond from Peckwith & Spaulding. The pay channel in which work is being done is said to be 20 ft. wide. The operations are in charge of Fred I. Phelps.

TUOLUMNE COUNTY

(Special Correspondence.)—The Black Oak mill has been started on ore from the rich shoot recently uncovered at the bottom of the mine, and a carload of high-grade ore was this week sent to the Selby smelter. The orebody is said to be one of the best ever found in that mine, both in size and richness. It is reported that gravel which yields $3 per mine-car is being mined at the Water Lily, situated near Melones. Lightning struck the transformer-house at the Jumper mine on February 23, causing its complete destruction by fire. As a result, work in the mine had to be stopped until new transformers were installed, which were obtained from the Cilo mines. Preparations are being made for the erection of a 10-stamp mill at the Contention mine, in the Knight's Creek district. The lumber necessary for this and other buildings to be put up is being sawed on the property, where a small mill is in operation. A score or more men are employed. Some work is being done at the Draper mine under the direction of R. A. Nicholls, the superintendent.

Development work has been resumed at the Birthday mine, situated near Tuttletown, and owned by local people. An adit is being driven on the vein. The Badger mine, comprising several claims, and lately sold to A. L. Ellis, of Gilroy, is to be unwatered at once, preparatory to active development operations. The property is situated about four miles northwest of Jamestown.

Tuolumne, March 4.

COLORADO

CLEAR CREEK COUNTY

(Special Correspondence.)—It is reported that the deal for the purchase of the Scepter mine on Democrat mountain will be closed within the next two weeks. The price is understood to be $100,000. A streak of galena 18 in. wide has been uncovered by the Vidler tunnel in East Argentine district. Driving is to be started for the exploration of the ground. The bore has been advanced over 5000 ft. from the eastern side of the pass. There remains to be broken 1600 ft. of ground before the connection will be made.

Georgetown, March 1.

(Special Correspondence.)—A. L. Lawson, representing the McKelvey process of ore reduction, has been endeavoring to secure contracts with operators, and in the event of a stated tonnage of ore being promised, a mill will be erected. A shipment of 700 tons of ore from the Refugee mine to the Hudson mill was made last week. The Katie Emmett mine is to be equipped with a 5-stamp mill, the machinery having been purchased a few days ago in Denver. W. W. Cannady is manager. R. F. Staley has purchased the Dover mill, situated on lower Fall river. The machinery will be overhauled and the plant put in good condition. H. B. Clifford, who is operating the Gem mines, has acquired the Castleton. The shaft, down to a depth of 425 ft., is to be repaired, while a lateral will be driven from the Crown Point vein.

Idaho Springs, March 1.

GILPIN COUNTY

(Special Correspondence.)—Ore is being shipped from the Newfoundland mine to the Iron City mill. This ore is being mined on the twelfth and thirteenth levels. A. H. Rose is manager. The new mill of the Denver Reduction Co. is operating. The Clay County mine is being developed by work on the 500-ft. level west. Reese & Co., leasing on the 600-ft. level of the Saratoga mine, made a shipment of 30 tons of smelting ore last week that brought $25 per ton in gold and silver. The shaft on the Baxter mine has attained a depth of 362 ft., and stoping is in progress on the 140-ft. level; a body of mill-ore is being followed that is from 3 to 4 ft. wide. G. R. Gibson is manager.

Central City, March 1.

LAKE COUNTY (LEADVILLE)

The zinc buyers, who changed their schedule so as to effect a reduction from $11.30 to $8.80 per ton to producers of ore running 30% zinc, have receded from their position and re-established the former schedule. The attempt to reduce the price to the miner by means of an additional treatment charge resulted in a suspension of some of the larger mines. Now that the old schedule has been agreed to, the mines are all producing again. The Continental Chief mine, situated at the head of Iowa gulch, is under lease to local men, who are mining and sacking ore which will not be marketed till later in the spring, as this camp is isolated by heavy snowdrifts. This ore contains gold, as well as silver and lead. Among the Fryer hill properties which are active are the Chrysolite, Little Chief, Hayden, McRae, Amy, Dunkin, Climax, Virginius, Silver, Matchless, and Pittsburg, and the majority of these are ore-shippers. The mines on Carbonate hill, including the Waterloo, Maid of Erin, Henriette, Adams, Wolftone, and Castle View, resumed operating March 1, as the result of the adjustment of the zinc schedule between the ore buyers and the operators. This schedule related to the zinc-carbonate ores, and it is stated by the *Carbonate Chronicle*, of Leadville, that the tonnage of zinc sulphide ore being shipped out of the camp is small, and will not increase rapidly pending the building of new zinc smelters in Oklahoma.

SAN MIGUEL COUNTY

C. E. Cherrington, who is mining vanadium ore at Newmire, has entered into a contract with the General Vanadium Co. of London, whereby he undertakes to ship to Liverpool 200 tons of ore per month. The price agreed on is said to be $1 per pound for the metallic vanadium contained in the ore, or $60 per ton for ore running 3% vanadium. The deposits of this kind of ore at Newmire are extensive, and it is claimed 10 or 12 operators are engaged in mining there.

TELLER COUNTY (CRIPPLE CREEK)

The gross proceeds of the Elkton Con. M. Co. for the last 10 months of 1910 amounted to $720,944; the operating costs amounted to $450,421, the net profit being $279,876. During that period the dividends aggregated $387,500, and there was a balance in the treasury Jan. 1, 1911, of $537,988. The water-level in the Elkton mine stands at about 30 ft. above the lowest level, and this is receding at the rate of 2 ft. per week. Recently the company has been operating with but one shift of miners per day, six days per week, but it is understood that there will soon be two shifts. The shaft is to be sunk deeper as fast as is practicable. The year's achievements were accomplished under the management of E. M. DeLavergne.

SUMMIT COUNTY

The mill of the Colorado-Toledo M. Co., now nearly fin-

ished, is equipped with a No. 5 Austin gyratory crusher, automatic sampler, revolving screens, coarse rolls, jigs, hydraulic classifiers, Card tables, fine rolls, and is designed to make jig and table lead concentrates, and an iron-zinc middling. The property is at Argentine. The Colorado Gold Dredging Co., operating on Swan river, near Breckenridge, kept one dredge at work steadily during the dredging season, and another part of the time. Additional dredging ground has been acquired, and it is probable that both machines will be operated steadily during the 1911 season. The dredges handled 1,400,554 cu. yd. of gravel last season, at a cost of 4.7c. per yard. This material yielded 25 to 45c. per yard in gold. One dividend of $50,000 was paid in 1910.

IDAHO

SHOSHONE COUNTY

(Special Correspondence.) — The Federal Mining & Smelting Co. will disburse its regular quarterly dividend of $210,000, on its preferred stock, March 15, which brings the total dividends to $8,719,750. The company owns and operates three groups of mines in the Coeur d'Alene district. An important ore-zone was opened in its Morning mine at Mullan, which gives promise of becoming one of the most profitable of the company's hold-

Mountain Scene in the Coeur d'Alene.

ings. Coeur d'Alene Nellie mine, near Kellogg, operated by the Wallace Development Co., for which E. C. Melklejohn is manager, is becoming a producer of silver-lead ore, instead of being a dry-ore property. It was formerly active and has netted profits of about $100,000. The lower tunnel, in 100 ft. when the present owners took charge, has been advanced 325 ft., and at the face, 200 ft. from the surface, there was 30 in. of ore averaging 100 oz. silver and 4% copper. The pay-streak is on the hanging wall side of the vein and has been explored for several hundred feet ahead of the new workings. On the foot-wall side is said to be a body of concentrating ore that samples 3½% lead. Tam O'Shanter, near Osborne, will be further developed this season. A shaft has been sunk 50 ft. from the apex and a cross-cut at the base of it shows the vein to be 18 ft. in width. The vein has been traced 6000 ft. Two adits are being driven, each one being in about 200 feet.

Wallace, March 3.

NEVADA

ESMERALDA COUNTY

The Combination Fraction mine, at Goldfield, is under a 15-months lease to M. B. Ashton and associates, who are required to sink 150 ft. deeper the 750-ft. shaft. The work is to be in charge of A. E. Camphell. The Florence-Goldfield M. Co. has declared a dividend of 10c. per share, amounting to $105,000, payable April 2. The Centennial mine, 3 miles from Lida, an active and profitable silver mine 20 years ago, has been purchased by San Francisco investors at $10,000. The new owners, who had previously spent considerable money in exploring and developing, expect to operate the mine this season.

HUMBOLDT COUNTY

W. G. Adamson and John R. Turner, who recently discovered high-grade gold ore in a 50-ft. dike, 5 miles from Winnemucca, are reported as having shipped 10 tons of their richest ore to Salt Lake by express.

LANDER COUNTY

The Austin-Manhattan M. Co., made up of Chicago men, a few years ago acquired mining property on Lander, Union, and Central hills, at Austin. These were operated at a profit in early mining days, and contained such veins as the Panamint, Union, and Patriot. Within the last two years the old drainage level has been cleaned out and retimbered for a distance of over 6000 ft., at a cost of $100,000; and the main cross-cut driven from this drainage level was cleaned out for a distance of 1300 ft. The Frost shaft has been cleaned out and retimbered from the collar to the tunnel-level, a depth of 700 ft., and has been sunk 250 ft. below that level as a 3-compartment shaft. A station was cut where this shaft and tunnel intersect, and here a counter-balance hoist was installed to operate skips in the lower section of the shaft. The Ophir shaft, which has been retimbered to a depth of 200 ft., is to become the main working shaft for the Union vein system. The Jack-Pot group, adjoining the main properties, has been purchased and its gold-bearing veins developed to a depth of 400 ft. In the meantime a concentrating-plant, designed by the Huff Electrostatic Separator Co., has been built and set in operation. Crude ore shipped to the smelter has sampled $126 per ton, and the concentrate shipped recently assayed $134 per ton. This work has been performed under the management of W. W. Wishon.

MINERAL COUNTY

The Douglass group of claims, situated in Gold range, near Mina, is to be developed by a 1000-ft. shaft, which is being sunk. This property is owned by Pennsylvania men, with whom C. D. Van Duser of Nevada is associated. The Douglass has been equipped with a 5-stamp mill for use in prospecting, developing, and proving the property as to its merits. G. B. Hyde, having a lease on one of the Van Duser properties, is preparing to erect a mill.

NYE COUNTY

The Tonopah Belmont Development Co., operator of the Belmont mine and mill, for the month of January sent 6839 tons of ore to the mill, marketed 2053 tons at the smelters; the gross production from both classes of ore was 3860.3 oz. gold, 386,409 oz. silver, of the gross value of $288,902.92. The net profit for the month was $159,511.39. The average value of metal extracted was about $32 per ton.

The Big Four Leasing Co., operating the Big Four mine and mill at Manhattan, recently made a mill-run of 1150 tons of ore, the clean-up as a result amounting to $50,000. The treated ore was taken from the 220-ft. level. The gross output of the last year was $150,000.

The coroner's jury, which enquired into the facts relating to the Belmont mine fire at Tonopah, and the manner in which 17 men met death, rendered the following verdict: "We believe from the evidence adduced that the management and bosses showed lack of knowledge and experience in such emergencies, and also inability to foresee and realize that serious danger might arise from such a fire."

STOREY COUNTY

The Ophir, Con. Virginia, and Mexican mines, the largest three north-end producers of Virginia City, yielded ore of the aggregate value of $22,715 for the week ended March 4. Of this, the Ophir production amounted to $12,126. There were 319 cars of ore, averaging $30.67, taken from the 2100-ft. level; 85 cars, averaging $17.43, came from the west cross-cut No. 2, same level; 57 cars, assaying $15.09, was mined on northeast stope, 2300-ft. level. Average per ton of all lots of Ophir ore was $26.30.

The Con. Virginia mined 283 cars on the 1800-ft. level, assaying $10.20 per ton, making an output of $2888.60. The Mexican mine produced 122 mine-cars of ore, assaying $63 per ton, yielding $7700. This ore was mined from the stopes and raises just above the 2500-ft. level, where

Con. Virginia Shaft.

the orebody is about 12 ft. wide. Driving is being done to open this ore-shoot on levels above the 2500-ft. The Yellow Jacket mill, having resumed operations on Feb. 28, crushed 279 tons of ore from the Crown Point mine, and 94 tons from the Belcher.

OREGON

GRANT COUNTY

The Red Boy mine and mill were active properties ten years ago. They are situated 4 miles from Granite and 18 miles from Sumpter. The mine, which was a gold producer, is well equipped and considerably developed to a depth of 400 ft.; the mill is equipped for concentration and cyanidation and was operated several years with considerable success. Most of the success was attained during the ownership of Clark Taber and E. J. Godfrey. The vein system, having a north-south strike, is cut off by a dike, and only recently was a vein opened on the south side of this dike. The ore found in this vein is said to be of high grade. If orebodies to be found south of the dike prove as rich as were those worked out on the north side, the Red Boy will have another period of productiveness.

UTAH

SUMMIT COUNTY

The orebody recently discovered in the New York Bonanza mine, at Park City, consists of an 18-in. streak of clean ore that assays $40 per ton. Some shipments have been made to the smelter. M. J. McGill is in charge, and the property is in the hands of Park City people, mostly.

Henry M. Crowther and associates, who have operated the Ontario mine during the last two years on short-term leases, have organized The Crowthers Company, to which this property has been leased for a period of 10 years. During the last two years these lessees made 160 shipments of 1 to 4-car lots of ore, considered average high-grade stuff for Park City district. But it is estimated that the Ontario workings contain 1,000,000 tons of second-grade ore, which accumulated during the years when the mine produced such high-grade ore, and it is found in old stopes and other places as filling. As a test of its value, several thousand tons have been shipped to the smelter, and the result is considered such as to justify the handling of it on a large scale. It is said 80% of this ore is found above the main tunnel, and can be extracted without hoisting. The content of the ore is principally silver, which is accompanied by gold in small value, and about 2% lead. The new company intends to modernize the old mill, and establish a system of electric-haulage in the mine where there are 60 miles of trackage. One feature of the mill-work is to be the cyanidation of the ore after the lead has been eliminated by concentration.

TOOELE COUNTY

The Utah Metals & Mining Co. is driving a tunnel from Middle canyon, on the Tooele side of the Oquirrh range, to Bingham canyon, on the opposite side. The size of the bore is 8 by 10 ft. cross-section, designed to give room for a double track. The heading has advanced about 5000 ft., and the cutting of profitable ore-bearing veins is anticipated. One object of this enterprise is to make an avenue for transportation between Bingham mines and the International smelter near Tooele.

CANADA

BRITISH COLUMBIA

(Special Correspondence.)—A recent statement of the B. C. Copper Co. shows that the profit on its operations amounted to $256,561.58 for the fiscal year ended Nov. 30, 1910. During the period named the metallic production was: copper, 7,143,456 lb.; silver, 84,180 oz.; gold, 24,962 oz. The company treated at its smelter at Greenwood 441,672 tons of ore, which yielded 18 lb. copper and $1.23 gold per ton. Most of this ore was from its own mines. The total mining costs per ton amounted to $2.73. The cost per pound of making copper, including cost of mining, smelting, and marketing, was 9.048c. The new Granby management announces present costs, not including marketing and refining the blister-copper, at approximately $2.39 per ton of ore. The cost of making and marketing copper is close to 10c. per pound. This figure compares favorably with the previous five years. This company is now producing copper at the rate of 20,000,000 lb. per annum, and this output may be increased.

Phoenix, February 25.

(Special Correspondence.)—The Steele interests in Vancouver have disposed of several rich mineral claims on Hudson Bay mountain, Hazelton district, for $300,000. English capitalists secured the properties, which have a rich showing of galena ore. The International Mining Co. of Portland Canal is to drive a permanent working tunnel. A contract has been let for 50 ft. of driving on the vein. Last week the Portland Canal Mining Co. opened high-grade ore in No. 3 adit. The vein is 5½ ft. wide, and 150 ft. of backs is available for stoping. This ore assays $12 gold and $4 silver per ton. Preparations are being made to ship some of its concentrate, and the capacity of the mill is to be increased. It is now 75 tons per day. A vein of galena ore, 18 in. wide, was opened in the Stewart mine recently. Ore found in No. 4 tunnel will assay $50 per ton. The directors of the Red Cliff Mining Co. have let a contract to F. Darling & Co., Vancouver, for the installation of a water-power plant for operating the air-compressor and generator. This will consist of 36 and 15-in. impulse water-wheels and a pipe-line. Three veins have been opened on the Main Reef group—one for over 400 ft., the ore therein assaying $50 per ton in gold, silver, and lead. The company has a lot of good ore sacked awaiting the completion of the Portland Canal railway. A crew of 23 is employed on the Ben Bolt property, of the D. D. Mann interests.

Vancouver, February 23.

(Special Correspondence.)—W. E. Zwicky, manager of the Rambler-Cariboo mine, near Kaslo, has recommended that the mill be moved from its present location to a point below the mouth of the main cross-cut tunnel on the 1400-ft. level. This would involve the construction of a tramway from the main tunnel to the mill. He believes recent developments on the various levels justify improved equipment. The showing on the 1050-ft. level, for more than 60 ft., averages 5 ft. of clean ore that runs 250 oz. silver and 70% lead.

Kaslo, March 2.

MEXICO

CHIHUAHUA

(Special Correspondence.)—The Republica M. Co. mined and milled 1067 tons of ore in January, producing metals valued at ₱72,262.80. Operating expenses and development costs amounted to ₱50,858.27; construction expenditures were ₱5735.63. Working is severely handicapped, and costs increased by the exigencies of the political situation.

Ocampo, March 1.

Personal

Professional men are invited to send news of their engagements and travels. Such news is interesting to friends.

M. L. REQUA is in New York.

J. H. MACKENZIE is leaving for Nicaragua.

F. OSKAR MARTIN was at Goldfield last week.

J. PARKE CHANNING was at Miami last week.

FREDERICK P. BURRALL was in San Francisco.

C. B. LAKENAN was in San Francisco March 4.

W. A. PRICHARD is now at Santa Cruz de Alaya, Sinaloa.

A. G. BLAKE is in Jalisco, Mexico, for a couple of months.

GEORGE E. FARISH passed through San Francisco this week.

FRED L. LOWELL is engineer at the Adargas mine, Jimenez, Mexico.

STEPHEN A. IONIDES, of Denver, has been in Redding, California.

J. E. SPURR was in Santa Eulalia district, Chihuahua, in February.

ROSS B. HOFFMANN leaves next week for London and St. Petersburg.

H. ABBOT TITCOMB has returned to London from Newton, Massachusetts.

JAMES KIRK is assistant manager for the Greene-Cananea Copper Company.

POPE YEATMAN has been at the mines of the Braden Copper Co., in Chile.

CHARLES E. BROWN, of Seward, Alaska, is at the Palace hotel, San Francisco.

ALEXANDER LEGGAT, of Butte, Montana, is temporarily in Yuma county, Arizona.

FERGUS L. ALLEN is general manager for the Mexican Mines of El Oro, Mexico.

H. C. WILMOT was in San Francisco last week, on his way to Rye Valley, Oregon.

W. B. and J. H. DEVEREUX, of New York, were in the Hostotipaquillo district, Jalisco, Mexico, last month.

H. F. REID is to deliver the Hitchcock lectures at the University of California this spring, probably in the latter part of March.

A. ROY HEISE has charge of the new Avila refinery for the Union Oil Company of California, at Avila, San Luis Obispo county, California.

OSCAR LACHMUND, formerly at Denver and Salt Lake, is general manager for Cia. Minera de Durazno-Tetamoa, at Alamos, Sonora, Mexico.

CECIL POCOCK, formerly with the Montezuma Mines of Costa Rica, has been appointed chief engineer for the Cerro de Pasco Mining Co., at Cerro de Pasco, Peru.

W. H. ALDRIDGE has opened an office at 603 Central building, Los Angeles, in connection with the Gunn-Thompson properties, comprising the Inspiration, Mason Valley, and Magma, and the Gunn-Quealy Coal Company.

COPPER PRODUCERS' ASSOCIATION REPORT

Stocks of copper on hand in the United States on March 1 showed on increase of 14,198,280 lb. over February 1. The increase in stocks was despite a decrease in the production for the month of February of more than 3,800,000 lb. Domestic deliveries for February exceeded those of the previous month by over 8,000,000 lb., but foreign demand fell off almost as much. Total deliveries for February aggregated 95,630,000 lb., a nominal increase over January. The detailed statement follows: Stocks of marketable copper of all kinds on hand at all points in the United States, February 1, 142,439,490 lb.; production of marketable copper in the United States from all domestic and foreign sources during February, 109,828,297; deliveries of marketable copper during February for domestic consumption, 50,518,998, and for export, 45,111,019, a total of 95,630,017; stock of marketable copper of all kinds on hand in the United States March 1 were 156,657,777 pounds.

Market Reports

LOCAL METAL PRICES.

San Francisco, March 9.

Antimony	12—12¾c	Quicksilver (flask)	$52½
Electrolytic Copper	14½—15¾c	Tin	45—46¼c
Pig Lead	4.75—5.70c	Spelter	7—7¾c

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

METAL PRICES.

By wire from New York.
Average daily prices in cents per pound.

Date.	Electrolytic Copper.	Lead.	Spelter.	Silver, per oz.
Mar. 2	12.20	4.39	5.65	53
" 3	12.20	4.39	5.65	52¾
" 4	12.20	4.39	5.64	52¾
" 5	Sunday.	No market.		
" 6	12.18	4.39	5.64	52⅝
" 7	12.18	4.39	5.63	52⅝
" 8	12.18	4.39	5.63	52⅞

ANGLO-AMERICAN SHARES.

Cabled from London.

	Mar. 1. £ s. d.	Mar. 9. £ s. d.
Camp Bird	1 12 6	1 13 0
El Oro	1 5 0	1 5 0
Esperanza	1 14 1½	1 13 9
Dolores	1 5 0	1 5 0
Oroville Dredging	0 7 0	0 7 0
Mexico Mines	7 3 9	7 7 6
Tomboy	0 15 0	0 15 6

(By courtesy of W. P. Bonbright & Co., 24 Broad St., N. Y.)

COPPER SHARES—BOSTON.

	Closing prices, Mar. 9.		Closing prices, Mar. 9.
Adventure	$ 5⅛	Mohawk	$ 43
Allouez	34	North Butte	28
Atlantic	4	Old Dominion	38½
Calumet & Arizona	51	Osceola	111
Calumet & Hecla	502	Parrot	12
Centennial	12¼	Santa Fe	1⅛
Copper Range	65¼	Shannon	10⅞
Daly West	3¾	Superior & Pittsburg	14⅞
Franklin	9¼	Tamarack	41
Granby	33	Trinity	4
Greene Cananea, ctf	5¼	Utah Con	13
Isle-Royale	12¾	Victoria	1⅛
La Salle	4⅛	Winona	7
Mass Copper	6½	Wolverine	117

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

MINING STOCK QUOTATIONS—NEW YORK.

(By wire from Catlin & Powell Co., New York.)

	Closing prices, Mar. 9.		Closing prices, Mar. 9.
Amalgamated Copper	$ 61⅞	Miami Copper	$ 19⅛
Arizona-Cananea	3	Mines Co. of America	5
A. S. & R. Co.	74⅛	Montgomery-Shoshone	1/16
Braden Copper	3⅞	Nevada Con	18½
B. C. Copper Co.	5⅞	Nevada Utah	⅞
Butte Coalition	17⅝	Nipissing	10⅞
Chino	21⅜	Ohio Copper	1⅝
Davis Daly	1½	Ray Central	1⅝
Dolores	5½	Ray Con	17⅛
First National	2	South Utah	1
Giroux	6	Superior & Pittsburg	14¾
Greene-Cananea	5¾	Tenn. Copper	37⅛
Guanajuato Con	½	Trinity	4⅝
Inspiration	7¾	Tuolumne Copper	4¾
Kerr Lake	6⅜	United Copper	3⅞
La Rose	4⅝	Utah Copper	43⅞
Mason Valley	9⅛	Yukon Gold	3⅞

SOUTHERN NEVADA STOCKS.

San Francisco, March 9.

Atlanta	$ 14	Mayflower	$ 5
Belmont	6.10	Midway	11
Booth	8	Montana Tonopah	88
Columbia Mtn	2	Nevada Hills	2 85
Combination Fraction	10	Pittsburg Silver Peak	75
Fairview Eagle	45	Rawhide Coalition	3
Florence	2.10	Round Mountain	41
Goldfield Con	6.90	Sandstorm Kendall	10
Gold Kewenas	6	Silver Pick	5
Great Bend	1	St. Ives	16
Jim Butler	26	Tonopah Extension	1.22
Jumbo Extension	38	Tonopah of Nevada	8.25
MacNamara	14	West End	53

(By courtesy of San Francisco Stock Exchange.)

Decisions Relating to Mining

Specially reported for the MINING AND SCIENTIFIC PRESS.

SALE OR OPTION CONTRACT OF MINE

A contract recited that one, Reed, was the owner of a mine, and that one, Hickey, and his associates, desired an option to purchase it for an agreed price of $36,000, with a 60-day privilege in which to prospect by sinking a shaft at a certain point; that Reed agreed to sell and convey the mine to the other parties at any time within 60 days on the following payments and conditions: a payment of $10,000 on or before 60 days after date, and other payments to make up the price within the year following. The contract provided that all pay-gravel taken out by the purchasers during the 60-day option should belong to Reed, as well as all improvements placed on the premises during the 60 days for prospecting, on failure of the purchasers to make the first payment. The contract also provided that on payment of the first installment within 60 days, Reed would execute and deposit a deed in escrow to be delivered on payment of the balance of the purchase money, but to be returned to him on failure to make any of the payments, or violation of the conditions of the agreement; that on receipt of the first payment Reed would turn over to the purchasers the property and all apparatus owned and used by him in working the mine and the purchasers should then have the right of operating the mine for their own benefit. It also provided that a default in payment of an installment at the stated time, or a default in other matters stipulated to be done by the purchaser, should at once abrogate the agreement and the seller should re-enter and take possession of the mine and all improvements made or placed thereon, and all payments made should be forfeited to Reed as liquidated damages for the use and occupation of the property. In an action by Reed to recover the unpaid installments of the contract price, the purchasers contended that the contract was no more than a continuing option which was renewed as each payment was made and continued until the next payment. But in considering the contract, the court said in substance, that by its terms the option was limited to 60 days, during which time the vendees had the right only to prospect the mine at a particular point, but any gold taken out belonged to the vendors; but when the vendees became satisfied, they preferred to work the mine for profit rather than be confined to prospecting, and accordingly changed their attitude as prospectors and became operators and workers of the mine; they ceased prospecting at the point designated and announced their intention to purchase and paid their first installment a month before it was due, after requiring the vendor to cease mining and to surrender full possession to them with the privilege of retaining all the gold mined by them, which is shown to be $20,000 up to the time the second payment became due. It is unreasonable, the court suggests, to suppose that the vendor intended to permit them to appropriate all the gold they might mine and yet not be required to make the payment agreed upon. Under a supplementary agreement, which was shown to have been made and pursuant to the delivery of the deed in escrow, the vendees, under their construction of the contract, could have decided on September 28 not to take the mine, and could have retained the $20,000 taken out without making a second payment. But the contract does not warrant such a construction. The supplementary agreement refers to the payment as to be made upon the 'purchase price,' and provides that if the vendors fail to remove the encumbrances by a stated time the vendees need not pay the second installment, or any future installments of the purchase price until the property is clear of all encumbrances. This raises a strong implication that the vendees, on the construction of the contract by the parties themselves, were obligated to pay the installments as they become due if the title was made clear, and they so acted when the second installment fell due. Before 60 days expired it appears that the vendees availed themselves of the right to purchase, and not merely as optionees with a continuing right to buy, or not to buy, as they might elect. The court accordingly held that the contract was not a continuing option renewed as each payment was made, and continuing until the next payment, but on the first payment being made the option agreement became an absolute contract of sale.

Reed *v.* Hickey, (Cal.) 109 Pac. 38. April 1910.

Book Reviews

Any of the books noticed in this column are for sale by, or can be procured from, the MINING AND SCIENTIFIC PRESS.

AMERICAN CIVIL ENGINEER'S POCKET BOOK. 4½ by 7 in. Pp. 1380. Ill. Flexible back. John Wiley & Sons, New York, 1911. For sale by *Mining and Scientific Press.* Price $5.

This pocket book has been built to order according to the very careful specifications of Mansfield Merriam. In the work he has had the assistance of a dozen of the best civil engineers in America and the result is a book of unusual excellence and usefulness. The contents include: Mathematical Tables, by Mansfield Merriam; Surveying, Geodesy, and Railroad Location, by Charles B. Breed; Roads and Railroads, by W. L. Webb; Materials of Construction, by Rudolph P. Miller; Plain and Reinforced Concrete, by F. E. Turneaure; Masonry, Foundations, Earthwork, by I. O. Baker; Masonry and Timber Structures, by W. J. Douglas; Steel Structures, by F. P. McKibben; Hydraulics, Pumping, Water-Power, by G. S. Williams; Water-Supply, Sewerage, Irrigation, by Allen Hazen; Dams, Aqueducts, Canals, Shafts, and Tunnels, by Alfred Noble and S. H. Woodward; Mathematics and Mechanics, by E. R. Maurer; Physics, Meteorology, Weights and Measures, by L. A. Fischer.

THE MINING MANUAL, 1911. By Walter R. Skinner. 8 vo. Pp. 1372. Maps, index. London, 1911. For sale in the United States by the *Mining and Scientific Press.* Copies may be seen at 29 Broadway, New York, and 667 Howard street, San Francisco. Price $5.25.

The promptness with which this indispensable handbook is issued this year is especially commendable. This promptness has been secured by thorough preparation rather than by sacrifice of pertinent data. Indeed, the Manual, which in the quarter of a century since the first edition was issued has grown mightily, now includes details regarding 5300 companies. British mining operations are world wide, and while therefore only English companies are discussed, there is valuable information regarding gold and silver mining in every country. In no other place can the same data regarding companies and mines be found. All firms attempting to do business abroad, and all engineers interested in gold mining will find the book extremely valuable.

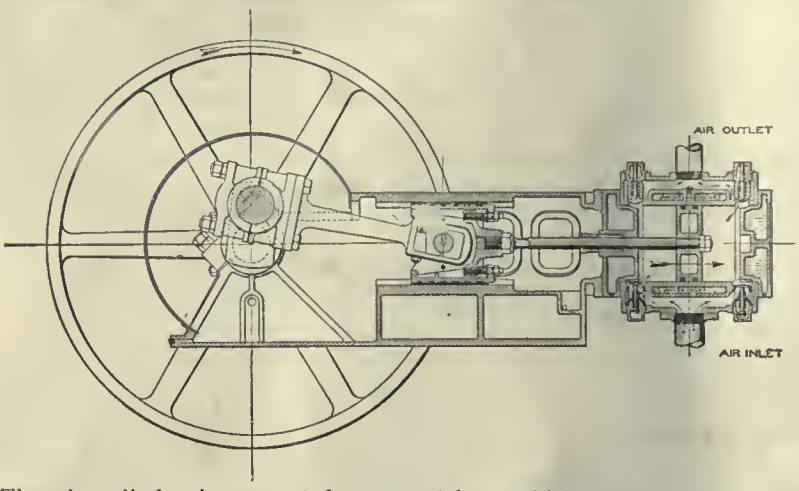
PRACTICAL MINERALOGY SIMPLIFIED. By J. P. Rowe. 5 by 7¼ in. Pp. 162. John Wiley, New York, 1911. For sale by *Mining and Scientific Press.* Price $1.25.

This book has been written in simple language and is designed for the use of miners and prospectors rather than trained mineralogists. It is an excellent and useful publication despite certain minor errors, such as the statement that blende is extensively mined in Pennsylvania, which is no longer true, and the omission of New Mexico and inclusion of Missouri in listing States in which smithsonite is most abundant. For the main purpose, however, that of assisting in the prompt recognition of the common minerals, the book is well designed and well executed.

WEST VIRGINIA GEOLOGICAL SURVEY, BULLETIN II. I. C. White, State Geologist. Pp. 385. Tables and index. Morgantown, 1910. Part I of this bulletin is a general table of elevations in West Virginia. Part II is a complete table of analyses of the coals of West Virginia, taken in order from the oldest to the youngest, including some new determinations. It is accompanied by a map of Wood, Ritchie, and Pleasants counties, showing the oil and gasfields.

SMALL AIR-COMPRESSORS FOR HEAVY DUTY

The accompanying illustration shows a new single-stage steam and power-driven Sullivan air-compressor, recently placed upon the market. The new compressors have been designed especially for mining work. Air-power service demands above all else, continuous and reliable performance. Troubles with the compressor mean idle tools and idle men, causing waste which soon evens up the difference in the purchase price between a good air-compressor and a poor one. The air-compressors here described are of small to moderate capacity and are built for various pressures running from 10 to 100 lb. per square inch. These compressors consist of a heavy substantial frame, supporting the bearings and crank-shaft at one end and the steam and air cylinders at the other. The machines are of the centre-crank type and a heavy steel guard surrounds the crank and prevents oil from being thrown upon the floor. In the steam-driven machines, the plain steam slide valve is controlled by an eccentric on the shaft, with which it is connected by a simple but satisfactory arrangement of valve rods. The air cylinder is placed outside the steam cylinder, and is connected to it by a heavy distance piece.



The air cylinder is supported on a sub-base which runs the entire length of the compressor, and maintains proper alignment of all the parts. In the belt-driven machines, the air cylinder is attached directly to the rear end of the frame, and all the working parts, such as the crank-shaft, cross-head, connecting rods, and main bearings are of dimensions and contain an amount and quality of material which provide a factor of safety much higher than is considered necessary in standard compressors of much larger size. All parts liable to wear are arranged so that wear may be taken up fully and with the least possible trouble, so that even after these machines have been in service for years, all their working parts remain accurately aligned and in condition to operate with practically their original efficiency. Particular attention is directed by the builders to the design of the air cylinder; it is cored to form water jackets, and the cylinder heads are also jacketed over their whole surface. This feature keeps the heat generated by compression within safe limits. The air-valve mechanism consists of radial automatic poppet valves for both inlet and discharge. These valves are placed close to the ends of the cylinder, the inlet valves being at the bottom and the discharge valves at the top of the cylinder. These valves act in a true radial direction to the axis of the cylinder, and reduce to the lowest terms the losses in efficiency made necessary by clearance. The ports or pockets leading to the valves are short and direct so that practically no air is trapped after compression. The valves and their parts are so made that in case of breakage it is impossible for the broken pieces to enter the bore of the cylinder. The valves are held in place in cages, which seat, by means of taper fits, in the cylinder walls. To remove these valves it is only necessary to unscrew the plug on the outside of the cylinder, when the entire valve and cage may be withdrawn for inspection or re-grinding. The main bearings have adjustable caps and are heavily lined with a good grade of babbitt metal. They are bored out at right angles to the centre line of the piston rod by a special fixture which assures accurate alignment. A box pattern cross-head is used, being the same type as that employed in cross-compound machines of the highest grade. It is fitted with adjustable shoes and is regarded as unexcelled in wearing qualities and ease of adjustment. The steam machines are governed by a split-ball throttling regulator with an extra cylinder which places the throttle valve under the influence of the air-receiver pressure. The power-driven machines are fitted, when desired, with an unloading device placed on the air inlet of the compressor. This device is set to shut off the incoming air to the compressor when the receiver pressure exceeds a pre-determined point.

SULPHURIC ACID HANDLED BY COMPRESSED AIR

In the manufacture of certain chemicals considerable danger and expense is caused by the rapid deterioration of piping and other receptacles with which the acids and fumes come in contact. Sulphuric acid is particularly destructive, and many serious difficulties are encountered in its manufacture. It is practically impossible to handle sulphuric acid with pumps, as they would deteriorate so rapidly that constant replacement would be necessary. A satisfactory method of pumping destructive acids is that used at the Nichol Syndicate's new plant at Bay Point, California. At one stage of the process of manufacture, the acid is accumulated in a cylindrical tank which is provided with suitable inlet and outlet valves. When it is desired to pump the acid into other retainers, the inlet valve is closed and air at from 60 to 100 lb. is admitted, which forces the liquid through the outlet valve to other parts of the plant. The flow of the acid is controlled by suitable valves in the piping system. To meet the increasing demand for apparatus that will handle destructive acids economically, the United Iron Works of Oakland, California, has built a motor-driven compressor unit. The compressor is a 6 by 6 Gardner-Rix Duplex; speed 200 r.p.m., pressure 60 to 100 lb., capacity 40 cu. ft. of air per minute. The compressor is driven by a Westinghouse type HF 3-phase, 60-cycle, 550-volt motor rated at 10 hp., 860 r.p.m. This type of motor is admirably suited to this work. The secondary is phase wound and the three phases are connected to the three collector rings shown. In starting, the controller gradually cuts out the starting resistance which is connected to the secondary through the collector rings. This motor is so designed that an unusually high starting torque is developed, with comparatively low starting current.

CATALOGUES RECEIVED

T. C. Eoleston, Denver, Colo. 'Maginnis Galvanized Steel Flume.' Illustrated. 32 pages. 9½ by 6½ inches.

Universal Smelting & Refining Co., Denver, Colorado. Bulletin No. 2, 'The Partridge Hot Blast Smelting Furnaces.' Illustrated. 16 pages. 6 by 9 inches.

Joshua Hendy Iron Works, San Francisco, California. Bulletin No. 122, 'Hydraulic Giants.' A particularly handsome catalogue, illustrated in colors, showing the giants manufactured by this pioneer firm. Illustrated. 24 pages and cover. 7 by 10 inches.

Fort Wayne Electric Works. Fort Wayne, Indiana. Bulletin No. 1120 (Fourth Edition), 'Type A Electric Rock Drill.' Issued by the Rock Drill Department, Madison, Wisconsin. Illustrated. 8 pages. 8 by 10½ in. Bulletin No. 1122, 'Small Motors and Their Applications.' Illustrated. 12 pages. 8 by 10½ inches.

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TABLE OF CONTENTS

EDITORIAL

INJUNCTION against the further operation of the Washoe smelter has been denied in the F. J. Bliss case, by the United States Circuit Court of Appeals, which thereby sustained the lower court.

ELECTRIC SMELTING of copper ores is one of the possibilities in California, where the process is already applied to iron-making at Heroult in Shasta county. An experimental plant for copper smelting is being built at Delamar.

VOTES of shareholders in the various companies proposed to be consolidated with the Calumet & Hecla Company indicate that, except among Osceola stockholders, the move has the endorsement of 70 to 90 per cent of those concerned.

THE Cia. Metalúrgica y Refinadora del Pacífic, S. A., has shipped from Guaymas to the Mountain Copper Company's smelter, near San Francisco, about 5000 tons of its excess silicious ores, and at the same time is a purchaser of basic constituents. So the international chemical balance is maintained. This is the largest ore shipment ever made from a Mexican Pacific port.

THE second annual edition of 'The Mogollon Mines' contains well written and well illustrated accounts of the principal mines in the southwestern part of Socorro county, New Mexico. This interesting region, in which gold and silver were discovered in 1876, has lately attracted renewed attention. A new road from Silver City, completed with funds furnished by the Forest Service, materially shortens the distance and increases the accessibility of the district.

CALIFORNIA corporations have been asked to make complete returns to the State Board of Equalization, and a tax on the 'franchise' of each corporation impends. This is an unforseen result of the Constitutional amendment adopted last fall, and while the tax will doubtless be small, it has disturbing possibilities of growth. Mining corporations that have not yet reached a productive basis are in a particularly vulnerable position and the new rule may force a number to disincorporate; a step already taken by a number of small mercantile companies. This would hamper development, though there would be some compensation if it brought about a revival of the old system of prospecting partnerships. Much work would be stopped, but if each investor had to accept a partner's liability he would pay closer attention to the business.

IMPORTANT changes in treatment of Butte ore at Anaconda and Great Falls, Montana, are now reported to be under consideration. The concentration methods employed at the mills of the Utah Copper Company have recently been studied by engineers and officials of the Anaconda company, and it is said that attempts will be made to increase capacity by introducing roughing-tables and other features of the Utah practice.

COPPER in Russia is attracting attention now, and American engineers are prominent in developing the deposits. We recently printed a brief note from Mr. S. H. Ball, who lately examined the Kyshtim deposits. Mr. R. Gilman Brown is in charge of these important mines, and Mr. H. W. Turner is now on the ground. Mr. W. G. Perkins has returned to London, having started the new smelter, which is reported to be doing satisfactory work with 1¼ per cent coke on the charge, which is excellent, though not the record for pyrite smelting.

THE UNITED STATES SUPREME COURT has, by unanimous decision, upheld the corporation tax provision of the tariff act. This renders a corporation subject to a one per cent tax upon its net income. It had been contended that such an impost was a direct tax, which is forbidden in the Constitution. The Court maintained that it is an excise upon the privilege of carrying on business under corporate rights and exemptions and, as such, entirely constitutional. When the National Government begins to examine the accounts of corporations to determine their net incomes, some interesting disclosures should result.

A FRIEND, not in the engineering profession, who has just returned from a long journey, writes us this pleasant assurance that a good opinion of the mining profession is not confined to its own ranks. "Coming from a country where in some professions, at least, the words 'professional courtesy' have not become trite from excessive use, it was delightful to see the sincere regard which mining men everywhere have for each other's interests. Self-interest and convenience seemed of no account if it was possible to aid a fellow mining engineer, while time, such a valuable commodity to the business man, was so courteously ignored. It made one believe that men in the mining professions are, as you remarked in a recent editorial paragraph, indeed 'bred in the deep purple'."

RECENT events in the Far East are not surprising, since they develop so naturally out of the Russo-Japanese *entente cordiale*. Trial and compromise is a recognized method in philosophy. Russia and Japan once met in a trial of strength to determine which should dominate the northern portion of the Chinese Empire, but now have philosophically agreed to compromise and divide it between them, if possible. Act I was the occupation and annexation of Korea, the building of military railroads in Manchuria in the face of Chinese protests, and the veiled and gradual attempts at usurpation of governmental functions in Manchuria. Act II is the movement of troops to the Mongolian border to enforce the demand for special privilege in that territory. What will be the third act in this Far Eastern drama? Has the most powerful nation on the Pacific no interests that are involved in the significant political events that have succeeded one another with such astonishing rapidity on its farther shore? The time for action is before it is too late.

The Mexican Situation

Concentration of a large force of American troops along the Mexican border has given rise to many rumors and much uneasiness, both north and south of the line. That the situation in the southern Republic is serious has been known for some time to mining men, as well as others who have kept in touch. Democracy has felt the pains of growth. The great progress that Mexico has made in the last half century has been a matter of pride to all familiar with the country and its people. The change from the old Mexico to the new has been fundamental and comprehensive. It has involved legal and social institutions as important as the more generally recognized industrial and commercial changes. That [illegible] has been accomplished with so little friction speaks volumes for the people as well as the leaders. Complete evolution, however, is never accomplished without pain; and from the Mexico of great *haciendas*, a feudal community of home industries, to the Mexico of tomorrow, an industrial democracy, is a complete cycle of evolution. The marvel is that so much has been accomplished so quietly. We have frequently expressed our high opinion of the one man to whom more than any other, this accomplishment has been due—Porfiro Diaz, president of the Republic of Mexico. We yield to none in our appreciation of his great service to his country and to the world; but there comes to each man a time when his particular work is accomplished, when another can take up the burden to the betterment of the result. Many have expressed the belief that that time has come to Porfiro Diaz. Had he on the celebration of the centenary of the Republic laid down his public burden, a grateful country would always have acclaimed him as he deserves. The moment, however, passed, and a revolution started November 20. The fighting since that date has been inconsequential; the movement is even yet thoroughly serious only in its potentialities. The Mexican Government, lulled into security by years of peace, had reduced the military establishment to a relatively small army. The sudden appearance of bands of *insurrectos* at many points has created a situation that is temporarily, at least, beyond the power of the Mexican officials to control. It must not be forgotten that one small but active band of men may keep a large force exceedingly busy, as was abundantly shown in the campaigns between the Cubans and the Spaniards. A few Apache Indians disturbed the whole Southwest for years, despite the presence of a much larger number of United States soldiers throughout the region. In Mexico the warfare has been so far of the guerrilla type. To the

mining industry the principal damage has been that incidental to the breaking up of ordinary lines of communication and transportation. In Chihuahua the situation in this particular has been undeniably bad for weeks. The Mexican Northwestern has been practically put out of service and it is not surprising that the Canadians are said to have made strong representations as to the need of protection for their properties. Foreign interests in Mexico, especially in mines and railways, are large. It is natural that security holders in the United States and abroad have become restless as the weeks have passed and neither the Federal forces nor the *insurrectos* seemed to be making permanent headway. Everyone, Americans most of all, concedes the right of Mexicans to determine their own form of government and to do it as they may see fit. We have a deep-rooted prejudice in favor of the established government; a feeling that rests on its long record for fairness and ability. If, however, the Mexican people want to change by revolution or otherwise, that is their business, not ours. The United States, it happens, has been made a vantage-ground from which a certain type of trouble-maker has operated in fomenting the [illegible]. There has been serious danger more than [illegible] during the last year, of 'Jamison raids' and a project to establish an independent State in Lower California and to apply for admission to the United States, have been freely discussed at Los Angeles. The international border-line forms an ideal place for filibusters and guerrillas, since the Rio Grande can be crossed with ease at almost any point, and, once crossed, the bandits are safe from immediate pursuit; as useful a privilege as the ancient right of sanctuary to the robber knight. To furnish such an asset to the enemies of the Mexican Republic is scarcely the act of a friend. Instead a cordon of troops along the frontier [illegible] at once aid and an earnest of good-will. That there are political questions of a serious nature demanding public attention in Mexico, no one would attempt to deny. Few nations are fortunate enough to have completely solved their great national problems in this century of rapid change and growth. But such problems call for the attention of the serious-minded; sansculottism can produce no other result than political chaos.

It is not to be denied that the force that has been sent South is larger than would be needed if guarding the border only was in view, and therein lies the ground for surmise. There can be little doubt that, whatever the cause, the General Staff has welcomed the occasion for undertaking the maneuver. In view of the frequent criticism of the American Army and the bad record made by the transport and commissary department in the Spanish War, it is not surprising that the general officers are delighted at a chance to show off. The new organization, for which Mr. Elihu Root is mainly to be thanked, has worked with a quiet efficiency that begets great confidence. Troop-ships out of commission in Norfolk harbor on Tuesday sailed, newly painted, fully provisioned, and loaded with soldiers, on Thursday, and other achievements of like order were in evidence plentifully. There are doubtless those in Washington who have taken pains to see that these items were duly reported to representatives of foreign governments supposed to be interested. In the main, we believe the movement has been a somewhat theatrical trying-out of a new organization; akin to the practice run of a new fire engine in a country village.

The international political credit of the United States is fundamentally involved in the maintenance of law and order within the Mexican border. The principle that European nations must not acquire territory in Latin-America carries with it as a correlative the responsibility of the United States to European nations for the protection of European interests in our hemisphere. European interests in Mexico are reckoned in the hundreds of millions of dollars, and a request from European powers for the United States to be more diligent in the performance of her international obligations would be as unpleasant as it should be unnecessary. With the aid of a strict policing of her guerrilla-infested northern border, Mexico should soon be able to restore stable conditions throughout her territory.

Avalanches

Snowslides in the Sierra Nevada, California, the Wasatch mountains of Utah, and in the San Juan country, Colorado, have wrought destruction to life and property during the last few weeks. The avalanches last week in Mono county, California, destroyed the power plant of the California Hydro-Electric Company at Jordan, damaged that of the Crystal Lake Power Company, and killed ten or twelve persons at Jordan, Crystal Lake, and Masonic. The loss of life and damage to mining property in Utah was noted in our news columns recently. The latest fatalities in the San Juan occurred on March 12, when the boarding-house at the Gold King mine, near Silverton, was swept away, and four men were killed. The destruction and damage to the power-plants near Bodie will retard to some extent mining and milling operations in Mono county and in some of the camps of Nevada, although it is reported that in Nevada connection can be made with transmission lines of other systems so that electric energy for light and power can be obtained. Snowslides occur in regions having precipitous mountain slopes, where the snowfall is heavy, and when the temperature is such as to cause a slight thaw. The compression of the snow gives it the hardness and density of ice, and the momentum the avalanche acquires in a movement of 2000 to 3000 feet on a slope of 45 to 70°, develops almost irresistible energy. Trees and deeply imbedded rocks are swept away, and structures built by man are demolished. To be caught in a body of compressed snow under such conditions is like being encased in solid ice. Slides may be divided and dispersed by deflecting barriers; but one difficulty is that they are likely to occur in new places, so that it is easier to think of escaping from them than of any means of resistance.

Cobalt District, Ontario

By S. F. Emmons

*Doubtless most of you are more or less familiar with the general geological relations of the Cobalt district as given by the Canadian geologists. My own examination of the district has been too brief and cursory to justify any criticism of their determinations, which I therefore accept as far as the areal geology is concerned. The ore deposits are, however, of so remarkable a nature and so utterly different from anything seen within the boundaries of the United States that I have thought it might be interesting to you to hear what particularly impressed one who has had considerable experience in the study of the latter. I will begin with a brief statement of the facts thus far determined by the Canadian geologists, since some of you may not have had occasion to inform yourself with regard to them.

The Cobalt district lies in the rugged region known as the Archean protaxis, about 330 miles due north of Toronto, midway between Lake Ontario and Hudson Bay. Rich ores were first discovered in the district in 1903, as the result of the building of the Government railroad, known as the Temiskaming & Northern Ontario, northward from North Bay on the Canadian Pacific railway. Yet the district is on an old traveled route, and an argentiferous galena deposit had been worked on the shores of Lake Temiskaming, eight or nine miles to the eastward, over 160 years ago, and which shows how readily valuable deposits of the precious metals may escape observation.

Two geological maps are published by the Department of Mines of Ontario, the smaller, the Temiskaming sheet, covering an area of 15 miles square, on a scale of a mile to the inch, with Lake Temiskaming in the eastern half, and the Cobalt district a little south of the centre. The larger represents the Cobalt district on a scale of 400 ft. to the inch, with a contour interval of 10 ft. The geological colors on these maps represent the following formations, commencing with the older:

Keewatin is the oldest pre-Cambrian formation, and consists of an igneous complex, largely altered diabase and basic tuffs, intruded by granite, in the southwest portion of the area.

Lower Huronian.—Unconformably on these lie the Lower Huronian rocks, consisting of conglomerates and graywacke (slate or altered quartzite), which contain fragments of the older series. These are separated by another unconformity from the next higher.

Middle Huronian.—A series of arkoses (or 'green quartzites') with conglomerates and quartzite, which rest unconformably on the preceding.

Diabase.—All the above mentioned rocks are cut by intrusive diabases which are hence assumed to be of pre-Cambrian age. A great unconformity, representing a long period of erosion, separates the preceding rock from the succeeding rocks.

Niagara limestone, which is found on the shores and islands of Lake Temiskaming. The area is one of many patches of Paleozoic rocks that seem to have escaped erosion, because of being included in a synclinal depression of the ancient surface.

The more common minerals of the rich vein deposits are the arsenides of cobalt and nickel, smaltite with some chloanthite, cobaltite, and niccolite, associated with native silver. Less frequent are native bismuth, the silver minerals pyrargyrite, proustite, dyserasite, and argentite, the nickel sulphide, millerite, with occasional mispickel and tetrahedrite. The ordinary sulphides, pyrite, galena, and zincblende, are occasionally found in the wall rocks, but apparently do not form an essential part of the deposits. The gangue minerals are calcite with a little quartz, but both are in relatively subordinate amount in the rich parts of the veins. Minute calcite veins are common throughout the rocks of the district and often serve as leaders which are followed in searching for pay-ore. On the surface the cobalt veins are traced by the delicate pale reddish-blue color of 'cobalt bloom' (the hydrous arsenate of cobalt) which is the oxidation product of the cobalt minerals.

The veins in which these minerals are found are remarkably narrow, being from one or two inches up to eight inches in width, and in exceptional cases more than a foot for short distances. They are generally nearly vertical, but seem to be rather irregular in strike. In some cases the pay portions bend almost at right angles: in such cases as came under my observation this was caused by the mineral leaving a fissure of a given strike to follow one running in another direction, the first fissure continuing on, though barren of ore. The linear extent of the pay portions of the veins is not great, generally not over a few hundred feet, but the actual extent of the fissure is evidently much greater. How much could not be determined, as they are often simple lines of barren calcite, which are not followed for any great distance. In depth it was soon found that the very rich ore, which carries from 2000 to 6000 oz. per ton, does not extend, as a rule, more than 200 ft. in depth, often not as much, and the first generalization of the Canadian geologists was that the Lower Huronian conglomerate is the favorite *habitat* of the rich silver ores, and that they cease when the vein reaches the underlying Keewatin, which was explained as due to the physical character of the rocks of that formation, which do not fissure as readily as the Huronian. As prospecting was therefore mostly carried on in the rocks of this formation, a larger percentage of vein deposits has been discovered in it than in the other formations, but, as I shall show later, this does not seem at present to be the most probable explanation, an increasing number of pay-veins being found both in the diabase and in the Keewatin.

As to the origin of the fissures, the idea has been more or less prevalent that they are the result of contraction, because in many places they resemble joints, and show no slickensided surfaces. On the

*Read before the Geol. Soc., Washington, January 26, 1910.

other hand, it is recognized that they run continuously from the Huronian into the underlying Keewatin, which are separated by a great unconformity. On this point, W. G. Miller, the geologist of this region, after calling attention to the fact that the fragmental Huronian rocks have been less disturbed in the productive area than in the surrounding regions, says: "This left them in the right physical condition to be readily jointed and fissured by the contraction of the diabase." As to the genesis of the minerals, they have been assumed in a general way to have been connected with the post-Huronian diabase eruption. There are said to be diabases of several ages from Keewatin to probable Keweenawan. The post-Huronian diabase carries

North-South No. 7 Vein; 90-Ft. Level; 12 Inches Wide; Kerr Lake Mine.

some quartz. Miller says: "After the deposition of the cobalt-nickel arsenides, the veins appear to have been slightly disturbed, giving rise to cracks and openings in which the silver and later minerals were deposited. Veins which escaped this later slight disturbance contain little or no silver." A granite or aplite dike cutting diabase is found within the Cobalt area, on the north shore of Giroux lake, on the University claim, and outside this area aplite is more frequent in similar association, and is said to carry cobalt, whence it has been assumed that the aplite, which constituted the last phase of the diabase eruption, was the mineral carrier. C. R. Van Hise considers that the diabase body in the Cobalt area is in thin sills and hence does not extend deep; basing his assumption on the fact that the rocky beds that it intrudes are not upturned or pushed back, but comparatively undisturbed. This assumption has been in a measure confirmed by the finding, either by shaft-sinking or drill-holes, of underlying rocks at one or two points within a few hundred feet of the surface. It is generally recognized that the native silver is of distinctly later deposition than the cobalt-nickel arsenides—indeed, the evidence in the mines is most conclusive. In one case I observed a distinct narrow vein carrying native silver and calcite that crossed the mass of cobalt ore at a slight angle. Very often minute cracks may be seen crossing the cobalt mineral and gangue rock which are filled with films of native silver, and the flake or sheet form in which the silver is so often found, shows that it has grown in such cracks. That, however, the silver, as a whole,

Macdonald Vein; 150-Ft. Level; in Bend of North Drift; Very Wide; Kerr Lake Mine.

is of a distinctly later period of deposition, as seems to have been assumed, I am inclined to doubt. At any rate, it does not appear to be, as yet, definitely proved.

My own visits to the district in the past year have been too brief to admit of an exhaustive study, though I was able to see one mine pretty thoroughly and visit one or two others, so that what I have to say is rather tentative than final. The early mining, owing to the novel character of the deposits and the want of experience of most of those in charge of mines, was not very systematic, being largely in the nature of trenching on the surface and digging out the rich ore immediately in sight. Systematic exploration by underground driving and cross-cutting is a comparatively recent feature of the work. I was, however, fortunate in visiting a mine that had been developed by an engineer of long practical experience in managing large mines

in Colorado, in which the facilities for underground study were in consequence exceptionally good. This is the Kerr Lake mine, which occupies a tract of 57 acres, part of which is under the lake. In spite of the relatively small area of the property, this mine has proved one of the most productive of the district, having thus far developed five remunerative veins, to say nothing of a host of small veins, as yet of no great producing capacity, but which may any day develop pay-shoots. Singularly enough, the largest orebodies, with one exception, thus far developed have been under the waters of the lake, which is also the case with the adjoining Crown Reserve mine. This fact has led some of the mining men to think there is some genetic cause which renders the ground under the bottoms of the many lakes that dot the region peculiarly favorable for the concentration of rich ore, and the rights to mine under these lakes have been purchased from the Government at very high prices in one instance, I believe, for over a million dollars.

The exceptional character of mining in this district, and the favorable results of a good system may be shown by extracts from the annual report of operations of this mine for the year ending August 30, 1909. The gross product for the year was 2,668,648 oz. of silver from shipments of 1072 tons of ore and 300 tons of screenings (an average of 2489 oz. per ton), and the net profits $1,129,047, of which $480,000 had been paid out in dividends, and over half a million held in reserve as an exploration fund. The aggregate length of driving and shaft-sinking during the year was over a mile and a quarter, the principle laid down by the directors being to open up two tons of ore for every ton taken out. Another particular in which the system of work in this mine differs from that of most of the other large mines, is that by careful handling and sorting, only very rich ore is produced, which is sacked, and the necessity of large concentrating mills to treat second-class ore (that is, ore running less than 100 oz. per ton) is obviated. I would say with regard to the Kerr Lake mine that since the close of the fiscal year several important new finds have been made, and the present rate of dividend is double that of the previous year.

One object of my visit was of a commercial nature, that is, to form an idea of the probable permanence of the camp as a whole. A power company had been formed to furnish compressed air from a central hydraulic power-plant to the mines of the entire district. Such a plant is of the utmost economic importance, because all the rocks are so hard that it is impracticable to mine without the use of machine-drills, but power is very expensive, owing to the high price of coal and the uncertainty of its supply, due to the frequent congestion of traffic on the single line of railroad that serves in the district. One naturally feels doubtful about the persistence of such extremely rich ores as are found there, the mines forming an extreme type of what in the West are denominated 'specimen mines.' Moreover, it is generally admitted, even among mine-owners, that the bonanza portion of the veins almost never extends more than 200 feet in depth. Evidently the installation of a power plant, however favorable the conditions today, would not be a desirable investment if the mines are likely to be exhausted in two or three years. The only offset to the want of persistence in depth would be the multiplicity of veins that might exist, so that with increased facilities for working it would be reasonable to expect that a constantly increasing number of productive veins would be opened.

There has appeared recently in the Journal of the Canadian Mining Institute a paper by G. R. Mickle on 'The Probable Number of Productive Veins in the Cobalt District', which bears upon just this point. The facts upon which he bases his deductions, however, were gathered prior to July 1907, and hence do not include two and a half years of the most energetic work. He estimates that in the productive area of under 10 square miles there are 2000 to 2500 veins, of which 90% are calcite veins quite barren of metallic minerals; 10% contain only occasional small amounts of metallic sulphides and a fraction of an ounce of silver per ton, and probably less than 1% are productive silver veins. This estimate was based on examination of certain tracts, not in the most productive area, that had been reduced in area because of the want of discovery of actual mineral. He then proceeds to count the actually developed veins, distribute them among the calculated areas of the three formations, Huronian, diabase, and Keewatin, and to compare them with the long-worked European districts where somewhat similar ones are found, Annaberg and Schneeberg in Saxony. I shall not go into details of his estimates, because the comparisons will soon lose their force when the Cobalt district is systematically prospected. Thus his estimate of 66 productive veins for the Cobalt district had, he admits, been increased to 84 by July 1909, and the preponderance of those he gives for the Huronian, being 53, to 6 in the Keewatin and 7 in the diabase, might be, in part at least, due to the more vigorous prospecting in that formation, as a result of the geological deductions of the Canadian geologists. He finds that in the Annaberg district of 21 square miles, there were about 200 productive veins, or 0.6 of a vein to a claim of 40 acres; and in Schneeberg, with an area of 3.8 square miles, 150 veins were found, or 2.5 veins per claim.

In my examination of the district, what particularly impressed me, besides the exceptional richness of the ore, was the peculiar character of the rocks as a whole, and of the fissuring of these rocks. The impression produced was that the phenomena were immensely old and had been produced under unusually great pressure. All the rocks are extremely dense and hard. It is not simply that they show evidence of great regional metamorphism, for metamorphosed rocks may be rather loose-textured, but they are peculiarly close-grained, and have grown to have a general resemblance to each other, so that in hand specimens the Keewatin rocks, and the intrusive diabase are scarcely to be distinguished from each other or in some cases from the Huronian

graywacke. The typical Huronian conglomerate in the vicinity of the town of Cobalt carries rather large and generally angular fragments of granite and other rocks that do not outcrop in the neighborhood, in a fine-grained matrix of more or less fragmental material, which might have been morainal, whereas what is called conglomerate in the Kerr Lake vicinity is a band of dark, homogeneous-looking rock, like an indurated mud, in which are rounded pebbles of similar material, the whole looking like a hardened boulder till. It seems that the suggestion of a possible glacial origin for some of these rocks has already been made, but the absence of a boulder till was one of the grounds on which it was rejected. In the Kerr Lake mine this lies between the dark greenish-gray Huronian graywacke, or altered quartzite, and the underlying Keewatin, but it is difficult to find any sharp dividing line between the two formations. The true conglomerate is supposed to overlie the graywacke, but I did not find the full series present at any one place. At the Kerr Lake mine these two formations, the Keewatin and Huronian, dipping gently northward under the lake, occupy the northern half of the claim, the rest of the area being covered by diabase, which also bounds the Huronian on the north. Its relations were not ascertained, it having been found impracticable to trace the contact between diabase and Keewatin.

No. 7 Vein (East-West) 150-Level; Several Thin Parallel Veins. Kerr Lake Mine.

That the ore-bearing fissures are true rock fractures or faults of slight displacement I feel quite certain. They contain in the wider parts broken-off fragments of the adjoining country-rock, they pass continuously and without interruption from one formation into another, and in the conglomerates they cut across pebbles or matrix indifferently. Yet no gouge or slickensided surfaces could be detected, either in primary or secondary fractures, and in some cases they are continuous with cracks that resemble contraction joints in an eruptive mass. The great majority of the veins are thin cracks a fraction of an inch in width, filled with calcite; what the miner would designate as very tight seams. They are generally straight and quite barren of metallic minerals for considerable distances, and may pass into a series of parallel fractures, one of which will carry ore. In the case of important ore-shoots, they then pass into remarkably well defined veins 3 or 4 to 8 inches in width, carrying a solid mass of cobalt and nickel arsenides, more or less impregnated with native silver and with a rather subordinate amount of gangue, mostly calcite with which a little quartz is occasionally associated. At times even greater widths are attained. In such cases there generally seems to have been a structural cause for the widening, such as a crossing of one or more fractures, or some other deforming disturbance. It is difficult to determine whether these enlargements of the veins are due to the primary or secondary fracturing; for it is very evident, as Mr. Miller states, that there have been two periods of fracturing. In one instance I saw a vein carrying native silver and calcite less than an inch in width, crossing at a low angle a vein 4 to 6 inches in width filled with massive cobalt ore; but in most instances the secondary fractures are so minute as not to be distinguishable by the naked eye. That they do exist, however, is indicated by the frequent sheet form of the native silver; on one of the polished specimens I have, properly reflected light shows very distinctly the silver following minute cracks across both cobalt ore and gangue, or else following the outlines of a more or less crystalline mass of cobalt. In the one instance where I was able to observe the vein in depth, below the zone of secondary enrichment, it had identically the same characteristics as in the levels above, where instead of 10 oz. it carried several thousand ounces per ton. Indeed, the miners distinguish between pay and non-payable ore by its feel rather than by its appearance. The thin projecting sheets and points of silver give a peculiarly rough feeling that the unenriched ore does not possess; but the native silver is by no means always visible in hand specimens of rich ore. This again is well illustrated in the two polished specimens, which are from the No. 3 vein in diabase of the Kerr Lake mine; one the ordinary enriched silver which averages over 2000 oz. of silver to the ton; the other taken from the 350-ft. level only a few feet below the rich ore, which carries less than 10 oz. of silver. In this latter specimen, however, polishing has disclosed several little points of native silver scattered through the generally thin white mass of cobalt ore. The niccolite that is present is only distinguishable with a glass as faint copper-colored spots in the general white mass.

In some cases the ore passes from one fissure system to another that makes a decided angle with it, thus producing a crooked vein. A marked instance is the No. 7 vein of the Kerr Lake mine. From the

shaft the rich silver vein runs due north for several hundred feet, then bends sharply to the west. There are two systems of narrow calcite veins here, one running due north, the other nearly east and west. The No. 7 vein, as it is called, has thus far been traced 700 ft. in pay, that is, in ore that runs from 2000 to 4000 oz. The west branch has been traced to the west boundary of the claim, and is apparently a continuation of the famous Crown Reserve vein, which, like the No. 7 vein, is mainly worked beneath the waters of the lake. In tracing the No. 7 vein westward, another rich vein, the Macdonald, was struck, which runs northeasterly, and near the junction the No. 7 vein attains a width of 22 in. The vicinity of the junction of these two veins has evidently been a region of unusual disturbance. The veins there vary greatly in strike, are very irregular in width, less continuous than usual, yet as a whole they are exceptionally wide and very rich in silver. The narrow calcite vein which forms the normal continuation of the north-south portion of the No. 7 vein has been followed several hundred feet north without developing pay-ore. At 200 ft. north of where No. 7 vein bends to the west, an exploring drift has been driven eastward on an east-west calcite vein that for over 200 ft. was a mere line in the dark homogeneous graywacke; then it began to widen, and split into several parallel cracks, which after a little merged into a 4-in. calcite vein, and then suddenly, in a short distance, developed a 6-in. vein of 4000-oz. silver ore. A cross-vein running northwest, carrying silver in considerable amount, had already been cut by the exploring drift, about a hundred feet back.

The most regularly remunerative vein in the mine has been the No. 3 vein in the southeast corner of the claim. This is a north-south vein, nearly vertical, and averaging 2 to 4 inches in width. Its payshoot is 300 ft. long and has been followed to a depth of 350 ft., where the ore suddenly stopped. This is entirely in diabase, whereas the No. 7 vein is in Huronian graywacke. So far as developed it is remarkably straight, and there is no essential difference in character of fracturing in the diabase or the Huronian. As I have already said, I was particularly impressed with the close character of the fractures, in strong contrast with those we are accustomed to see in the Rocky Mountain region, where width is measured by more feet than these have inches. It may be that it is less close in the mines near the town of Cobalt, where the coarse conglomerates prevail and ore containing up to 50 oz. of silver is found in the wall rocks, so that mills have been built for concentrating such materials, but it is a difference rather of degree than of kind, as far as my observations went.

I could find no evidence that the silver had been introduced from below by a later accession of metal-bearing solutions, as seems to have been implied, if not explicitly stated, by those who have written on the subject, and I am inclined to believe that the second period of fracturing has served simply to furnish channels for descending silver solutions. I further believe that the reason that in the early veins the very rich ores did not extend far into the underlying Keewatin is to be found less in the fact that the Keewatin is unfavorable to the formation of fissures, than because the downward limit of secondary enrichment had been reached about at that depth. The change from rich to poor ore is certainly a remarkably abrupt one. In the No. 3 Kerr Lake mine, it occurs within 20 ft. or so, and in the No. 7 vein at the shaft it has been said that within two feet the ore dropped from 2000 to 20 oz. The depth at which this change takes place is extremely variable. There are cases in which it has occurred within a few feet of the surface, and as already stated in the No. 3 Kerr Lake vein it is at a depth of over 300 ft. That denser, more plastic rocks may have an unfavorable influence, since in them there is less likelihood of cracks that are sufficiently open to admit the descending solutions, is quite probable, but there does not seem to be any general association of this condition with the bottoming of the bonanzas. I have in mind a single case. In the north-south portion of the No. 7 Kerr Lake vein, the bonanza seemed to stop at a band of dense black indurated slate which dips northward with the other sedimentary formations, but is above the so-called Huronian conglomerate, already spoken of as resembling a tillite. In the northwestern part of the claim, however, where this slate band has not been distinctly recognized, the bonanza has already gone down 50 ft. below the horizon the slate should occupy, and has reached a depth of 190 ft., whereas at the shaft it stopped within 100 ft. of the surface. At other points observed there seemed to be no change of rock associated with the bottoming of the bonanza zone. The microscopic study of polished specimens of the same vein in and below the bonanza discloses, as the main difference, the absence in the latter of the minute cracks traversing the vein material that characterize the former, and that evidently have served as channels for the introduction of the silver.

Mr. Van Hise has stated, as a general truth, that openings in the zone of fracture of the rocky crust gradually decrease in size as depth increases, and doubtless many of you have had occasion to observe, as I have, cases where the opening of a given fissure vein decreases very perceptibly as distance from the original surface increases, and that a fissure-opening that may have a width of many feet in its upper part, if followed to sufficient depth, is found to end in a series of very small cracks whose width is to be measured in inches rather than in feet. It would seem, therefore, that the natural conclusion to be drawn from the extreme narrowness of the fissures in the Cobalt region is that they were originally formed under the pressure of a great weight of superincumbent rock or at great depth below the then existing surface; hence that the greater part of these original fissures has been eroded away, and what we see today are merely the roots of veins that once could have been measured in thousands rather than hundreds of feet. The question then is, what evidence is to be found in the geological history of the region that would

justify this conclusion? Let us search and see.

The geology of the region to the north of the Great Lakes and west of Hudson Bay has not yet been worked out in detail, but its general character is assumed to be a great plateau of low relief, composed largely of pre-Cambrian rocks in which are patches of early Paleozoic beds that have escaped erosion, presumably through being enclosed in synclinal troughs, in like manner as have the Triassic beds which are found to be infolded with the crystalline schists in the Piedmont region west of Washington. The veins, as has been seen, cut through both series of pre-Cambrian rocks as well as the igneous rocks that have been intruded into them, but so far as known did not penetrate the Paleozoic sediments, and are hence assumed to be of pre-Cambrian age. From the manner in which the exposures of the two unconformable members of the latter series are distributed, it is evident that there must have been a considerable period of erosion before the Paleozoic beds were deposited over them, though there seem to be no criteria for estimating the length of that period. Since these beds were deposited, however, and the region has been again raised above the sea, it has been exposed to sub-aerial degradation continuously up to Glacial times, which in itself is a much longer period than the entire existence of the ores of Mesozoic or Tertiary age, which constitute by far the greater part of the ore deposits of the Rocky Mountain region. The evidence afforded by the peculiar character of the phenomena of secondary enrichment at Cobalt furnishes, to my mind, a still more convincing argument in favor of the assumption that the veins, both primary and secondary, are extremely old and have been exposed to degradation for an immensely long period, for secondary enrichment and degradation are processes that go on *pari passu*, and in a given region are necessarily coördinated. It seems fair to presume, then, that the erosion and wearing away by the continental glacier was only the emphasizing of a similar process that had been going on, though at a slower rate, for much longer periods of time. Secondary enrichment of ore deposits proceeds in a sort of arithmetical progress. As the vein with its enclosing rocks commences to wear away, certain of its metallic contents, rendered soluble through oxidation, are leached down and redeposited at a lower level, which we call the zone of sulphide enrichment because the ore in that region is abnormally enriched. But this enriched zone is gradually brought nearer the surface by continued wearing away of the latter; hence increasingly richer material is carried down, and the zone of secondary enrichment is constantly increasing in richness; but the primary ore beneath this zone, which is not reached by the enriching solutions, remains constant and unchanged in the condition in which it was originally deposited. Thus there seems no limit to the amount of enrichment that may take place, provided sufficient vertical extent of original vein is provided, and enough time allowed for wearing it down to its roots.

The exceptionally rich ores are not confined at Cobalt to any single mine, or to the veins in any one formation, and the change from bonanza ore running several thousand ounces to that containing only enough to be counted on the fingers is abrupt and rapid wherever it takes place. It is a change, moreover, that can not be explained on the assumption made by the Canadian geologists, that the silver is a later addition to the contents of the veins, if by this they mean, as I assume they must, that it came from the same general deep-seated source as did the cobalt and nickel. For if such were the case, it is impossible to understand why the rising solutions should carry up their silver contents, practically without spilling any by the way, until they had nearly reached the surface, and then suddenly dump the whole load within an extent of comparatively few feet. Furthermore, it does not appear that the secondary cracks have extended below the bonanza zone. Hence the assumption of exceptionally long periods of erosion, and correspondingly great vertical extent of veins that have been eroded away seems, if the facts have been correctly interpreted, to be the only explanation that suits the case.

The chemistry of the processes of secondary enrichment that have gone on here presents some new and interesting problems, that are well worthy the attention of those geologists who have the necessary time and energy to devote to it. Hitherto we have had to do in such studies only with the sulpho-salts of the metals, but in the present case it is their combinations with arsenic and antimony that form the predominant minerals. In the present reasoning it is assumed that the chemical action of the latter would have been of the same general nature, differing only in degree from that of the former, but the actual reactions that take place are probably more complicated, and stand in need of special investigation in the laboratory. The sulphates of the metals are in general more or less soluble and are carried down in descending atmospheric waters to be reduced to sulphides in contact with large masses of unaltered sulphides. For the present it is assumed that the same is true of analogous compounds of arsenic and antimony. Precipitation takes place more readily in proportion to the relative insolubility of the sulphides. Now the silver sulphides are relatively more insoluble than cobalt, nickel, or iron sulphides, and silver, moreover, is, next to gold, the metal most readily reducible to the native state, so that it is easy to understand that it may be precipitated in the metallic state, as well as in the state of sulphide or arsenide. On the other hand, in reapproaching the surface, this metallic silver may easily combine again with sulphur or arsenic, to form a sulphate or arsenate, in the presence of sulphides and arsenides of the other metals that are being oxidized, and then resume its downward course.

The safest guide in reasoning about such deposits is the study of analogous forms of ore deposits whose geology has been carefully worked out. A most instructive parallel is furnished by the deposits of Kongsberg in Norway as described by J.

H. L. Vogt.* These deposits occur also in pre-Cambrian rocks, intruded by both acid and basic eruptives, but the significant point of resemblance with the Cobalt deposits is that the greater proportion of their value lies in the native silver. The very rich ore is found where the veins cross the fahlbands (or brown bands) which are belts of schist impregnated with pyrite. It had long been a puzzle to geologists to understand the reason for this enrichment in the fahlbands, and to Vogt apparently belongs the credit of determining that it was because of the presence of pyrite, which he assumed had by partial decomposition given out enough sulphuretted hydrogen to precipitate the silver from its solutions as sulphide. In these mines it is not uncommon to find bunches of native silver with a core of argentite, and native silver forming a thin coating over masses of argentite or projecting out of them in wire form. Similar phenomena are found in connection with the relatively rare occurrences of proustite (the sulph-arsenide of silver). Hence he reasons that the native silver must have resulted for the most part from the reduction of the sulphide in the presence of carbonaceous matter, so-called anthracite, which also occurs. (Graphite is said to be found at Cobalt.) Some of the silver, he reasons, must have been deposited as native because it rests at times directly on galena, blende, etc. At the time Vogt wrote, the theory of secondary enrichment as it is now understood had not been developed, and it does not appear from his descriptions whether there are any secondary fractures such as would have admitted of enrichment by downward-seeping waters, but from the manner of occurrence of the ores it seems likely that this process must have been an important factor in forming these deposits, and that they might be detected if specially sought for. His assumption, as was natural at that time, was that the present distribution is that of original deposition, the only secondary action having been the reduction of the sulphide. In the Kongsberg mines native silver is still found at depths of about 500 metres, but the tenor of the ore is said to have fallen off very greatly with increasing depth. They differ from those of Cobalt in carrying no such large amounts of cobalt and nickel, and in being prevailingly sulphides, rather than arsenides and antimonides. They are the only other important mines that I know of in which the main value is in native silver, the proportion of sulphide ore being estimated by Vogt at 5 to 10%, while others have assumed it to be even less. The total production of the Kongsberg mines is estimated to have reached a value of over 137 millions of marks, while Cobalt is producing today over 20 million ounces of silver per year, and bids fair to produce as much or even more for many years to come.

Accidents in mines are very often the result of carelessness—most often of the victims themselves; for miners are notoriously unmindful of the dangers about them.

Jour. f. Prak. Geol., Vol. VII (1899), p. 113.

Kern River Oilfield

By J. H. G. Wolf

In reviewing the output of the various oilfields of California, one of the most striking showings is the wonderful uniformity of the yield of the Kern River field. Watts, in his valuable work, the 'Oil and Gas-Yielding Formations of California',* gives the number of producing wells in Kern county in August 1909 as 163, distributed as follows: Kern River field, 130; Sunset field, 17; McKittrick field, 16. The yield for Kern county that year was (U. S. Geol. Survey figures) 892,550 bbl.; it is probable, therefore, the Kern field produced 750,000 bbl. in 1900, its initial producing year. By 1901 the wells of the Kern River field had increased to 559 in number, and the county's yield to 4,493,455 bbl.; the following year there were 800 wells, and the yield 9,705,703 bbl., while by 1903 the yield of the county had leaped to 18,077,900 bbl. annually, and that of the Kern River field to approximately 14,000,000 bbl. The latter year marked the building of the pipe-line to tide-water (Kern River field to Point Richmond on San Francisco bay, 278 miles) which afforded a convenient and economical method of transport for the oil, steadied production, and built up markets.

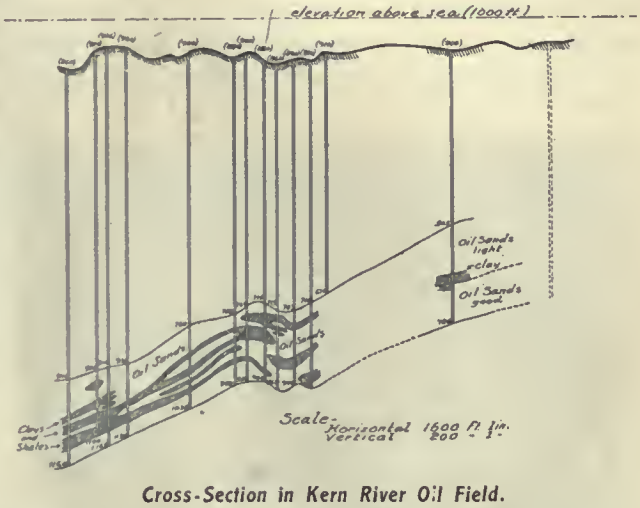
From 1903 to 1909, inclusive, the Kern River field produced a net of from 13,000,000 to 14,500,000 bbl. annually (the latter figure being for 1909), while by December 1909 the number of producing wells had increased to 1375 of the 3950 wells on the beam in California at that time. The output fluctuated with price and consumption, yet the area from which the supply was drawn was not extended after 1901, and up to March 1910 it remained practically constant at nine square miles. The southwest and northeast sides of the field are being extended now with satisfactory results, which will add to the area to be pumped. The net yield of Kern county, or the amount actually shipped in the ten years from 1900 to 1909 was 139,296,609 bbl., according to the U. S. Geol. Survey. Allowing one barrel for producing and marketing seven, and disregarding the quantity consumed in development work, the gross production was probably 159,196,124 bbl., of which the Kern River field produced at least 125,000,000 and possibly 130,000,000 bbl. Statistics present dry facts unless put in a form to be digested and to bring out the commercial importance of what is under consideration, or to permit scientific facts to be deduced therefrom.

Referring directly to what may be taken from the figures presented by the Kern River field statistics, the following summary is given: (1) The 800 producing wells in 1903 yielded a net of 17,500 bbl. each. (2) The 1375 producing wells in 1909 yielded a net of 10,600 bbl. each, hence apparent decline in yield per well in six years on the assumption that all the wells were drilled in equally prolific ground (which is not true) was, roughly 39%. (3)

*State Mining Bureau, Bulletin No. 19, 1900.

The gross yield of 125,000,000 bbl. came practically from 3000 acres of developed or drilled-up land, representing one well to 2.25 acres; hence the gross yield per acre was 41,700 bbl. (4) If the decline in yield per well was 39% in six years, and the quantity extracted 41,700 bbl. per acre, the gross to be extracted from these 3000 acres is theoretically 107,000 bbl. per acre, or the 6000 acres of the field may yield a gross of 642,000,000 bbl. petroleum. (5) It is neither safe to estimate nor is it reasonable to suppose that the rate of decline in yield will continue constant at the above figure, nor that the amount of oil that can be extracted profitably will equal that theoretically extractable; nor is it correct to assume that the pumping from the 3000 acres already developed has not drawn down the general oil-level, or its general plane. It is allowable to assume, however, that the developments of the present edges of the field will extend the area to be pumped possibly 10%, that methods will be devised to extract the oil which is mingled with water in the sands above the main oil measures, and which is not sought now, and that when the field is fully drilled and the wells are reduced to producers of from 2 to 5 bbl. each (as the wells in the Los Angeles fields are today), cheaper methods of pumping will then have been devised. Experiments in pumping with electric motors will be attempted in 1911. In light of these considerations, it may not be far wrong to place the amount of oil in the ground at the theoretical 642,000,000 bbl. The Baku field in Russia produced between the years 1859 and 1897 the enormous total of 648,000,000 bbl.; the field is still producing and yielded during 1908, according to the statistics of the U. S. Geol. Survey, 55,863,000 bbl., or 90% of the output of the Russian field. The physical conditions under which the deposit exists in the Kern River field are more like those of the Baku than any other prominent field ever opened; that is, the oil lies in a gravelly reservoir in strata of fine and coarse sands mingled with kidneys of clay and shales, the formation being incoherent, as are also the covering strata. The sketch in the next column is a cross-section taken across the north side of the field along a section line. The dip of the oil-formation along that line is 2° 24′. (6) The theoretical period of exhaustion of the 1375 wells pumping on January 1, 1910, on the premises stated in (4), is 15 years, hence the date of the ultimate exhaustion of the field is dependent upon the rate at which the drilling of the future is conducted, and upon the manner in which the encroaching water is handled. (7) During the calendar year 1909, seventeen properties on the north side from which figures were obtainable marketed from 143 wells drilled upon these particular properties, whether old or new wells and whether or not each well was kept constantly pumping, a total of 1,802,937 bbl., or 13,608 bbl. per well per annum, which is 2008 bbl. above the average for the field for 1909. The property which made the best showing was on the north edge of the field and yielded 17,760 bbl. per well. This production of 1,802,937 bbl. was drawn from 295 acres of developed ground (one well to 2.06 acres), or the net product per acre was 5820 bbl., or 6650 bbl., gross.

The foregoing exhibit shows that each acre of developed ground in the Kern River field has produced to date 41,700 bbl. petroleum. How much more is extractable is not known, because of the ever-recurrent question, when will the water drown out the oil measures? Judging from the way the present encroachment is being handled in the southern portion of the field, the loss in the yield from this source will not be a serious one for some years. There remain approximately 3000 acres of proved ground to be drilled, much of it situated in the heart of the field, where the original saturation was very high. Another method of calculating the possible yield is by taking the thickness of the oil



Cross-Section in Kern River Oil Field.

sand to be an average of 200 ft. and, assuming the voids in the sands to approximate 35% and all completely saturated, there are 70 ft. thickness of oil and gas under each acre of ground. If 50% of the above 70 ft. be extractable, and the gas content be 50% of the latter, the number of feet of solid oil extractable is 17 ft. 6 in., or 135,625 bbl. per acre. The gas-pressure, however, which is the principal means for the expulsion of the oil from the measures, will have died down long before any such quantity is recovered from the area, and the ultimate yield, therefore, is a matter of conjecture and not of precise calculation.

Bulldozing is a term used to indicate the process of breaking large boulders in open-cuts, or in stopes, by placing powder on top of them and exploding it in the usual manner. At some mines the men place pieces of rock, weighing from 3 to 10 lb., on top of the charge of powder, presumably to prevent the fuse from being shaken loose by the discharge of neighboring shots. The practice is an extremely dangerous one, for these pieces of rock fly through the air to incredible distances, and are a far greater menace to the men than the fragments flying from the boulder itself. If the charge of powder and the fuse require protection such as suggested, a few handfuls of sand or of fine rock will answer the purpose just as well as a lot of rock fragments, and the fine material is without danger.

Valdez Creek Placers

*Valdez creek is one of the upper tributaries of Susitna river, which flows into Cook inlet. It is about fourteen miles long and lies in the mountains flanking the Alaska range, flowing into the Susitna from the east. Its broad valley is floored with gravels that are largely the product of glaciation. All its largest tributaries rise in the mountains south of Valdez creek. They include Timberline, White, and Roosevelt creeks. Rusty creek and Lucky gulch are tributaries of White and Roosevelt creeks, respectively. The total gold production of the Valdez Creek district up to 1910 has been approximately $260,000.

The most productive part of Valdez creek proper is the lower two or three miles of its course and includes about one mile of the stream. In addition to the placers of the creek, Lucky gulch, which is about seven miles from the main Valdez Creek camp, produces gold and, as has been intimated, prospecting on Rusty creek during a number of years has given good grounds for believing that that stream also will become a gold-producing stream. During 1910 most of the mining on Valdez creek was confined to four creek claims and to the Tammany bench claim. Mining began here in 1903 and at present the richest part of the creek claims, so far as they are known, are nearly worked out. The Tammany bench claim, however, which is the richest property yet discovered in the region, continues to yield as it has in the past, and there is no reason to suspect that it will not do so for some time to come. This part of Valdez creek flows in a canyon cut in slate and the overlying gravel deposits. The canyon has its greatest depth, 170 ft., in the vicinity of the so-called Monahan tunnel, which is the adit to the Tammany bench, just mentioned.

The gravel ranges from 3 to 8 ft. in thickness and consists of slate, schist, and granite, together with a small proportion of light colored porphyritic intrusives and dark basaltic and tuffaceous material. The gold of Valdez creek differs considerably in appearance. Part of it is flat and smooth, but another part is rough and little worn. Much 'ruby sand' and a little 'black sand' is associated with it. The gold-producing gravels of the Tammany bench fill an old canyon formed long before the present canyon of Valdez creek was cut. It intersects the present canyon at an angle of about 45°. Its bottom is 60 ft. above the level of the creek, so that the Monahan tunnel is at that elevation also, thus affording an excellent dump for the washed gravel. Most of the gold is found in the lower 5 ft. of the gravel, and the output of this tunnel alone is nearly half the total production of the district.

Lucky gulch is occupied by a small stream, little more than a mile long, coming down from one of the mountains south of Valdez creek. It is a narrow V-shaped gulch cut in slates that dip to the north at about the same rate that the stream falls. A notable feature of Lucky gulch is that a large portion of its gold is in coarse nuggets, two of which weighed 52 and 32 oz., respectively. Owing to its situation on the north side of the mountain and to its small drainage area the stream derives its water largely from melting snow, and its flow in consequence is at times inadequate for use in mining.

Rusty creek, the largest tributary of White creek, is four and a one-half miles east of the camp on Valdez creek. It heads in a complex of slates, tuffs, and basalts, but most of its course is in slate. Prospecting has been done on Rusty creek for three years, yet it was not till 1910 that results of much promise were obtained. A large cut, several hundred feet long, was made in the creek bed by 'booming.' The gravels filling the old gulch, as it seems to be, include an upper deposit of unsorted glacial débris, from 10 to 20 ft. thick, made up of basalt and slate. Below this is another deposit of fairly well sorted gravel and coarse sand with distinct cross-bedding. The cut contains many large boulders, derived chiefly from the upper glacial deposit. Most of them are of basalt, but a few are of granite. The cut is 25 ft. deep in places and has a rock wall on its east side, but its west wall is gravel. Small benches on the rock-wall side yielded good prospects in gold all the way down, and the bottom of the cut was especially encouraging. The stream gives good promise for future production.

The Tammany bench claim and the adjoining creek claims are favorably situated for hydraulic mining. Valdez creek affords an abundant supply of water under good head which can be utilized with comparatively small expense and labor. The creek provides dump room.

Two difficulties that the miner must face in this district are the high cost of transportation and the unusual proportion of large boulders in all the gravel of the main stream. Rusty creek is somewhat more fortunate in respect to the boulders, for it was out of the influence of the glacier that moved down Valdez creek, and thus did not receive the large contribution of diorite boulders that filled the main stream. Freight rates from Valdez to Valdez creek average approximately 30c. per pound, but there should be some reduction in this rate when the Copper River & Northwestern railway is completed. The improvements that have been made in the military road from Valdez to Fairbanks will also make the conditions for mining on Valdez creek more favorable, since it will lessen the difficulty of communication with the outside. Valdez creek is 65 miles west of Paxsons, on the military road, but there is no well-marked and regularly traveled trail to the road, since there is little summer travel between them. Freight is brought in during the winter by way of Gulkana, Maclaren, and Susitna rivers, which afford an excellent winter trail.

*Condensed from a report now being prepared by Fred H. Moffit, of the U. S. Geological Survey.

Some of the early-day hydraulic-mining plants in California cost over $500,000. This included reservoirs, ditches, flumes, and the other improvements necessary to the operation of the mines.

An Old California District

By A. F. McEwen

Sawyer's Bar is on the north fork of the Salmon river, about 65 miles from the railroad at Yreka in Siskiyou county, California, and in days gone by was a little place. The region in general is very mountainous, Tanner's peak, one of the highest points in the vicinity, being 7000 ft. above sea-level. The properties here described are at altitudes ranging between 1500 and 2500 ft., above the north fork of Salmon river. Timber for mining purposes is abundant. The old 20-stamp mill and other machinery at the property I examined recently were driven by electricity, the power (which could be considerably augmented) being furnished from the river at Sawyer's Bar. Water for milling and domestic uses is readily available. The annual snowfall is fairly heavy, though the seasons vary considerably in this respect. The orebody, from 2 to 5 ft. wide, is between slate walls, and consists of quartz, carrying arsenopyrite. As thus far exposed in the various workings, these quartz-veins lie somewhat flat. The average dip may be set down as 15°, with a strike a little east of north. As a matter of fact, the dip of the vein varies considerably throughout this entire zone, and at certain points on the property the vein takes a sudden and steep (45°) inclination. Winzes have been sunk at such spots in one or two instances, but at the time of my visit these were full of water, and in any case (as far as I can gather) the work was altogether inconclusive in its bearing on the question of dip, at increased depth.

Sawyer's Bar, Siskiyou County, California.

As a result of the conditions here, notably the dipping of the vein into the mountain at a small angle, and the subsequent heavy erosion of the mountain itself, the vein is exposed along its dip at sundry points for a distance equivalent to several thousand feet, if these points were in line with each other on the dip, which they are not. From this same point of view a vertical depth of about 1000 ft. may be said to be attained between two of the adits which were driven on the vein; although it must be understood that these adits are a long distance apart horizontally. Evidences of considerable movement in the vicinity of the vein are abundant, such as contortion of the slates, the frequent presence of gouge matter, etc. This extensive property was opened up by numerous adits, driven usually on the vein itself from its exposed outcrops on the mountain-side. Many of these workings are now, of course, quite inaccessible; but, as far as was practicable, I carefully sampled the whole of the ground. Some extremely rich ore has undoubtedly been taken out in the past, and although at the time of the last run in 1908 all the ore then developed was put through the old 2-stamp mill, good assays can still be obtained over fair widths of vein at several underground points. A 2-in. seam of banded quartz, containing rich sulphides, assayed by myself, yielded $1611 in gold per ton; while 27 in. of quartz overlying this same rich streak, assayed $11 per ton. The average assay value of the ore treated in the past seems to have been from $10 to $12, but the loss in the tailing was heavy.

These properties have been operated intermittently for at least 47 years, and have several times changed hands. Statistics of their production for this period are uncertain. Still from the data available, it may be safely stated that the gross output has been in the neighborhood of $600,000 or $700,000. Assuming it to have been satisfactorily established that the placer gold, recovered from what is known as Eddy's Gulch basin, below the quartz properties in question, was derived from the disintegration of the gold-bearing veins, which exist in the mountains above, the yield of placer gold becomes a matter of some interest. The north fork of Salmon river in Siskiyou county is credited with a production of $25,000,000 during 60 years of placer operations. It is estimated that Eddy's gulch, which runs into the north fork of Salmon, has alone yielded over $3,000,000. As a matter of fact, hydraulic mining is still in progress on a small scale. Concerning the future outlook for the quartz properties, I may say that exploration might reasonably be undertaken at a number of points underground with a fair prospect of success.

The depth at which water may be reached in an undeveloped mine, and the amount that will be present when it is reached are very uncertain. At many mines the water-level is surprisingly near the surface, and in this altitude and topography have little influence. For instance, on Mount Union, southeast of Prescott, Arizona, the water-level in mines not drained by adits is close to the surface. This is at an altitude of nearly 8000 ft., though down the valley of the Hassayampa river, which heads on Mount Union, there are mines over 200 ft. deep in which no water has been found. Some mines make a large volume of water between the surface and the 1000-ft. level, but little or none below that depth. The Silver Islet mine, situated on a small island in Lake Superior, was worked to a depth of 500 ft., and was a remarkably dry mine.

Tin in Malaya

By F. Douglas Osborne

*The chief sources of the world's tin supply are the Malay Peninsula, the islands of Banca and Billiton, Bolivia, Australia, Tasmania, Cornwall, Nigeria, the Transvaal, Swaziland, and China. Tin is also produced in New Zealand, Burma, the Congo Free State, Korea, Japan, Spain, Portugal, Central Europe, France, and Alaska, but not in important quantities. Of the sources named, the Malay Peninsula is the most important, as from there comes more than half of the total supply. Situated at the southeastern extremity of the continent of Asia,

Malay Peninsula.

the Peninsula consists of a narrow strip of land varying in width from less than 50 to nearly 200 miles, and extending from latitude 13° 30′ N. to 1° 18′ N. The northern part of the Peninsula is feudatory to Siam, and in this part the mineral resources have hardly begun to be developed. Toward the south are the Federated Malay States, which, under British protection, have so wonderfully developed during the past thirty years. It is from these States, Perak, Selangor, Negri Sembilan, and Pahang that the majority of 'Straits Tin' comes. In 1909 the amount exported was little short of 49,000 tons.

That mining for tin in these States has been going on for long years, there is evidence in the form of old workings all through the country; but it was not until the advent of the Chinese that any considerable quantity was produced, and only since their factional fights, which led to British interference and subsequent protection, that the States have rapidly developed and become the mainstay of the world's tin supply.

The tin exported from the Federated Malay States is almost entirely won from alluvial deposits. The most important of these are in Perak and Selangor, Perak being at present responsible for about 56% of the total. From the Federated Malay States during the twenty years, 1890 to 1909, there has been produced 873,703 tons of tin, or an average of 43,685 tons yearly. This production was distributed as below:

	Tons.
Perak	447,900
Selangor	329,564
Negri Sembilan	73,315
Pahang	22,924

The maximum production was made in 1905, when the output for the States reached a total of 50,991 tons; since then the production has diminished slightly, 48,743 tons being produced in 1909, and it appears as if there will be a greater falling off during 1910 (total, 45,000). Almost the whole of this production comes from alluvial workings, as at present, with the exception of the mines of the Pahang Consolidated in Pahang, and some workings in the Kledang range of hills near Ipoh in Perak, no lode mining is carried on, and the total production from these two sources does not exceed 1200 tons per annum. The chief centres of the alluvial workings are the Kinta valley in Perak and the flats near Kwala Lumpur in Selangor drained by the Selangor and Klang rivers. In these places it is hardly an exaggeration to say that tin occurs everywhere, from the surface of the ground down to depths of 250 ft., on the flat land, in the valleys, and high up on the mountains.

The Kinta valley, which is so enormously rich in tin and which is typical of the characteristic deposits, is the valley drained by the Kinta river, the most important tributary of the Perak, with which it runs parallel in a southerly direction, the Kledang range forming the watershed between the two rivers and the boundary of the Kinta valley on the west. On the east of the valley is the main range of the Peninsula. The valley is about 30 miles long by 12 wide and is very flat, the mountains on each side rising abruptly. Mining villages, well laid out and tidy, are scattered throughout, connected by well made cart-roads, and the main railway runs through the centre. The main geological features of the valley may be described as a floor of highly crystalline limestone or marble, usually white in color, and lying in the centre of the granite mountains. On the east side this limestone forms a series of wonderful pinnacles or hills, rising in cases as high as 2000 ft. above the surrounding country, covered by dense jungle scrub, and honeycombed by caves and fissures. It has been weathered to a very irregular surface, forming innumerable small pinna-

*Abstract of a paper read before the Royal Society of Arts, London.

cles and crevices, is non-fossiliferous, and its geological age is unknown. The mountains on either side are composed of intrusive granite, which has doubtless been the cause of the upheaval and contortion of the limestone, the intrusion of the granite having probably occurred simultaneously on both sides of the valley, and thereby squeezed the limestone into the extraordinary shapes which it has assumed.

The tin deposits are extremely irregular and follow no well defined lead. The richest occur in the vicinity of the granite foothills, much tin being occasionally concentrated in the fissures left at the junction of the granite and limestone, as in the case of Tronoh and Lahat. The channels and crevices in the limestone valley bed invariably are rich in tin, and it is from these shallow deposits that the majority of the tin is won by the Chinese workers. The tin wash may be sandy or heavy clay; it may occur in layers separated by barren ground, or the whole of the ground from surface to bedrock may carry tin; and as in the valley the holes and crevices in the limestone are filled with tin-bearing ground, so it is in the hills, even up to heights of 1200 and 1300 ft. Isolated deposits from time to time are found in the limestone, the most notable of these being the Tambun mine, from which in 1903 as much as 350 tons of tin ore was won during one month, and the average for the year was some 250 tons per month. There being no connection between this deposit and any other of considerable value makes it all the more difficult to evolve a reasonable theory as to the origin of the mineral, more especially as, in the case of Tambun, the tin is much less water-worn than is the case in many of the cave deposits in the hills, which are much closer to the granite ranges, from the weathering of which the alluvial tin was most probably derived. Mr. Scrivenor, the government geologist, is of the opinion that it is much more probable that the bulk of the alluvial tin has been derived from the masses of pegmatite, lodes, and stockwerks which take part in the formation of the low rolling country at the foot of the high ranges, than that it was derived from the high granite mountains. In his report for 1904 he states that undoubtedly the bulk of the tin found in the Tronoh mine had its source in the hill lying to the west of the mine.

If this theory is accepted, it becomes still more difficult to account for the presence of alluvial deposits high up in the limestone caves and on the mountains. My opinion is that the bulk of the tin deposits of the Federated Malay States came from the weathering and erosion of lodes that existed in the granites and schists. Even close to the foothills, the tin deposits are almost invariably much water-worn and rounded, which naturally leads to the conclusion that they have traveled a considerable distance. Then, if the tin came from high granite hills, it is a simple matter to account for its presence in the high caves and fissures of the limestone cliffs, for where the granite pushed through and distorted the limestone, huge crevices are left which would catch the detritus subsequently washed down from above, and, acting as receptacles for large bodies of water, hydraulic power would be provided, capable of forcing the alluvium through channels in the limestone and to considerable heights.

Most of the tin is found on the west side in an almost continuous line from Taiping to the north to Seremban to the south, and an interesting feature is that their extent and value seem to diminish toward the south. From this it might be deduced that the main source of the supply was the mountains of Perak. On the east coast the tinfields are less numerous, and more scattered; the deposits are of a more recent period, and, as the bedrock of the alluvial workings is generally granite rock, there seems but little likelihood of discoveries being made here of new fields which will equal in richness those on the west coast. It is probable, however, that

Federated Malay States.

lodes of considerable importance may in time be discovered and worked in the eastern States.

For the development, in the future, of the tin resources of the Federated Malay States there is no doubt that modern machinery and abundant capital are necessary. The shallower, richer, and easier-won deposits having become exhausted, those remaining require, for their development, modern engineering skill and plant capable of treating large quantities commercially. The methods by which alluvial deposits are worked may be described under four heads: (1) Ground sluicing, with its modern development of hydraulicking; (2) open-cut workings; (3) underground workings; (4) dredging.

Ground sluicing is only practicable where a sufficiency of water is available and an outlet for the débris. It is a favorite form of mining for small parties, little capital being required. The scene of this class of operations is, generally speaking, some narrow valley up in the hills. Of hydraulicking it is not necessary to say anything, as the method is well known. No bucket dredging has so far been attempted in the Federated Malay States, though

the use of bucket dredges for the recovery of gold and tin from the river beds and flats is general in Australia and New Zealand. Dredging by centrifugal pumps is a modern adaptation of the principle of hydraulic mining, and was first introduced in Australia. Essentially it is hydraulicking at a low level, the difficulty of getting rid of the tailing being met by the introduction of a centrifugal pump which raises it to a height at which it will find an outlet by gravitation.

For the future development of the tin resources of the Federated Malay States, plants of this description must be the mainstay if cheap power can be procured. Already it has been demonstrated practically that ground which has already been worked Chinese fashion, and abandoned as exhausted, can be worked profitably, and it needs only the introduction of some more economical means of generating power than is at present available, for the thousands of acres of so-called exhausted tinfields to be profitably re-worked. The substitution of suction-gas for steam has already met with a considerable measure of success in the Sungei Raya mine in Kinta, where the plant has been intelligently treated, and there is a scheme in prospect for generating electric energy by the water-power of the Kinta river. Should this scheme be carried to a successful issue, working costs, where its electric energy is employed, must be reduced to such a low figure that but little land in the Kinta valley and other mining fields is too poor in tin to be profitable.

So far the alluvial resources only have been dealt with; but, in addition to these, there are the lodes to be developed, and in a country where such abnormally rich alluvium has been found, all of which at some period must have come from the decomposition or erosion of metalliferous veins in the rocks, it is but reasonable to presume that time and patience, with the assistance of capital, may discover the sources of the alluvial supplies and develop them into profitable tin-producing mines. Already a company has begun to develop the lodes in Perak and Pahang. So far, in Pahang, the majority of the tin won has been found in the slate country, overlying the granite, none of the lodes having been followed through the slates into the granite. The property of the Pahang Consolidated Co. at Sungei Lembing (formerly owned by the Pahang Corporation and the Pahang Kabang Co.), has been worked for over twenty years, and it is said that more than thirty lodes have been discovered, having an east-west course, the angle of dip varying from 10 to 40°, according to W. H. Derrick. The country in which the lodes have been worked is schist or slate overlying the granite. Mr. Scrivenor, the government geologist, considers that the lodes here are fissure veins, and expresses as his opinion that they will continue to great depth. Certainly the lodes can in some cases be traced into the granite, but the measure of success that has so far rewarded the liberal development policy of the Pahang Consolidated Co. is so small that an opinion as to the future value of the property can not be formed.

Treatment of Silver Ores at Guanacevi, Mexico

By R. C. Kline

The Guanacevi district, situated in the northwestern corner of the State of Durango, has for many years borne an important part in Mexico's production of silver and its yearly output is still not inconsiderable. Owing to the comparative inaccessibility of the camp, lack of cheap power, and highly refractory character of most of the ores, little progress has been made in handling the ores of low value. There is now a strong probability that a line of railroad will shortly be built in from Tepehuanes, and if this be done the situation should be very much improved.

Upon my arrival in Guanacevi in the spring of 1907, I found that none of the companies in operation at that time were successfully cyaniding their ores. One company was getting ready to build a new cyanide annex to its concentrating mill, while another was still trying to get a satisfactory rearrangement of their equipment and was putting in some of the more modern devices at the disposal of the metallurgist. Former attempts to treat by coarse crushing, with separation, leaching, and air agitation in flat-bottom tanks, had proved complete failures. This work had been done before much of anything was known regarding the cyaniding of silver ores, and the results in no way reflect discredit upon the men who were responsible for them.

The first company for which I examined ores was developing a portion of the Santa Cruz vein. The ores of this vein may be divided, for purposes of this article, into two classes: oxidized and unoxidized. It is concerning the oxidized ores that I shall write. These apparently varied little in their metallurgical composition, but yielded vastly different percentages of extraction under identical conditions of treatment. Oxides of iron and manganese were present in considerable quantity, together with small amounts of zinc. The ores nearer the surface showed less zinc than those from deeper levels, but contained approximately as much manganese, in the form of pyrolusite, as did the others. This fact is interesting, since the presence of pyrolusite in considerable quantity is believed by many to be the cause of poor extraction; yet the ores from the upper level of the property in question yielded over 90% of their silver without any special difficulty. A curious point in this connection was the fact that the ores from the second level yielded a much poorer extraction; those from the third level also poorer, but better than those from the second; while those from the fourth level gave a good extraction, considering the nature of the ore, in fact almost equal to those from the first. Black oxide of manganese was present in practically the same amount in all four samples, and its presence could have, therefore, little bearing upon ultimate results. Nor would it appear probable that the varying extractions obtained were due to intermediate oxidation products

of the manganese minerals, even though many of the unoxidized ores of the district show heavy percentages of pink rhodochrosite and rhodonite.

Work on the above ores was begun by crushing in solution to a total product, or 'slime,' all of which would pass 200 mesh. The crushing dilution was about 8 to 1. Agitation was carried out for varying periods and with different dilutions. The resulting extraction of gold was excellent, and although the gold value of the heading was low, in no case did I find over 8c. per ton in the residues, while they more often assayed as low as 5c. This figure is perfectly trustworthy, as from 40 to 50 buttons from 1 A. T. charges were always combined and parted for a gold weighing. The use of chemical agents such as lead acetate, barium peroxide, mercuric chloride, ammonium chloride, and bleaching powder, was thoroughly tried, but in no instance with any appreciable benefit. The effect of varying dilutions showed very clearly that anything greater than three of liquid to one of solids was of absolutely no benefit, with the possible exception of a very slight cut in the time required for completing solution of silver. This was not sufficient to balance the increased cost of equipment and power, for the larger quantity of material. This is strictly in line with later experience of others, and of my own. The increase in time of agitation, from 24 to 30 hours, in every case showed that the added cost for power and tankage was more than repaid and the results were consistent. Periods of agitation greater than 30 hours did not, however, show any material or commercial profitable increase in extraction of the silver. Concentration tests, carefully made by passing the material over a small canvas table, showed in every case that after treatment had been completed, the concentrate did not contain enough to pay costs of concentration, freight, and treatment charges. This matter was thoroughly checked and concentration, as a commercially profitable means toward treating this class of ores, was eliminated.

It will be noted that my method for deciding the advisability of concentrating an ore, is to extract the concentrate from a sample of the ore which has already been subjected to cyanide treatment. This, in combination with a narrow and long canvas table, which ensures catching the fine material, gives conclusive evidence one way or the other and can be afterward checked by tests on fresh portions of the sample containing the concentrate and others free from sulphides. The latter tests will show the additional consumption of chemicals, if there be any. At the time this work was carried out, Charles Butters had comparatively recently presented to the metallurgical world his admirably effective vacuum-filter and most millmen believed in giving at least one extra wash and decantation to a slime charge before sending it to the filter. More often they gave three or four. We were pretty well fixed in our ideas on this matter, at least those of us who had had previous experience with the old type of filter-press, in which, owing to the segregation of the crystalline portion of the charge in the lower part of the cake frame, complete washing of the colloidal, or upper portion, was impossible. E. M. Hamilton proposed and adopted the modern slime treatment, whereby the charge, after having been subjected to agitation until solution of metals was commercially complete, was settled, decanted, and the thickened pulp run direct to the filter, there to be washed practically free of soluble metals. This mode of procedure he had already adopted at the numerous mills of the Charles Butters company.

I tried this method on the ore in question, carefully checked it against identical samples treated by one and by several extra washes and decantations, and found that washing was practically complete on the experimental filter. In view of later practical experience of my own and of many others, these views are of course proved correct. Leaching tests on samples carefully classified wet and free from any considerable amount of colloidal slime, were made. This work, while carried out on a small scale, was entirely practical in its results, care being taken to have a leaching depth of sand equivalent to that of practical plant work, thereby giving the same conditions of packing of charge, length of column of sand through which the solution must pass, etc. Preliminary leaching tests showed that in order to obtain the best commercial result the sand must come fairly close to passing 100 mesh.

The final results were good, but when treatment was complete, the coarser material sized out, re-crushed through 200 mesh, and agitated, sufficient additional recovery of silver was shown to pay for the power and chemicals and to leave a small profit beside. Crushing through 200, or 'total sliming,' was therefore decided upon. An attempt to improve extraction by first giving the ore a sweet roast gave astonishing results, and instead of improving matters it lowered the silver extraction to a little over 10%. It would be interesting to hear of the experience of others in this connection.

The question of coarse free gold was effectively settled by a series of amalgamation tests. The crushed ore was made up to a thick pulp and, having sufficient mercury present, was thoroughly agitated in bottles. The pulp was subsequently thinned, washed free of mercury, and after dewatering, was given the regular treatment. Parallel samples were given identical treatment, but without attempting to amalgamate any gold. The results in both series of tests averaged practically the same extraction. The treatment decided upon for this class of ore was therefore essentially as follows:

1. Crushing in solution, so that no more than 2% would remain on 200 mesh.

2. When a complete charge had been milled into a tank, to add sufficient cyanide to bring the solution up to a strength of 2.5 lb. true free cyanide per ton, as determined by silver nitrate, without the iodide indicator or the addition of any caustic alkali other than that already in solution.

3. Agitation to be carried on continuously for not less than 30 hours. After decantation of the resulting solution, the charge to be run to the filter.

4. Filter-cakes to be washed, in position, with from 1½ to 2 tons of barren solution per ton of

slime, and then discharged from the filter.

5. Lime in sufficient quantity to maintain a protective alkalinity of 2.5 lb. per ton of solution in terms of sodium hydrate, to be added at the battery. In view of later practical experience with other classes of Guanacevi ores, this figure was proved to be too high, the best strength being about 2 lb. per ton or slightly under.

The unoxidized ores of the district presented a much more varied mineralogical character and a cursory description of some of the combinations encountered may be of interest. They are: (1) A clean quartz, in which the silver, as evidenced by high-grade specimens, appeared to be chiefly in the form of the sulphide, with smaller quantities of double antimonial sulphide, or stephanite. Little or no light or dark ruby silver in evidence. This ore treated easily to about 89% silver extraction. (2) A very clean ore, with little mineralization apart from the silver, small amounts of which were in the form of dark ruby, or pyrargyrite. Samples proved streaky, with regard to treatment, but the reason for this was not ascertained. Ores with gold content up to $28 per ton easily yielded over 96% extraction, with an average silver recovery of about 80% by straight cyanide. (3) A light brown ore, evidently partly oxidized. Treated to about 84% silver and over 95% of the gold. (4) A hard and heavily mineralized quartz, containing considerable quantities of pyrite and marcasite, with less galena, sphalerite, rhodochrosite, and rhodonite. It proved refractory, and an examination of high-grade specimens showed that the silver was chiefly present as argentite and stephanite, with smaller quantites of ruby silver. It yielded about 77% of its silver and 93% of its gold. (5) Ore from the same mine as No. 4 and essentially the same in character except as regards the quantity of sulphides present. It proved to be the most refractory found and yielded only 50% of its silver. About 24 hours continuous agitation was found to be sufficient for the solution of all silver capable of being removed by cyanide treatment and, as in the case of the oxidized ores, the use of other chemical agents gave no additional extraction whatever.

In view of the fact that the silver proved refractory, while the gold responded easily to treatment, in the sample, an examination of the probable chemical reactions involved in the case of the silver is of interest. This matter has already been presented in a very interesting manner by Francis J. Hobson, in a paper contributed to the *Mining and Scientific Press* some time past. I regret that I have no copy of his contribution at hand, and it must be at the risk of repeating what he may already have said in this connection, that I go into the subject.

Probably no positive knowledge of the more complicated silver reactions is available. Regarding the more simple silver combinations, it is known that: (1) Argentite and cerargyrite readily go into solution, forming double silver potassic cyanide and the corresponding alkaline sulphide and chloride, respectively; (2) that the silver thus dissolved will stay in solution in this form provided there be present sufficient zinc or lead salts to precipitate the alkaline sulphide. In treating many ores and tailings, there is enough zinc dissolved to answer the purpose, without resorting to the use of lead acetate or litharge.

With stephanite and ruby silver the case is somewhat different. It is known that these minerals are attacked by potassium hydrate, which turns them black and under favorable conditions partly dissolves them. What probably happens may best be seen by examining the following reactions. The chemical composition of the minerals in question is:

$$\text{Stephanite } (2Ag_5SbS_4) \rightarrow 5Ag_2S.Sb_2S_3$$
$$\text{Pyrargyrite } (2Ag_3SbS_3) \rightarrow 3Ag_2S.Sb_2S_3$$
$$\text{Proustite } (2Ag_3AsS_3) \rightarrow 3Ag_2S.As_2S_3$$

Under the action of potassium hydrate, stephanite, for example, would probably react as follows:

$$2Sb_2S_3 + 10KOH = 4KSbO_2 + 6KSH + 2H_2O$$

The potassium hydrosulphide thus formed would react on another portion of antimony trisulphide, thus:

$$3Sb_2S_3 + 6KSH = 6KSbS_2 + 3H_2S$$

The hydrogen sulphide formed in the above reaction might, in its nascent state, further interact with potassium hydroxide, forming nascent potassium sulphide, which would react on another portion of antimony trisulphide thus:

$$Sb_2S_3 + 3K_2S = 2K_3SbS_3$$

Of the above reactions, the first two, resulting in the formation of potassium metantimonite and metasulphantimonite, appear to me to be the most probable. It is, however, equally possible that some modification of the third, resulting in the formation of potassium sulphantimonite and potassium sulpharsenite, where proustite is involved, takes place. In any event the sulpho compounds are strong reducing agents, tending to take up oxygen and go to the mono and poly sulphoxy arsenates and antimonates. This fact takes on added importance if there be gold or native silver present in the ore.

That the action of potassium hydrate is highly beneficial in breaking down the above silver combinations, thoroughly proved by experimental work done by myself on a sample of high-grade silver ore carrying over 1200 oz. and on which ordinary treatment with potassium cyanide solution carrying enough cyanide to completely dissolve the silver, together with sufficient lead acetate to protect against re-precipitation, only served to extract some 40%. On subsequently boiling with a solution of caustic potash and resubmitting to the action of cyanide solution, sufficient additional silver was dissolved to bring the extraction up to about 90%. But while this method of recovery was interesting, from the chemical point of view, throwing some light upon the benefit to be derived from the use of strong caustic alkalies, it is unavailable in the case of practical operations, owing to the impracticability of heating up large quantities of pulp. Nor does it give uniformly good results in all cases.

The use of strong caustic soda solution failed to give satisfactory results. It is probable, therefore, that potassium hydrate is much more active, and this appears to me to be an added argument in favor of

the use of potassium cyanide in the treatment of silver ores, instead of the sodium salt, since the presence of other alkaline hydrates, such as calcium hydrate, would in the natural course of the process, liberate corresponding quantities of potassium hydrate. In fact, the activity of potassium hydrate explains perfectly the beneficial effect derived from the use of the leach liquor from wood ashes. During the year 1905, at which time I was in charge of the treatment at the Creston Colorada mill, at Minas Prietas, Sonora, I began the use of wood-ash leach, through the advice of M. F. Perry, manager of the Grand Central at that place. He used it simply as a substitute for lime, which is generally of poor quality in Mexico. The manner in which I began the use of the leach was to introduce it into the crushing solution. We were much surprised at the resulting highly increased activity of the crushing solution. I could not account for it on any known chemical grounds at the time, but believed it due to the action of the potassium carbonate upon the large excess of zinc salts present. The above experiment, however, thoroughly explains why some operators find a preliminary treatment with lime beneficial.

To return to the question of economical treatment, I found in the Guanaceví district many rebellious ores which would yield only from 40 to 70% of their silver to plain treatment, and this recovery was not increased even when agitation was carried on indefinitely. The work in question was being done for E. F. Knotts, próprietor of the Anita custom mill, and the successful handling of this class of material meant a profitable increase to his tonnage, apart from the advantage to local mine operators. The process formerly in use at this mill was chloridizing roasting with pan-amalgamation. The idea of using pan-amalgamation in connection with the cyanide process naturally suggested itself, and it was simply a question of how the two could best be combined. It is well known that considerable gold is volatilized in giving an ore a chloridizing roast. Most of the refractory ores in question carried sufficient gold to make such a loss a serious one. Tests were therefore made on the following lines and the resulting extractions proved commercially available: (1) crushing in solution; (2) ordinary cyanide treatment; (3) chloridizing roasting of the residues, with pan-amalgamation.

While an ore must contain sufficient gold or silver to stand the heavier costs of such a combined process, the resulting recovery is surprising and the added cost for the chloridizing roast is not as prohibitive as one might at first believe. The residue discharged from the vacuum-filter should be allowed to dry, as far as is practicable, in the sun, and such drying is quite thorough within a reasonable length of time in the case of a totally slimed ore, containing a large proportion of finely divided crystalline material. Some moisture is beneficial in the subsequent roasting operations, and the net result is the recovery of most of the gold and practically all of the silver. This method answers well for any ore carrying antimony or arsenic, and its availability is simply a question of what sort of treatment cost the ore will stand. It will of course be understood that I am not speaking of copper-bearing ores, but of refractory silver ores, which yield only small percentages of the valuable metals to ordinary treatment. For the less refractory unoxidized ores of the camp, partial concentration, fine grinding, with 24 hours agitation, and a thorough removal of soluble values on the vacuum-filter, was found to answer perfectly.

A study of high-grade samples leads to the conclusion that the readiness with which a silver ore responds to treatment, depends almost wholly upon the mineralogical form in which the silver is present, and, apart from the question of silver locked in particles of galena, the presence or absence of other mineral constituents in the gangue has little or no effect. In confirmation of this view it will be noted that in one and the same sample of ore the gold yielded easily, while the silver proved refractory, and this was true in many different instances.

FEBRUARY COPPER REVIEW

By Misha E. Appelbaum

During the month of February, copper sold at 12½c., and closed at 12⅜c., delivered 30 days basis, for electrolytic, and 12⅝ to 12¾c. for Lake. Business was of a hand-to-mouth nature. The domestic deliveries were slighly better than in January, and the exports were about normal. The production was at a slightly higher rate than during the month of January, with the net result of an increase in stocks of 14,200,000 lb. The consumers were much disappointed that the ratio of production to consumption was not as low or lower than in January, and as a result, they are again keeping up the policy of buying only when absolutely necessary. So long as consumers do not carry any surplus, it is difficult to see how any sustained improvement in price can take place. Considering the general retrenchment in business, and that no decided improvement in business can take place until the Supreme Court's decisions have been announced, the conclusion seems warranted that the metal has held remarkably steady, indicating that when an improvement in business does take place, slightly better prices should prevail. I, however, do not believe that a higher average than 12½ to 12¾c. will be recorded for the present year.

The Grand Canyon of the Colorado river, in Arizona, is 4500 ft. deep on the south side of the canyon opposite Bright Angel canyon. The rim on the north side at the head of Bright Angel is 6000 ft. above the river. This difference is due to a slight dip of the formation toward the south. The distance across the canyon at this place, from rim to rim, is about 14 miles. Yosemite valley could easily be lost in one of the side canyons of the Grand Canyon. There are a few mines in the Grand Canyon region, near Cataract Falls, mostly lead-silver. They are worked in a desultory way by the owners. There are also copper prospects there, these being chiefly on the plateau on both the north and the south sides of the canyon.

Discussion

Readers of the MINING AND SCIENTIFIC PRESS are invited to use this department for the discussion of technical and other matters pertaining to mining and metallurgy. The Editor welcomes the expression of views contrary to his own, believing that careful criticism is more valuable than casual compliment. Insertion of any contribution is determined by its probable interest to the readers of this journal.

Thin Rock-Sections

The Editor:

Sir—Observing the request of 'Inquirer' in your issue of February 4 for information regarding the preparation of thin rock-sections for study under the mieroseope, I submit the following as the result of my own experienee. As I understood him, he has no power apparatus, and must therefore do the work entirely by hand. I had the pleasure of making about 200 slides in this laborious manner and learned a few things which may be of interest to others who are obliged to undertake a similar task. At the outset I will say that if any sort of machine is available, or ean be improvised, upon whieh an emery or carborundum wheel ean be mounted, by all means take advantage of it, as it will save a great deal of time in the preliminary stages of slide making. The essentials of a slide-making outfit are: 1. Several pieces of plate-glass, each about 1¼ in. square. 2. Slips of glass for mounting objeets to be examined under the mieroseope, which come prepared for this purpose, being careful to select those that are not too long, or they will interfere with the rotation of the slide when on the stage of the mieroseope. 3. A supply of eover-glasses used to eover the rock-section after it has been attaehed to the glass-slip. Often these thin eovers are rather hazy in appearance, being coated with some sort of film very difficult to remove. I tried hot and cold water, alcohol, and other things in an effort to elean these eover glasses, but never got satisfaetory results until one day an old German petrographer told me to try dilute acid, sueh as vinegar or dilute nitric acid. I found diluted vinegar to answer the purpose and never had any further trouble with hazy eovers. 4. A small bottle of the best grade of Canada balsam. 5. A pair of good, thin, flat nippers. 6. A dozen or more spring elothes pins. These will be found very convenient, though not absolutely neeessary. 7. A small alcohol lamp. 8. Powdered emery or carborundum, medium coarse and fine grades, the first for cutting and the second for finishing the rock-seetions. A still finer grade of finishing powder will be required for polishing than can be bought, and this ean be obtained by washing the sections from time to time, as the grinding proeeeds, in a small tank of two compartments, the first overflowing into the second. An impalpable powder will be obtained from the bottom of the second compartment whieh may be utilized to polish the roek-sections before mounting. 9. A plate of sheet-lead about ½ in. thiek on whieh to grind the rock chips. 10. A plate of east iron or steel on whieh to finish the grinding. 11. A snitable light-weight geologieal hammer for spalling off chips of rock from hand speeimens. 12. A good store of patienee and perseveranee. With this outfit, after a little experienee and the loss of a few slides, very good rock-sections may be made by using eare. Much time will be saved if suitable thin pieees of the rock to be eut ean be obtained by chipping them from a larger piece with the hammer. This can be done very neatly after a little experienee. Do not select chips for grinding which show too mueh evidenee of having been shattered by the blow from the hammer, for they will break into small fragments before they can be finished and mounted. Some massive rocks, partieularly the softer magnesian kinds, do not readily chip off in thin flakes. With sueh the only way is to grind down a thiek chip. Soft and friable rocks which disintegrate readily should be boiled in Canada balsam before grinding is commeneed. The cooking must be done at a low temperature, otherwise the balsam will become yellow. Canada balsam is naturally a viscous liquid that does not harden readily. Heating it causes a partial evaporation to take plaee, and on eooling it becomes brittle. This property renders it partieularly useful in the preparation of thin rock-seetions.

When a chip has been selected to be ground down, a small quantity of the coarse emery powder, or carborundum, is plaeed with water on the lead sheet. If a lead sheet is not available one of iron will do, but the lead being softer the grains of emery sink into it and the entting proceeds more rapidly than on an iron plate. Plaee the ehip of rock on the plate and holding it firmly with thumb and fingers, scour it around and aronnd, on the face of the plate, keeping the ehip of rock in as nearly a level position as possible or the result will be either more than one faeet, or a rounded surfaee of the chip. The grinding should be carried well over the plate, and not around in a ring, for this would quickly wear a shallow eirenlar channel in the surface of the plate, unfitting it for further serviee. When a fair-sized area has been grounnd off on the under side of the chip, say a spaee ¾ in. square, wash the chip carefully and eontinue the grinding, but now using only the fine powder and on a different plate. If an iron plate only is used, either do the fine grinding on the reverse side of the plate, or carefully wash from it all trace of the eoarse powder, otherwise the rock-section may be spoiled. When the fine grinding and polishing have been completed, as determined by a smooth, almost glassy surface of the rock specimen, wash it with care and dry it over the flame of the lamp. When it is dry, heat one of the pieces of plate-glass, the edges of whieh have been filed or rubbed on a stone to dull them. When it is hot place on its eentre several drops of Canada balsam, using a glass stirring-rod to transfer the balsam from the bottle to the glass plate. Place the polished surfaee of the rock ehip face down upon the balsam and press it down firmly, excluding all air bubbles, and clamp it in position by means of one of the spring elothes pins. The balsam will not harden until it is eold, so either begin grinding another ehip of rock or wait patiently for the first to cool and harden. Remember the balsam will not harden unless it has been gently heated for some time. Some heat the balsam and mold it into sticks for future use. It melts

readily. When the glass is cold and the balsam brittle, the opposite side of the rock chip may be ground in the same manner as before, this being now somewhat easier, as the plate of glass affords a more secure hold upon it. As the grinding proceeds, sooner or later, depending on the character of the rock and the thickness of the chip, the section will begin to appear faintly translucent. With continued grinding this becomes more evident, until a point is reached where care has to be exercised. The slide must then be frequently washed and examined, and toward the end may even be placed for inspection under the microscope to test for transmission of light. A thick slide is never satisfactory, and it requires good judgment to know just when to stop grinding, for a rub or two too many may in an instant destroy the hard work of an hour or more. A few losses of this kind make the operator careful. All grinding, toward the end of the operation, must be done with the fine powder, for if a single grain of coarse powder now scratches the section it is likely to ruin it. Having finished the section, including the polishing, carefully wash and dry it, then gently heat the thick glass plate to which the chip is attached. Meanwhile heat one of the glass slips upon which to mount the rock-section. When hot place on it two or three drops of balsam and then, with great care, gently move the thin section from the thick to the thin glass plate, using the blade of a pocket knife, pushing carefully sideways. If the rock section does not move readily it is too cold and must be made hotter. When it slides off easily deposit it upon the drops of hot balsam on the glass slip and press it down gently but firmly upon the glass. The balsam will ooze out from under the edges of the rock-section, but this does not matter. Care must be taken to exclude all air bubbles, at this time. Heating the glass slip too hot will cause the balsam to boil, creating air bubbles between the rock-section and the glass. This is always to be carefully avoided. When the rock-section has been well set on the glass slip, let a drop or two of balsam fall upon it and immediately cover with one of the thin glass covers, pressing it down and again being careful to exclude air bubbles. I prefer square cover-glasses, though some like round ones. If the slide be too hot to use the fingers, press the cover-glass down with a small cork. Clamp the finished slide with a spring-pin, using one having not too strong a spring or it may break the frail cover-glass. Allow it to cool thoroughly. When cold scrape off the excess balsam with a knife blade, wash carefully with alcohol, rub dry and clean. The slide is now finished and ready for the microscope. Although slides may be prepared much more rapidly by machinery, they are no better than those made in the manner here described, for the finishing—the fine touches—has to be done by hand, anyway, to get the best results. Slide-making is laborious and painstaking work, but it is full of interest from beginning to end, and the laborer feels well paid for his work if he gets a good slide.

WILLIAM H. STORMS.

Berkeley, California, February 8.

Inquartation of Assay Buttons

The Editor:

Sir—In the correct assaying of many gold ores, an addition of silver is required, either in the crucible or to the lead button before cupellation. The object of this is to serve as a collector of the gold to prevent the loss of the otherwise minute button in cracks formed in the cupel, to so dilute the gold that the cupel loss may bear a comparatively small proportion to the gold sought, and to indicate the possible presence of tellurium. Where the silver present in the ore is also required, this silver addition necessitates a separate assay for that purpose. Various methods have been proposed to make this silver addition so accurate that a correction could be made for it, and the extra assay and frequent re-assays required because of the accidents which occur in handling small buttons might be done away with.

The use of solutions of silver has not proved satisfactory in my experience. With the concentration permissible, sufficiently close measurements are not possible, and frequently some of the solution is absorbed by the crucible before reduction. Alloys have not been successful, owing to the irregularities caused by liquation. I have not found punching silver foil accurate enough for the purpose, but have finally succeeded in getting close results by using silver wire. This is of uniform density and may be drawn to any required degree of fineness. There are various methods of cutting this regularly; for example, by winding around a knife-blade of uniform width and cutting carefully along the edge, or by using a glass rod and cutting along a line. The various pieces check close enough for ordinary work, or they may be arranged in classes of equal value.

I have devised a simple cutter (which I hope to perfect), that cuts 20-gauge wire into pellets weighing 35 mg. which do not vary over 0.05 mg. and which could be sold at a good profit at less than fifty cents per hundred pellets. It can be seen that this method adds to the accurracy of the assay, lessens the cost, and increases the output. A blank assay is run with a pellet, and the resultant button flattened and used as a counterpoise with other assays using similar pellets. This pellet is used with the weights and the reading of the weights taken, ignoring its value. The cupel loss is automatically corrected, and two crucibles may be made to serve as a control for both gold and silver.

GEO. A. JAMES.

San Francisco, March 4.

Natural ventilation in mines in some regions is noticeably affected by atmospheric conditions, particularly where the difference in elevation between the two or more entries to the underground workings is small. This condition has been frequently observed in the Cripple Creek district. On some days there, when the barometer is low, the ventilation of the mines is very poor unless artificial air currents are created by fans or blowers.

Special Correspondence

LONDON

The Oroville Dredging Co.—Pato Mines, Ltd. — Oroville Exploration. —Half-Yearly Reports of Cornish Tin Mines.

The official news about dredging operations at Oroville, California, is more readily obtainable in London than on the spot, though the information published here is not at all up-to-date. It will be remembered that the Oroville Dredging Co. was formed in America in 1905, to consolidate a number of gold-dredging companies operating in California. As a large proportion of the shares were held in England, a new company was formed under English law in June 1909 to acquire the shares of the American company and eventually to take over the direct management of the properties. The English company has now issued a report covering the period from its incorporation in June 1909 to September 30, 1910. This shows that the exchange of shares is not yet complete, as several American holders have not yet sent consent, and consequently the American company is still continuing in existence and acting as owner and manager of the properties. Accompanying the report of the English company is the report of the American company for the year ended July 31, 1910. Shortly after the incorporation of the English company, the Pato gravel mine on the Nechi river, Colombia, was acquired, and a subsidiary called the Pato Mines (Colombia) Ltd. formed in England with a capital of £100,000 to work it. The purchase price paid to the owners of the property was 25,001 shares, and £11,000 in cash, and 74,993 shares were allotted to the American company as purchase consideration. The working capital for the Pato Mines was to be provided by the issue of debentures, but owing to the opposition of the owners of the Pato property, 8% income notes are being issued instead. The money is being provided out of the profits of the American company and the notes are to be redeemed by the allocation of 75% of the net profits of the Pato company every year. Up to December 31, the American company has advanced $271,017, and probably the whole amount required will be about £100,000. It is estimated that the Pato property will before long be making £40,000 per year profit. During the time that this financing of the Pato mine is being done the Oroville companies are paying no dividends. The report of the American Oroville company for the year ended July 31, shows that at the four properties, 5,661,612 cu. yd. of gravel yielded gold worth $561,569, with a net profit of $275,452. The Oroville Exploration was the largest and most profitable producer, the amount handled being 2,885,074 cu. yd., the production $317,270, and the profit $199,168. The extraction per cubic yard was 11c. and the cost 1.09c The Bear River property, as before, has been worked at a loss. The area left for the three profitable companies to work is sufficient for six years operations. The Bear River ground is not included in the estimate, though W. P. Hammon, the manager, considers that the advances made in dredge design will make this tract profitable later on

A batch of half-yearly reports of Cornish tin-mining companies have been issued this week. The report of Dolcoath for the second half of 1910 shows that 44,659 tons of ore was raised and treated, yielding 878 tons of concentrate, which sold for £85,819. The yield per ton was 44 lb., and the average price received per ton of concentrate was £97 15s. or 38s. 5d. per ton of ore. The amount of ore treated was 2620 tons less than in the previous half-year, the reason being that 60 of the old stamps have been dismantled. It is expected that 8 of the 12 new Holman air-cushion stamps will start work this month. The decrease in ore treated was more than compensated by a rise of 3.63 lb. per ton in the extraction and by the increase of £9 1s. in the average price obtained. The total receipts for the half-year were £87,043, the working costs £56,807, and lord's royalties £5721, leaving a profit of £24,515, as compared with £13,018 during the previous half-year. The dividends of 9d. declared in December and 6d. now announced absorb £21,500, and £3449 has been written off for depreciation. The continued high price of tin makes the present situation most satisfactory. The new main shaft has been sunk to 3000 ft., the present intended depth, and the pump stations have been finished. A cross-cut has been driven southward to cut the main lode and the equipment of the shaft with rail guides is now in hand. It is expected that everything will be ready by the middle of May. An analysis of the accounts shows that the cost of working was 25s. 5d. per ton, or 28s. per ton including lord's royalties. The report of Carn Brea & Tincroft for the same half-yearly period shows that the receipts and expenditures have practically balanced. This compares with losses of several thousand pounds during the last two or three years. The amount of ore raised was 38,892 tons, and 473 tons of tin concentrate was produced. This was an extraction of 27¼ lb. per ton, which is 3 lb. less than the average during the previous three years. The average price obtained was £82, the highest price since 1907; the total amount received was £38,930 and the receipts per ton of ore 20s. In addition, £2202 was received from the sale of copper, arsenic, and wolfram concentrates. The working cost was £40,689, to which is added £1507 for lord's royalties, the net result for the half-year's work being a profit of £13. In recording the progress of this company six months ago I described at considerable length the old method of mining and concentration and quoted R. Arthur Thomas' report on the subject, together with his recommendations. I then recorded that Viscount Clifden, one of the lords, had undertaken to provide a magnetic separator for the better treatment of the ore found at North Tincroft. This plant is now in place and should be at work by the time this notice is published. The other lord, Mr. Basset, has undertaken to contribute to the cost of certain development work, up to a sum equal to his royalties during two years. The managers give details of underground developments, but have no important discoveries to announce. The capital funds of the company are running low, but it is hoped by reason of the present high price of tin and of the improved dressing methods to accumulate a working surplus during the current year, so that it may not be necessary after all to reconstruct. Perhaps the report of the Grenville company is the most interesting, for it shows that the new manager is trying to break away from the time honored practice, almost universal in Cornwall, of buying mine supplies from individual directors or shareholders. Cornishmen know only too well that mining in that county is a sort of family party, and that timber, machinery, etc., are bought without any public competition, but from people interested in or controlling operations in the mine. In addition, there is no real competition for the sale of the tin concentrate, and less is received than would be the case if the concentrate were sold to Germany. The consequence is that the cost is too high and the income too low. Though the community may benefit by this family arrangement, the shareholders, as shareholders, do not get much return. Take the case of most of the companies working near Camborne and ask where they buy timber; the answer is, from Mr. Harvey, our chairman; where do they buy machinery and drills? From Mr. Holman, a director. To whom do they sell their tin concentrate? To Mr. Pearce, Mr. Bolitho, Mr. Bain, or Mr. Lanyon, any of whom may be on the board. Far be it from me to say that this system is carried out in an immoral way, or that the community is treated badly by it; but it is obvious that the system does not allow the manager a free hand in beating down the sellers of supplies for the benefit of his mine. The fact that Mr. Battens has decided to advertise his requirements in the way of supplies is sufficiently remarkable to warrant special notice. However, to return to the Grenville: The mine is situated to the south of Camborne and has been worked for many years under the old cost-book system. The company was reorganized under limited liability in July 1906. The ore is fairly clean, containing little wolfram or pyrite, so that the concentrate brings a good average price. The mining and metallurgical equipment is of the old Cornish

type. The report for the half-year ended December 31 shows that 21,047 tons of ore was raised and 298 tons of concentrate sold, being an extraction of 32¾ lb. per ton. The price received was £29,485 or £99 per ton, a figure which, when compared with that of Carn Brea & Tincroft, shows the high quality of the concentrate. The balance of profit, after paying £1077 as lord's royalty, was £4308. The half-year began with a debit balance of £10,465 and ends with one of £6157. During the period under review the heavy rain has caused serious flooding in the lower levels, and it has not been possible to gain access to the best ore. The water-level is, however, being lowered again. Mr. Battens is strengthening the pumps with the object of combating the water in a more efficient manner. He also reports that he has inaugurated a better method of sampling, so that less low-grade ore and waste is now being mined.

NEW YORK

Report of Copper Producers.—Comment on Copper Situation.—Cessation of Mexican Investments.—Adverse Market Factors.—The Calumet & Hecla Merger.—Hedley Gold M. Co.—Profits of Federal Co.—United Rico.

The report of the Copper Producers' Association, covering the month of February, shows an increase in copper stocks of 14,198,280 lb., which, with the January increase of approximately twenty million pounds, makes a total of 34,000,000 lb. gain since the first of the year. But for the fact that domestic deliveries increased during the short month the showing would have been even more unfavorable. Domestic consumers took 50,518,998 lb. in February, as against a home consumption in January of 42,078,557 lb. The anticipated completion of equipment for the new copper properties has been much talked about during the last year, and pride taken in the magnitude of those mines and their probable production. Now nothing is heard of the first results at the Ray Consolidated, and the Miami, where the first units of the concentrating plants are being started. It is not strange that, in the face of prevailing conditions, the copper-share market should have few followers, nor that a huge output should no longer be considered a good argument in favor of any specific copper issue. It is not alone North American porphyries that are to be considered, as production in other parts of the world is on the increase. J. B. Haggin's Cerro de Pasco mine in Peru has cost a large amount of money, but it will now become a factor in the metal market, with a possible production of approximately seventy million pounds of copper per annum. Australia's output is not large, but it is increasing; the copper mines of Africa have figured mostly so far as stalking-horses, but in due time they, too, will be turning out copper. All of which is good argument for the consumer and held to be ample reason for the adoption of the present policy of allowing the producers to carry the burden of all of the metal up to the moment it goes into mill or factory. While copper for a year or more has been the centre of public interest in the East, there has been for a long time a constantly growing investment in Mexico. Just what the present situation means is not known. The order for the massing of troops along the Rio Grande, and the assembling of the fleet off the Gulf coast, may or may not mean a grave crisis in Mexican affairs, but it does mean cessation of investment for the time being. One well known promoter of mining enterprises, who has been connected with several successful Mexican mines, remarked that there were several thousand poorly financed and worse managed Mexican companies that would welcome a serious revolution, as it would give the managers an excuse to quit. It is probable that many an investor, following up his money, will hear the story that the revolution stopped all operations.

The unsatisfactory conditions prevailing in the outside market in New York is causing many of the more important mining issues to seek admission to the Exchanges. Ray Consolidated and Chino are trying to satisfy the listing committee of the New York Stock Exchange; Tuolumne Copper, Mason Valley, and Inspiration have been admitted to the Boston Stock Exchange, and other important issues are to follow, especially if the listing committee of the New York Stock Exchange can be induced to extend any privileges to companies whose properties have not reached the producing stage. The market has so many adverse factors to contend against just now that it can not be expected to make progress. The possibilities of trouble in Mexico are doubtless magnified, but the uncertainty is enough to drive traders from the market; add to this the special session of Congress with tariff revision almost a certainty; the recent decision of the Interstate Commerce Commission is not now considered so drastic, but it has strengthened the impression that the coming decisions by the United States Supreme Court will be radically against the corporations. Thus it is not surprising that the market should register low prices for the year, and that trading should fall to almost nothing. The Calumet & Hecla consolidation has not been abandoned, as it was reported it would be when it was made apparent that obstructive litigation would be begun. Inasmuch as temporary restraining orders have been issued by the Federal Court in Michigan, the Calumet & Hecla management has resorted to the expedient of informal action by the various companies. At a meeting held this week for the purpose in Boston, the Calumet & Hecla shareholders, representing over three-fourths of the issued stock, voted unanimously in favor of the proposed merger. The Allouez meeting was held on the same day and resulted in a safe majority in favor of the merger. While these expressions of opinion are not binding and the votes will all have to be taken again, the record of such action will be the strongest argument in Court, and undoubtedly will be used to show that the dissenters are a small minority. The stockholders of the Ahmeek, Centennial, Superior, and Tamarack are now all informally recorded in favor of the merger by majorities that make such action practically unanimous. That part of the public that cares to do so is now able to get the inside history of the career of Union Copper, in which Walter George Newman was a specialist for a long time and which was used as the vehicle of more than one picturesque coup by Newman. The story is being told in the bankruptcy proceedings of Sig. H. Rosenblatt & Co. One of the chief parties in interest in Union Copper is James H. Phillips, Jr., of the Nevada Consolidated.

The Hedley Gold Mining Co. makes a satisfactory annual report for 1910, showing gross earnings of $519,356; expense, $255,370; net, $263,986, which is equal to nearly 23% upon the issued capital of $1,200,000. The Hedley company operates what is known as the Nickel Plate mine and mill, situated in the Yale district, in Hope mountains of British Columbia. It is paying 3% quarterly and the last distribution just declared is increased by a 2% extra disbursement. The Federal Mining & Smelting Co. has been the centre of some market activity recently, and shareholders have been taking more interest, owing to increased earnings; the past quarter shows a profit of $345,000, which, after deducting the dividend on the preferred, leaves a surplus equal to 9% per annum on the common. The reorganization committee of the United Rico Mines Co., of Rico, Colorado, is extending the time for the deposit of bonds and stocks under the reorganization plan. This company was floated in the East by a New York Stock Exchange house and there are a good many grievances owing to the failure of the company's operations to produce any profit, and the apparent abandonment of the concern by the interests at one time most prominent in it. Another example of the interlacing of copper interests is to be noted in the possible absorption of the United Metals Selling Co. by the Amalgamated Copper Co. This move will make Amalgamated the largest holder in the International Smelting & Refining Co., as the United Metals owns 40,000 of the 100,000 shares of International Smelting & Refining outstanding. The Arizona Copper Co. is to issue debentures for £200,000 to finance the rehabilitation of the plant. Recent development work is said to have developed some smelting ore sampling as high as 7% copper.

SALT LAKE, UTAH

Two Lead Furnaces Being Installed at International Smelter.—Operations of Bingham Mines Co. — Notes on Park City and Tintic.

Definite announcement is made that the International S. & R. Co. will install two furnaces, each of 500 tons capacity, for the treatment of lead ores. The outlay will be $500,000, and about 100 men will be added to the force. Work on the new furnaces will commence at once, so that the plant will be ready to treat ores of this class as soon as possible, and the purchasing of lead-bearing ores will be commenced when the bins are ready for them. Only Utah ores will be sought at first, but the field will be extended and the plant enlarged as occasion requires. The annual report of the Commercial mine, operated by the Bingham Mines Co., shows a profit for 1910 of $65,902, about $10,000 more than in 1909. The earnings would have been greater but for the fact that the company was obliged to move all of its surface buildings last fall and drive another tunnel through which to work. This was due to the fact that the Utah Copper Co. acquired

Map of Utah.

the old tunnel site and needed it for dumping purposes. The new tunnel gives greater depth, with a correspondingly less distance to hoist ore and pump water, so eventually the Commercial will be the gainer. The Dalton and Lark mines, also part of the Bingham Mines Co. holdings, made an increase in production and earnings, 12,536 tons of ore having been produced, of a value of $153,047. The total production of the two mines was: gold, 2140 oz.; silver, 169,974 oz.; copper, 1,031,241 lb.; lead, 3,411,499 lb. Treasury balance of the company is $124,000. By a decision of the Secretary of the Interior, the Nemesis claim, owned by E. A. Wall, has been canceled. Patent on this claim was applied for over eight years ago and contested by the United States S. R. & M. Co. The first decision eliminated all but less than an acre of the Nemesis, and on an appeal it is decided that this is also overlapped by locations of the United States company.

The annual report of the Daly-Judge shows that during the past year the net profits were $94,177, and the cash balance January 1, $316,215. Included in the disbursements was an item of $36,000 as advance rental on the Ontario tunnel for three years which was required by the contract. This item will not appear again until three years after the Daly-Judge extension of the tunnel is completed, so that actual profits were $130,000. Production for the year was 1253.19 oz. gold, 633,539 oz. silver, 10,755,841 lb. lead, 9,880,525 lb. zinc, 393,170 lb. copper, which were sold for $552,100.80. The drift from the Ontario tunnel, which is being driven to the Thompson-Quincy, is within 150 ft. of the latter's side-lines, and within another two months this company should be getting the benefits of it. Ernest Bamberger has resigned as general manager of the Daly West, and has been succeeded by H. G. McMillan, who has been a director of the company for some time.

The stockholders of the Tintic Empire, Tintic Combination, and Bullock have ratified the agreement entered into by the boards of directors to consolidate the three companies as the United Tintic Mines. The new company will be capitalized for 2,000,000 shares, half of which is to remain in the treasury and the other half is to be exchanged for old stock, share for share. The consolidated property comprises 28 claims along the Bullock and Aspinwall veins. Operators of the Knight mines have made a contract with the A. S. & R. Co. to supply a minimum of 250 tons of ore per day. They have also a 70-ton contract with the International, so that they will be required to mine and ship 10,000 tons per month. Most of the increased tonnage will come from the Iron Blossom. Directors of the Uncle Sam have declared a quarterly dividend of 5c. per share, amounting to $25,000, the same as last quarter. Beck Tunnel operators have tapped the orebody of the Uncle Sam, 12 ft. above where the latter found it, and have followed it south along the line which has been agreed upon between the two properties for 125 ft. The body is 12 ft. thick and 50 ft. wide at this point. The orebody found on the 1050-ft. level of the Victoria is proving better than was expected. Two carloads have been shipped, but smelter returns have not been received. The Colorado made a shipment recently of one 40-ton carload which brought $25,000. The week's shipments from Tintic mines amounted to 171 carloads, and for the first time in months Centennial-Eureka did not head the list, Iron Blossom shipping 43 cars and Centennial-Eureka 37. The Union Chief at Santaquin has commenced shipping, having sent out a 35-ton carload which netted $1000.

BUTTE, MONTANA

Boston & Montana Co. Dissolved. — The Crescent at Philipsburg. — Tendency to Reopen Idle Mines. — The Conrey Placers. — Anaconda Co. Buys Lime Quarries.—Litigation.

The Boston & Montana Con. Copper & Silver M. Co. has been dissolved in accordance with the application made to the District Court by the directors of the company. This action was taken by direction of the stockholders December 27 last, as a result of the property having been sold to the Anaconda Copper M. Co., under the terms of the merger agreement, for 1,200,000 shares of Anaconda company stock. Soon after the application for dissolution was made, one Louis Seasongood, of Cincinnati, sent a notice to the clerk of the district court in this city, saying that as the holder of 25 shares of stock he was opposed to the dissolution and proposed to fight the same. In consequence of Mr. Seasongood's statement, the hearing of the application was continued for a week, and under the court's order a notice was sent to him. Instead of coming in person to the hearing or engaging an attorney, he wrote another letter asking for a further continuance for two weeks. This was deemed unfair, and was opposed by the representative of the Boston & Montana company, the court taking the same view. Evidence was accordingly heard as to the indebtedness of the company having been discharged, and the fact that the property had been transferred to the Anaconda company, after which the court issued an order dissolving the corporation.

While conditions are not favorable to the starting of new mining enterprises, there is a tendency all over the State to revive mining properties which have been idle for many years, showing a good degree of confidence in the future. In some cases such properties have ore of good grade, but the method of treatment is antiquated.

With the adoption of modern methods, good results can be achieved. In Madison county many owners of claims in Alder Gulch district refused to dispose of their interests, declaring that they are going to install new machinery and work the properties themselves. In this district it is reported that there are 10 to 12 claims which have not been worked for 12 to 15 years on which there will be activity next spring and summer. In Ruby valley, where the Conrey Placer company has been operating three dredges all winter, the fourth dredge will be started in the course of the next three weeks. The company has planned for extensive work this season. The Granite-Bimetallic company, operating near Philipsburg, has recently finished a 4-mile ditch to carry water from Stony lake to its placer and sapphire ground. Other placer miners are working along the tributaries of Rock creek. Indications are that the season will be prosperous in Granite county. In the Georgetown district, south of Anaconda, the probability is that no properties will be idle in the course of another month, a condition of affairs which has not existed for many years. Chicago capital has been invested in the Crescent company property, on Stony creek, near Philipsburg, and a season of activity is anticipated. The 10-stamp mill, connected with the mine, has been started, and as soon as the addition to the building is completed, ten more stamps will be crushing ore. The machinery is all on the ground. There are sixteen claims in the group, but the greater part of the work is being done on the Trenton, and in this claim alone there is said to be enough ore to keep the 20-stamp mill operating for several years. The property is developed by 4700 feet of adits. Ore treatment in the cyanide plant is successful, and material for several more tanks has been ordered. The Pilot Butte Mining Co., organized by people of Milwaukee, St. Paul, and this city, has taken over the Pilot Butte claim and expects to begin operation in about three weeks. Machinery ordered is being placed in position. This claim is surrounded by producing properties, such as the Badger State, the Elm Orlu, the Black Rock of the Butte & Superior company, and the Berlin of the North Butte company. There is a belief that the claim contains the Berlin vein and also an extension of the copper vein now being developed by the Badger State. The Pilot Butte has a 3-compartment shaft, 530 ft. deep, and it is proposed to sink till 1000 ft. depth has been reached. An effort is being made with the Butte & Superior company to arrange to run a cross-cut from the 1200-ft. level of the Black Rock shaft. This will provide a means of ventilation for both properties. The Anaconda company hereafter will supply its own fluxing material for the Great Falls smelter. It recently purchased the lime-quarries of W. H. Albright for the sum of $100,000. The ground secured consists of 1500 acres and does not include the water rights, nor gypsum deposits. The Great Falls smelter requires about 600 tons of limestone daily.

The Court of Appeals of San Francisco, in handing down its decision in favor of the Anaconda Copper Mining Co. against the Deer Lodge ranchers, gave the latter a chance to bring the case before the United States court by means of a writ of review, and one of the attorneys for the ranchers says that the opportunity will be embraced. The ranchers alleged in their case, which was heard before a Master in Chancery appointed by Judge William H. Hunt, that the smoke and poisonous gases emitted from the big stack of the Washoe smelter killed their vegetables and grasses and poisoned their cattle. After Judge Hunt had gone over a transcript of the evidence he gave his decision in favor of the Anaconda company and the case was taken on appeal, with the result as stated above. The Deer Lodge ranchers sought to close down the smelter, and this would have had the effect of throwing thousands of men out of work and the closing down of the greater number of mines in this city.

The Butte & Ballaklava company has filed its answer to the suit of the Anaconda company for $750,000, the value of ore alleged to have been extracted from ground belonging to the latter company. In the answer the Butte & Ballaklava company asserts that no location of the Right Bower claim was ever made, nor was any notice or location of the same verified by law ever filed, until long after December 15, 1879, at which time the notice of location of the Ballaklava claim was filed, and that the location notice of the Right Bower claim placed on record was wholly void for the reason that it was not made on oath, and that the oath of verification affixed thereto did not recite or aver the truth of the matters set forth in the notice or declaratory statement. It is further set forth in the answer that the patent to the Right Bower claim was not issued until long after December 15, 1879. The Butte & Ballaklava company maintains that by reason of prior location, even if the Right Bower vein unites with the Ballaklava vein at depth, the apex is in the Ballaklava claim and that the Ballaklava company is the owner of all ores in such veins below the point of union as against any claims thereto that may be asserted on the part of the plaintiff or any owner of the Right Bower claim. It is denied that the Mountain Chief vein is disclosed on any level of the Ballaklava mine below the 500-ft. level, or that the said vein is disclosed in any workings from the Ballaklava company's shaft to which the plaintiff has not been able to obtain access. It is further denied that the Mountain Chief vein continues on its dip in a general southwesterly direction, or that it so far departs from a perpendicular as to extend through the south sideline of the Mountain Chief lode claim, or into or beneath the Ballaklava lode claim. It is admitted that there is a vein in the Right Bower claim and that in its dip it is carried through the Mountain Chief claim. It is denied that ore has been extracted from the Mountain Chief or Right Bower in excess of $750,000 or in any amount greater than $150,000. It is also asserted that the Anaconda company extracted ore from the Ballaklava lode claim to the value of $864,130 and asks for judgment on this amount.

JOHANNESBURG, TRANSVAAL

The Premier Diamond Co. — Transvaal's Gold Output for January. — The Rand Mines and their January Production.—City Deep Mine. —Mine Earnings.—Tin Mining.

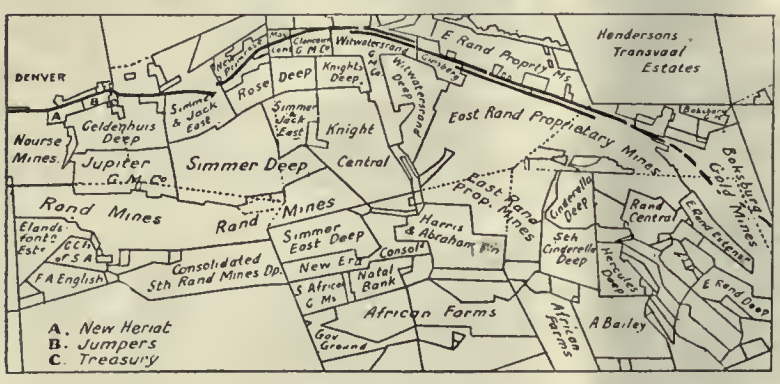
An advance copy of the eighth annual report of the Premier (Transvaal) Diamond Mining Co., Ltd., has just been issued. The significant features of the statement now submitted to shareholders in this, the second largest diamond mining company in the world, are (1) a much larger scale of operations as compared with the previous year, and (2) an improved selling price for the company's product. As regards the enlarged scale of operations, it is important to note that the material handled was increased by 2,253,565 loads as compared with that of the preceding year. The directors state that the average price realized per carat improved from 12s. 6.29d. to 13s. 11.39d. during the year. Furthermore, it is stated on authority of the general manager in London that "the prospects of a good and sound business during the coming year are very bright indeed." In commenting on the results secured during the year, which have yielded a profit of £541,191 13s. 7d., or £102,380 13s. more than in the preceding year, the directors state "the scarcity of labor has not yet been overcome and is consequently a cause of much anxiety to your directors. Every endeavor is being made to raise the labor force to at least the minimum required for operating the whole plant, now complete, and thus insure the best results. Experience has shown that a deficiency in labor must be reckoned with at one time or another during every year, and it is now a serious problem to minimize this risk." A large amount of development was carried out in the mine during the year. The Premier pipe has now been worked down to an average depth of 125 ft. The fifth level has been opened at a depth of 210 ft., and the material above this level represents 20,000,000 loads. Among the many interesting features contained in the report of W. McHardy, general manager for the

company, mention may be made of the equipment of the mine with search-lights in place of the arc lamps previously employed, and which were damaged by blasting operations. In huge open-workings, such as that of the Premier mine, search-lights erected on the edge of the pipe would appear to be almost ideal for lighting purposes and for the detection of theft. At the Premier they have proved satisfactory, both as to efficiency and economy, and it has been decided to complete the equipment of the mine in this respect by the installation of five additional search-lights.

The gold output of the Transvaal for January has been declared at 651,027 oz. of fine gold, of the value of £2,765,386. This compares with an output of 640,995 oz., valued at £2,722,775 announced as the result of the previous month's operations. The increase amounts, therefore, to 10,032 oz., or £42,611, but falls about £9000 below the Transvaal's production for October 1910. In January the Witwatersrand contributed £2,658,338 to the total, outside districts (Lydenburg, Barberton, Klerksdorp, and Heidelberg) producing £107,048. The leading productive mines on the Rand last month are given below, with output of each mine:

Mine.	Locality.	Output.
East Rand Proprietary Mines.	East Rand	£254,201
Crown Mines	Central Rand	223,193
Randfontein South	West Rand	132,172
Robinson	Central Rand	113,475
Geldenhuis Deep	East-Central Rand..	96,024
Simmer & Jack	East-Central Rand..	89,190

Among the features of last month's production is the declaration of an output of 3576 oz., worth £15,190, by the City Deep mine, the great Eckstein-Wernher-Beit deep-level which is assured of becoming one of the leading gold producers of the world at a comparatively early date.



Part of the East Rand.

This is the City Deep's initial declaration, and it affords, of course, no reliable criterion as to the productive potentiality of the company, since the first crushing operations have been attended by the disadvantages incidental to the starting of a large plant. A considerable amount of gold has, of course, been absorbed in the setting of the plates and is in circulation in the cyanide plant. Furthermore, the quantity and efficiency of the native labor employed has left much to be desired, and at the outset of productive operations trouble was experienced with the balance-ropes. These matters are being adjusted, and the City Deep company may be expected to record large outputs. The profits of the leading mines for last month are as follows: Crown Mines, £104,000; East Rand Proprietary, £103,058; Robinson, £78,050; Simmer & Jack, £49,873; Village Main Reef, £39,313; Ferreira Deep, £33,650. The above does not include any of the profits earned by the Randfontein mines, for which figures are not, at the moment of writing, available.

The improved prices for tin prevailing in Europe and America have quickened interest in tin mining in South Africa, and a feature of the Johannesburg Stock Exchange dealings during the past fortnight has been the activity displayed in connection with Transvaal and Swazieland tin stocks, particularly with regard to the Zaaiplaats and Swanzie tin companies. The output of the former for last month was 162 tons of 70% concentrate, and it is understood that a wealthy London and Johannesburg mining house is negotiating for the acquisition of a substantial interest in the company. The question of erecting smelting works in the Transvaal province to treat the products of the various mines now declaring outputs has again come up for consideration, but the consensus of opinion at present appears to be that, for the time being, the project is premature. The gold output of the Witwatersrand for the current year is likely to mark a big advance over that for 1910. In addition to the City Deep, two or three other big new producers will be adding their quotas to the 1911 output. For instance, the Randfontein Central Co. has just started 300 of the 600 stamps erected on the property, and the new mill of the Brakpan Mines Co., which will have a capacity of 60,000 tons per month, is rapidly nearing completion.

HOUGHTON, MICHIGAN

Cost of Mining and Milling Native Copper Ores.—What to Include in Operating Costs. — Tonnage Costs and Costs of Finished Copper.

The Calumet & Hecla management is credited, in the press, with an ambition to reach the basis of 'dollar rock.' By this figure is meant a total cost of mining and milling ore carrying native copper of $1 per short ton. This figure never has been reached in the Lake Superior district, and although costs have been decreasing almost since the beginning of mining operations, nearly seventy years ago, much further progress must be made before dollar rock is reached by any mine in this district. All of the leading mines show substantial reductions in operating costs, per ton of ore stamped, during the past decade. The pioneer of the field in low tonnage-cost was the old Delaware mine in Keweenaw county, working a conglomerate bed supposed to be a northern extension of either the Allouez or conglomerate lodes of Houghton county, which, nearly thirty years ago, mined and stamped its ore at a cost of $1.27 per ton, under the management of Charles H. Palmer, a veteran miner, who is still active, though in other fields. The Delaware was unsuccessful, however, because of the exceedingly low average content of copper. Some twenty years ago the Atlantic mine managed to get its costs under $1.50 per ton, and eventually reached about $1.30 per ton. None of the other mines of the district are yet as low as the Atlantic was before it was ruined four years ago through air-blasts. The matter of tonnage costs, while of supreme importance, is complicated by a variety of prime factors. The first of these to come up for consideration is the matter of development costs. It was the habit of the mine managements, except the Calumet & Hecla, in the early days and until a comparatively recent period, to carry a construction account, to which was charged all extraordinary expenses, such as new shafts, machinery, equipment, and general surface improvements, beyond ordinary repairs. By reason of this convenient construction account, which proved a catch-all for miscellaneous costs, it was possible for many mines that actually were losing money, to figure out annual profits on production, and great was the grief of confiding shareholders, after years of such paper profits, to be faced with the necessity of further assessments, absolutely imperative for financing operations. The construction account enjoys less favor than formerly, but it is obvious that the matter of unusual development and construction costs must be taken into consideration in arriving at a just estimate, not only of present costs, but of future possibilities. For instance, the Ahmeek mine, which is one of the best new mines in the district, showed a cost of almost 15½c. per pound for finished copper, and as the average price for which the metal was sold that year

was only 13.37c. per pound, the year's results, on their face, were most unsatisfactory; but, as a matter of fact, the high cost was due to charging directly to operating expenses very large sums required for sinking new shafts which were not productive, adding new hoists and general machinery equipment, building, constructing, and equipping a new mill, and adding a great deal of miscellaneous building. While a considerable amount of outlay is required every year for construction work, including the various items of new shafts, new machinery, new buildings, and remodeling of mining and milling plants, it is obvious that this should be charged direct to operating costs, as such construction expense is a continuing charge. The difficulty in this case lies in striking a fair average, as construction costs necessarily are much heavier in some years than others, at the old mines. In the case of the new mines, such as Ahmeek, having everything to provide, at the start, construction costs necessarily are exceedingly high, but as these provide permanent equipment, allowance must be made for the unduly high cost of finished copper, when including the heavy expenditures required to open and equip the mines.

'Dollar rock' would mean much to the Lake Superior district, as with copper at 12½c. per pound, it would permit a developed and equipped mine to make expenses on copper-bearing ore averaging a net mill-run of only about 10 lb. of blister copper per ton of ore stamped. That 'dollar rock' may be reached eventually, by some of the mines more favorably situated for cheap tonnage costs, it is reasonable to infer, from the steady reduction in figures of costs, per ton of rock, that has been effected since the beginning of mining work in this district. The cost of mining and milling, per ton of ore, necessarily varies from the cost of finished copper per pound. In the case of the old Atlantic mine, before referred to, tonnage costs were low, but finished copper costs were high. Tonnage costs were low because the Atlantic ash-bed, of about 15 ft. average width, was mined from wall to wall and the entire product stamped, without selection, while finished copper costs were high because the ash-bed averaged a return of only about 13½ lb. of copper per ton of ore stamped. It is obvious that a low-grade mine, having a wide bed, can secure cheap costs per ton of ore, but will be unable to make cheap copper, while a mine having a narrow bed or vein, like the branch vein of the Michigan mine, can make cheap copper, though at high costs per ton of ore stamped. Up to and including the production of 'mineral,' which is the native copper with gangue rock adhering that is produced at the mills, one mine can produce copper about as cheaply as another, making necessary allowances for width of lode, depth of workings, and difference in cost between amygdaloidal and conglomerate beds, in both mining and milling, owing to the more refractory nature of the conglomerate, but thenceforward the costs vary according to the amount of copper recovered. It costs little more, if any, to mine and mill a ton of ore from a rich bed than a ton of ore from a lean bed. In fact, the Baltic and Champion mines of the Copper range probably are able to mine and mill a ton of ore cheaper, on the average, than one can be mined and milled from the Isle Royale mine, only a few miles distant, for the reason that the Baltic lode of the Baltic and Champion mines is considerably wider than the Isle Royale and Portage beds of the Isle Royale mine. From the point of milling onward to the production of finished copper, the Champion and Baltic mines show much higher costs, for the reason that their bed carries 75 to 100% more copper than the beds of the Isle Royale mine, and costs of smelting, freight, insurance, and commissions on sales are fairly constant factors. The cost of preliminary crushing, done in 'rock-houses' at the mines, is 4 to 6 cents per ton, in the case of mines having modern equipments, and much higher with some of the small mines having poor crushing plants. The cost of final crushing at the stamp-mills has been reduced largely from the inception of milling, and within the last 15 years has been practically cut one-half at the best mills.

General Mining News

ALASKA

Reports from Seattle show that all steamships bound for southern and southeastern Alaska are carrying hundreds of prospectors, miners, and tradesmen to such ports as Cordova, Valdez, Seward, and Skagway, and from those places the travelers will make their way over the snow and ice trails to interior points before such trails and streams become impassable with the opening of spring. Many of those going in early are men who have been in the country before, and most of them are going to the Tanana, Innoko, the upper Kuskokwim, the Yukon, and their tributaries, including the Koyukuk. There is no stampede to Alaska, but the indications are that the travel thither during the next four or five months will quadruple that of 1910. Quartz mining in that country is receiving an impetus, this being especially true of the Fairbanks region, Valdez, and the Copper River country; and there is to be more than the usual activity in the regions tributary to Juneau and Ketchikan. The diggings in the Innoko and Kuskokwim basins, however, will be confined to placer beds. Stores of supplies and camping stations are now pretty well established in the great interior country, and the perils of travel are not what they were 10 to 12 years ago. Reports are that shipments of freight to Alaska is much in excess of what it has been in recent years.

KETCHIKAN DISTRICT

(Special Correspondence.)—The Jumbo mine at Sulzer has made three shipments of ore amounting to about 4500 tons since Jan. 1. The large bodies of ore discovered last season while doing diamond-drill work are being opened. About 50 men are employed at present. A small cargo of gold ore was shipped from the Gold Stream mine last month to the Tacoma smelter. The Victory tunnel at Seal Bay is now in over 1700 ft., 10 well defined veins having been opened by it. The main, or War Eagle lode, will probably be cut within the next 300 ft. The Victory company has taken a bond on the adjoining property, known as the Sanford Lhote group, the price named in the bond being $35,000. Some development work has been done on the Veta this winter by Ickis & Polson. The Tongas shaft, Thorn Bay, is now down about 150 ft. The ore is pyrrhotite and chalcopyrite, and contains silver and copper, with some gold.

Ketchikan, March 4.

ARIZONA

GILA COUNTY

(Telegraphic Correspondence.)—One section of Miami concentrating mill was started March 15. Machinery is running smoothly this morning.

Globe, March 16.

(Special Correspondence.)—The Old Dominion company is developing a body of oxidized ore in block No. 2, opened by the west cross-cut on the sixteenth level; this ore assays 10% copper. Development in the United Globe ground is revealing bodies of ore of concentrating grade, both on the twelfth and fourteenth levels. The Old Dominion continues to handle United Globe ores through shaft A. An electrically operated blower is being installed on the twelfth level of the United Globe to keep up ventilation on the fourteenth level until connection can be made with the Kingdon shaft. This shaft is being sunk on the Lady Elgin claim, in the southeastern portion of the property, and is now nearly 70 ft. deep. The Old Dominion is pumping about 3,500,000 gal. of water daily. The hoist installed last August at shaft A has proved satisfactory in every respect. An electric hoist soon will be in place at the Kingdon shaft. When finished it will be the third electric hoisting engine to be installed by this company, which is now operating the Gray and Buckeye shafts by electric power. The electric power supplied by the low-pressure electric turbine installed last July has

resulted in a large conservation of power. Mr. Dowell, the manager, will not give an estimate of the actual saving until he has made further calculations. The turbine is driven by the exhaust-steam from the three compressors, furnishing mine power and ventilation, three blowers that supply the furnaces, and two that furnish the blast for the converters.

The Summit Copper Co. has extended the south drift on the 400-ft. level of the Pasquale vein a distance of 216 ft. from the cross-cut connecting the shaft with the vein. The high-grade chalcopyrite that was found at 142 ft. from the cross-cut is 4 ft. wide at the breast. The north drift heading on the same level is now 160 ft. from the cross-cut and is still in low-grade ore. In this drift high-grade ore was opened 75 ft. from the cross-cut, and was cut by the drift for a distance of 45 feet. A raise will be started at once to explore this body. The raise being driven on the vein from the 400-ft. level toward the 300-ft. is now 70 ft. from the floor of the drift, and the 4-ft. vein containing 2 ft. of ore running 30% copper, and 2 ft. sampling 18%, is still in evidence. On the 200-ft. level both the north and south drifts are in good milling ore.

Miami, Arizona.

Globe, March 11.

PINAL COUNTY

The Ray Con. Copper Co., the mines of which are at Ray, has developed ore deposits of a maximum length of nearly 8000 ft., and of a maximum width of 3500 ft. Ore shipments to the mill, at Hayden on the Gila, amount to 700 to 1000 tons per day, a considerable part of it being mined incidentally to development work. Stoping has been commenced, however. While there is a new working shaft, there are four other shafts which have been used for development purposes. The main haulage adit, by which all the shafts and working levels are connected, has a length of 4000 ft. It is 8 by 14 ft., and double-tracked, the ore-cars being drawn by 10-ton electric locomotives. One section of the mill is doubtless in operation by now.

CALIFORNIA

AMADOR COUNTY

The 80-stamp mill of the South Eureka is operating at full capacity, and although some heavy expenses have been incurred in putting the mine shaft in better condition, the directors have announced an increase in the regular dividend to be paid. The Hardenburg mine is being equipped with a new air-compressor.

BUTTE COUNTY

The Burlington Gold M. Co., of which W. C. Ralston, G. W. Grayson, H. T. Creswell, E. B. Braden, and W. S. Graham are directors, has the New Burlington, Mexican, Jo and Annette claims, situated near Forbestown, these locations covering 4498 ft. of the New Burlington lode. This lode has a north-south strike, a dip of 55 to 65° northeast, stands between diabase and greenstone, and has a width varying from 2½ to 25 ft. On the Burlington claim are 10 test-holes along the cropping; the Mexican has a 100-ft. adit, which is caved; on the Jo is a 335-ft. adit, and some cross-cuts, and there is a small amount of development work on the Annette. Engineers who have examined the property have concluded that this lode and that in the Golden Queen are the same, though the latter has been displaced by faulting. It has been recommended that two 500-ft. shafts be sunk on the group. Samples of ore have assayed $4.75 to $160 per ton in gold, with some silver. It is estimated that with a mill having the capacity of 300 to 500 tons per day the ore may be mined and milled at a cost of $2 per ton. The company is now active and it is reported that a mill is to be built this year.

CALAVERAS COUNTY

The Water Lily mine, situated near Melones, on the Stanislaus river, has a force of 15 miners, who are taking out 50 mine-cars per day of auriferous gravel, said to yield $3 per car. John Whitney has charge of the work.

ELDORADO COUNTY

The Mother Lode Mines Co., operating the Kelsey mine, situated near Placerville, is so encouraged by results of development that it contemplates erecting a mill on the property next summer. W. A. Hooten is engineer in charge.

KERN COUNTY

The Phoenix mine and 5-stamp mill, near Randsburg, are active again. The mine has been considerably developed, and in a new shaft being sunk a 3-ft. vein of ore was opened, the gold in which amounts to $10 to $20 per ton. C. A. Burcham owns the property. The Arondo mine and mill, situated in Argus mountains, out from Randsburg, are being operated with a force of about 30 men. J. K. Miller is in charge.

MONO COUNTY

The power plant and other buildings of the California Hydro-Electric Co., situated at Jordan, were wrecked by a snowslide on March 8, and, according to reports, 8 or 10 persons were killed. Among the killed are John Sullivan, Ben Pessin, Harold Hardy, F. Stromboli, R. H. Mason, Harry Weir, and P. M. Peacock. Transmission lines of this company extend to Hawthorne, Rawhide, Fairview, and Wonder, Nevada, but it is understood they connect with another system whereby light and power can be supplied to those places.

NEVADA COUNTY

The Pittsburg mill now has 20 stamps in operation, the installation of 10 additional stamps having been completed recently. The property is at Nevada City, and is owned by the Pittsburg Gold Flat Mines Co., Mark B. Kerr being manager.

PLUMAS COUNTY

The Crescent Hill mine and mill, purchased some time ago by W. E. Oddie, are being operated successfully. J. Tefft, who sold the Crescent Hill, is developing a mine on an adjoining property. The properties are situated six miles south of Quincy, near the middle fork of Feather river.

SAN BERNARDINO COUNTY

Hart district is equidistant from Searchlight and Barnwell, and contains some gold-bearing veins of ore which have been developed considerably during the last three years. The Oro Belle, in charge of W. B. Andrews, may be provided with a 10-stamp mill, and it is claimed a sufficient tonnage of ore is available to warrant it. Sinking is in progress to obtain a supply of water, which is almost as important a factor as the ore-supply. The Jumbo, in the same district, first developed to some extent by the Quartette company of Searchlight, is now in control of the Big Chief company, by which further development is to be done. Other properties of the camp include the Flyer, and Rambler.

SHASTA COUNTY

(Special Correspondence.)—It is reported that the Milkmaid will be equipped with a cyanide plant in the spring. Developments are progressing at the property, and some good ore is reported. It is understood that the Black Tom company is planning to resume work at the Niagara group within a short time. Mr. Riordan, managing director of the Bully Hill Copper Co., is looking over his company's holdings. It is rumored that the company is planning the resumption of activities at its mines, but nothing of an official nature has been given out. The smelter has been idle since last July, owing to the complaint of the Forest Service, which claimed that the fumes were seriously damaging Government timber. At the Gladstone, rich ore continues to be mined below the 500-ft. level. A full force of men is employed, and the mill is operating at full capacity. The monthly clean-up averages $30,000 to $45,000. I. O. Jillson is managing director, and E. Young superintendent. Developments are progressing at the Mad Ox. It is reported that H. O. Bals, formerly in charge of the mine, will again direct the affairs of the company. The Midas is maintaining its usual heavy production. At the Gambrinos, five stamps are in action. The past winter has been unusually moderate in this county, consequently the mines have been able to maintain constant operations without difficulty.

Redding, March 11.

SIERRA COUNTY

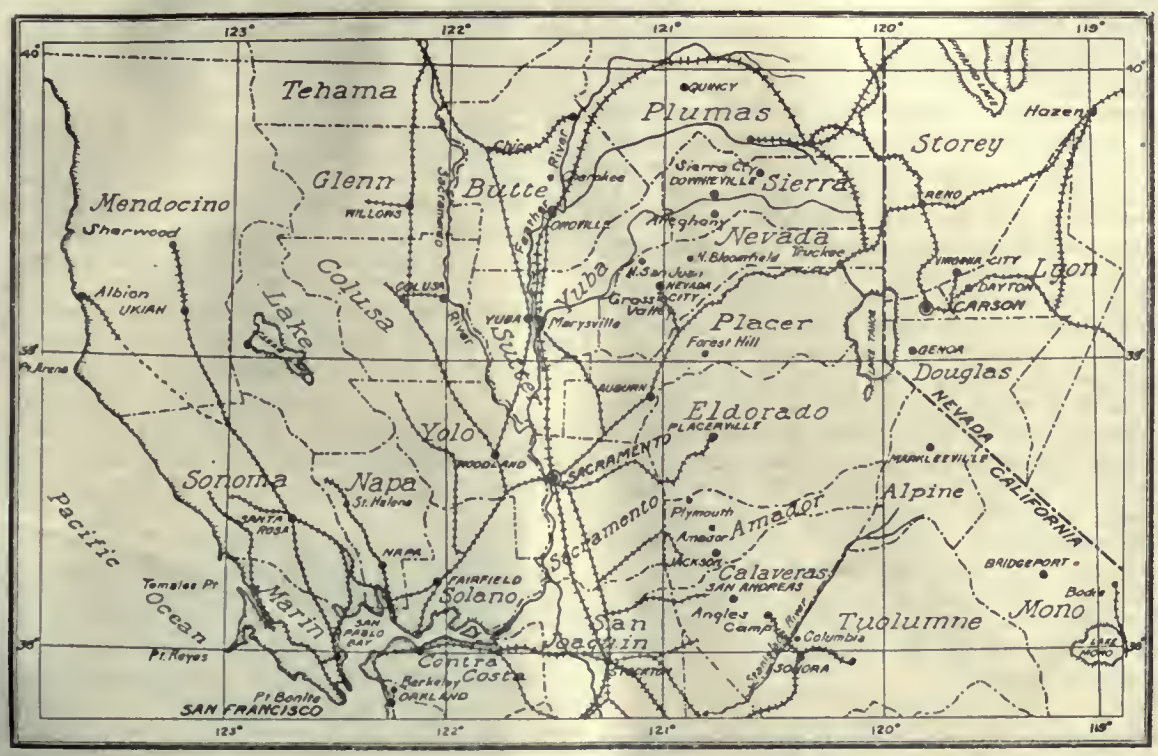
The Sacred Mound mine, under bond and lease to George A. Aldridge and associates, has good ore in a vein recently found. A tramway has been built to carry ore from this vein to the Butte Saddle mill.

TUOLUMNE COUNTY

(Special Correspondence.)—The Street mine, at Tuttletown, owned by Richard Kinsman, of Oakland, but recently bonded to Barret and Snoogoose, is being re-opened for extensive development. The shaft will be sunk several hundred feet deeper. There is a 5-stamp mill on the property. The new mill at the Berkeley is approaching completion. Within a few days a new pump will have been installed and the mine unwatered, when a crew of miners will be put at work. A small stamp-mill probably will be purchased soon for the Gianelli mine, situated near Arastraville, and owned by James J. Masgheno. Development has proved the rich shoot of ore uncovered several weeks ago to be of fair size. Preparations for beginning gravel mining on the Mill Villa are being made. The property is between Sonora and Jamestown, and has just been deeded to John W. Cobb by the San Francisco Power Co. A shipment of three carloads of ore is being made weekly from the Black Oak mine to the Selby Smelting & Lead Co. Operations have been discontinued at the Donella mine, above Arastraville, formerly worked under a bond held by George H. Brown. The mill at the Mazeppa has been started. It is reported that operations will soon be resumed at the Omega. The new mill at the Duffield, near Arastraville, will soon be ready for operation. When started a larger force will be employed in the mine.

Tuolumne, March 11.

The Badger group of mining claims, situated four miles from Jamestown, has been purchased by A. L. Ellis, who intends to have considerable development work done this season. The property, which has been idle a number of years, was formerly a producer. One of the requisites to operating will be to unwater the old workings.



Central California.

COLORADO

CHAFFEE COUNTY

The Monarch-Madonna mine, situated 20 miles west of Salida, which was a rich producer of ore from 1882 to 1894, was practically idle for 14 years following the last date; but about a year ago the property was purchased by Burton brothers of Leadville. The great vein had been opened and the ore taken out through a series of adits, five in all. Burton brothers had the sixth adit driven, lower than any of the others, and at a distance of 1500 ft. from the portal they opened the vein, finding it as wide at this depth as above, and the ore of even higher grade. In fact, whereas lead and zinc predominated in the higher workings, it was found that silver and gold prevailed in the ore opened on this lowest level. During the last nine months of 1910 they shipped ore of the net value of $105,000; this ore was taken from the stopes between the sixth and fifth levels.

CLEAR CREEK COUNTY

(Special Correspondence.)—It is said that a net earning of $8000 per month is being made by the Pay Back M. Co., operating the Josephine mine on Kelso mountain. From 10 to 12 tons of $60 ore are being sold daily. The output from the Capital mine during the month of Feb-

ruary was a little over $30,000, and it is believed that March will witness that amount being doubled. The Pioneer mine, on Covode mountain, has been taken under bond and lease by J. H. F. Smokey, representing Cripple Creek mining men. Development work is to be commenced at once. This property has been a steady producer of smelting and concentrating ore for several years. A body of ore from 16 to 20 in. wide has been opened in the breast of the adit on the Mint vein, samples of which assay $45 to the ton in gold. The operating company will start the 10-stamp mill before the end of this month. The Bard Creek M. Co., operating a group of claims on Lincoln mountain, is making ready to perform development work. As soon as the roads are in good condition shipments of smelting ore will be started. The Homestake G. M. Co. has given another contract to E. C. Bovie to drive the adit 100 ft. This will take the heading past the Homestake vein.

Georgetown, March 5.

(Special Correspondence.)—The Lucania adit, at the mouth of Fall river, is to be driven 1500 ft. L. Sternberger, owning a vast mining estate on Bellevue mountain, has agreed to perform the work to compensate for a right-of-way in the adit. Ground will be broken at the rate of not less than 7 ft. each day. Development is to be carried forward at the Gum Tree mine at Freeland. Shipments of ore to the Golden smelter have commenced. Owen & Co., who recently secured a lease on the Bellman vein, and who are operating through the Central adit, have work well advanced. Shipping ore has been found, and within a short time a heavy tonnage will be marketed. The discovery recently made on the Good Friday mine, situated on Red Elephant mountain, is improving with the shooting of each round of holes. The orebody is 12 in. wide, and from shipments that have been made returns of 150 oz. silver per ton have been realized. R. B. Morton is manager. Occasional shipments are going out from the White property, the ore milling from 225 to 250 oz. silver per ton. Operations are in progress through the Commodore adit. A streak of ore 10-in. wide has been uncovered on the Ten Spot property on Santa Fé mountain that is worth $18 per ton in gold.

Idaho Springs, March 4.

GILPIN COUNTY

(Special Correspondence.)—Work is to be resumed on the O. K. mine, situated on Central hill. The shaft that is down 620 ft. is to be sunk 100 ft. deeper. Eilman Bros., leasing on the 620-ft. level, are making regular shipments of concentrating ore. Shipments of mill dirt have been started from the Newfoundland mine. Work is being done on the twelfth and thirteenth levels. A. H. Rose is manager. A local pool of operators is developing the Alger-Kansas mine. Stoping has been started on an 18-inch streak of ore that mills 2 oz. gold to the ton. A. C. Most has secured a bond and lease on the Comet mine, and the work of exploration has been started. A streak of ore 18 in. wide has been exposed that shows assay-values of from $12 to $30 per ton. Ore is to be shipped from Coeur d'Alene mine, situated on Academy hill. Operations are in progress on the 700-ft. level, a big body of smelting ore being exposed. Recent shipments have brought returns of $60 per ton. The shaft on the Paola is to be sunk 100 ft. A streak of ore 8 in. wide is exposed in the deepest workings that is worth $30 per ton. After years of idleness, work has been resumed on the Central City mine. R. R. Demeter is owner.

Central City, March 6.

LAKE COUNTY (LEADVILLE)

The Crysolite mine, an old property on Fryer hill, has passed to Howard E. Burton and associates under a ten-year lease. The intention of the lessees is to employ a force of miners and prospect the ground for carbonate of zinc. The same lessees are operating the Seneca, Little Chief, and Little Pittsburg. Zinc carbonate is being mined in that part of the Seneca opened from the Hayden shaft. The Western M. Co. has a good force of miners at work at the Wolftone shaft, Castle View, and Big Chief, on Carbonate hill. The Evelyn is also being operated by M. A. Nicholson and associates. The mines in this locality are producing about 800 tons per day of zinc carbonate. The output of zinc carbonate by Leadville mines during 1910 amounted to 20,680 tons. A large increase over these figures is anticipated for 1911.

OURAY COUNTY

The San Pedro M. Co., owning a large area of patented ground adjoining that of the Camp Bird, is controlled by New York men, whose plans are said to contemplate the building of a mill. Development work has resulted in opening five veins, in which is blocked out about 300,000 tons of ore. A development and building fund of $150,000 is being raised by the stockholders. The Atlas mine, near Sneffels, has a mineral lode which is exposed for 5000 ft. on its strike, and has been opened to a depth of 1200 ft., by which a great tonnage of milling ore is made available. The Atlas company now has a 10-stamp mill, and has in view the building of a much larger plant.

SAN JUAN COUNTY

The Sunnyside mine, belonging to the Terry estate, and being operated by Terry brothers and their sister, Mrs. Strong, is said to be under option to a syndicate of Eastern men, whose engineers have reported 441,000 tons of ore in sight, capable of yielding a net profit of $2.35 per ton. The general direction of the mine and mill work is in the hands of Walter Bunce. The mill is at Eureka, the mine being over a mile distant from there, near the head of Eureka gulch.

IDAHO

IDAHO COUNTY

The Elk City Reduction Co. is erecting a custom mill at Elk City. The plant provides for plate-amalgamation, concentration and cyanidation, and will have a capacity of 20 tons per day.

LEMHI COUNTY

The Pittsburg-Idaho company, which operates the old Gilmore mine in Lemhi county, Idaho, has been shipping from 100 to 125 tons per day to the Salt Lake smelters. New machinery has been purchased and the output will be increased. According to A. S. Ross, a dividend was to be paid on March 15, which will probably be increased at a later date.

SHOSHONE COUNTY

(Special Correspondence.)—Ore of good grade has been uncovered in the new tunnel being driven on the Ajax property in the Coeur d'Alene district. The owners are negotiating for the use of one of the Moonlight company's tunnels, which, with 500 ft. of extension, will permit the development of the orebody at depth. The vein was uncovered 200 ft. in from the portal of a drift below the old workings. A drift to the east, now in 100 ft., has been in ore the entire distance on the hanging wall. The face shows 18 in. of quartz, carrying 20% lead.

Wallace, March 11.

(Special Correspondence.)—Bunker Hill & Sullivan Mining & Concentrating Co. paid dividend No. 172, of $81,750, on March 4, making a total of $12,538,350 to date.

Kellogg, March 8.

Shipments of ore from the Jack Waite mine were commenced about March 1. The mine is 12 miles from Eagle station, near Murray, and the ore is sacked and hauled on sleds to the railroad. A recent shipment of 500 sacks is said to have sampled $70 per ton in lead, silver, and gold. It is possible that a spur of the Idaho Northern railroad will be extended to the mine, as P. Burke, the manager, undertakes to guarantee the shipment of 100 tons of ore per day from this mine.

MONTANA

FERGUS COUNTY

(Special Correspondence.)—Five of the eight directors of the Barnes-King company elected at the annual meeting recently held at Kendall, are Butte men. The New

York people were headed by W. H. A. Fischer. The five Butte men selected are C. W. Goodale, manager of the Great Falls smelter; Andrew J. Davis, president of the First National bank; W. C. Lewis, a business man, John E. Corette, and John K. Kirk, attorneys. The Eastern men were given three directors. It is expected that the future of the Barnes-King mine will be decided March 30, when an adjourned meeting of the new directors will be held to consider the question of investing the cash in the treasury, or at least a part of it, in some other property, or dividing it up and winding up the affairs of the company. The new directors have elected C. W. Goodale president; E. G. Hothorn, of New York, vice-president; C. C. Swinborne, treasurer; John E. Corette, secretary, and Jas. A. Bailey, assistant secretary-treasurer. Mr. Bailey and Mr. Hothorn are residents of New York. In addition to the local directors, W. H. A. Fischer, of New York, the retiring president, was present. There were forty properties considered, and the conclusion was reached that of these there were three which might prove a profitable investment, so it was decided to have them examined. This conclusion was reached after having discussed the advisability of winding up the affairs of the company and dividing the money in the treasury among the stockholders *pro rata*.

Lewistown, March 11.

NEVADA

HUMBOLDT COUNTY

(Special Correspondence.)—Developments on the 300-ft. level of the Auto mine, at National, have resulted in opening a 10-ft. vein, the ore in which is said to be of good milling grade. The National Mines Co. is developing at several points and opening much rich ore. The mill is operating on high-grade quartz. The company has paid

National, Nevada.

a total of $345,000 in dividends since the discovery of ore about two years ago. It now ranks as one of the best properties in the State. The ore recently found on the A and T claims, on the north side of Winnemucca mountain, is gaining importance with developments. The vein has a width of from 14 to 18 ft., the ore containing 2 oz. of gold to 1 oz. of silver. The Nineteen-Ten Mining Co., at Barret Springs, is now an ore shipper. Seven tons of ore are being sent out daily from the Cole-Bullis lease, recently acquired by the parent company. The vein is 3 ft. wide, and all the ore is reported to be of shipping grade. J. M. Blood is superintendent. A 2-ft. vein of good ore has been opened on the Blue Bell, and a few cars will soon be sent to the smelters.

Winnemucca, March 8.

NEW MEXICO

SOCORRO COUNTY

(Special Correspondence.)—The clean-up made at the Socorro mines for the last half of February amounted to 19,500 oz. of gold and silver bullion. The Wilfley tables were re-installed in the mill, and they are turning out 3½ tons of high-grade concentrate per week. The driving on the 500-ft. level is soon expected to tap the vein; and the Queen vein was opened on the 700-ft. level by driving a cross-cut from the shaft, exposing 7 ft. of ore, having an average assay-value of $12 per ton. The clean-up of the Ernestine M. Co., as the result of 14 days run, amounted to 8475 oz. of gold and silver; and for the last week of February 686 tons of ore was treated, the concentrates amounting to 45 sacks. The manager for the Mogollon Gold & Copper Co. has returned to camp, and it is reported that the force of miners will be increased. It is reported that the Treasure Mining & Reduction Co. is considering the establishment of an aerial tramway from the mine to the mill. At present the ore haulage is by wagons. It is reported that the Maud S. mine has been acquired by a New York syndicate, which will re-open the mine and mill. The mill and other surface improvements are in good condition.

Mogollon, March 10.

OREGON

BAKER COUNTY

The Golconda mine, situated in Cracker district, four miles from Sumpter, is to be re-opened by William Kinnear, of Susanville, who has taken possession under a bond and lease. A syndicate of Spokane men is said to be backing Kinnear. The Golconda, which has been idle about six years, formerly produced high-grade and is understood to have now an abundance of low-grade ore. The property is equipped with a 20-stamp mill for amalgamating and concentrating.

UTAH

It is announced in Salt Lake by E. P. Mathewson, general manager for the International Smelting & Refining Co., that lead furnaces are to be installed in the plant of this company at Tooele, and that designs for them are being made. Much interest attaches to this announcement, as it presages additional competition in the smelting of ores other than copper in the inter-mountain country. The silver-lead districts, outside of the Coeur d'Alene, which may be drawn upon for ores suitable for the lead-smelter are Park city, certain parts of Bingham, Stockton, Tintic, Beaver county, American Fork, Utah; Wood river, and Lemhi county, Idaho; and such camps in Nevada as Pioche, Hamilton, Ward, and Eureka. The entrance of this company into the lead-smelting industry will open the fourth plant for custom ores in Salt Lake valley, the three now in operation being that of the U. S. S. R. & M. Co. at Midvale, and those of the A. S. & R. Co. at Murray and Garfield.

WASHINGTON

FERRY COUNTY

(Special Correspondence.)—A pay-streak has been found on the Rico placer ground, on Gold creek, 20 miles south of Republic, where a bedrock drain 450 ft. in length has been cut. The drain is 16 ft. deep at the head, and overlying the bedrock the pay dirt is 3 ft. deep, and yields from 50 to 75c. per cubic yard. The gold washed is shot, flake, and dust. Gold creek has a fall of 50 to 60 ft. to the mile. The present find is the result of eight months prospecting.

In raising from the 100-ft. level of the Quilp mine a deposit of quartz, rich in argentite and native silver in crystals, has been opened. The north drift on the vein on the 400-ft. level of the Quilp has passed from the Quilp 44 ft. into the Surprise ground. The drift is about 7 ft. wide, and samples from the face assay from $37 to $43 per ton. The cross-cut from the main incline shaft on the Surprise ground has broken into a body of shipping ore, on which a drift has been started, and a raise will be made to the winze below the Jim Clark adit, where some rich ore has been developed. A winze is being sunk below the 300-ft. level of the Lone Pine mine on a body of ore from 6 to 10 ft. wide and about 56 ft. long. The assays show from $15 to $100 per ton. The San Poil Consolidated company has taken over the San Poil, North San Poil, Snowstorm Fraction, one-half of the Kangaroo, and the Trade Dollar claims. Five men are employed on the 300-ft. level of the San Poil. In the south drift, 435 ft. from the main adit, two men are raising on a deposit of ore

from 6 to 10 ft. wide, which assays about $21 per ton, of which $16 is in gold. The drift on the vein to the northward is in about 430 ft. and has penetrated the North San Poil ground, on which a raise toward the North San Poil shaft is up about 60 ft. on a solid shoot of ore, 7 to 8 ft. in width, which assays about $35 per ton, in relative proportions of 4 oz. silver to 1 oz. gold. J. W. Turner, of Spokane, is the general manager for the company. In the Knob Hill mine 27 men are employed, of whom 10 are on machine-drills. Development is progressing on the No. 2 and 4 levels. On the No. 2 a drift is being driven on a lateral vein, and assays of 24 samples averaged $49 per ton. This vein makes a sharp bend to the west and is being followed to a supposed junction with a parallel vein. On the No. 4 level a cross-cut is being driven, with 40 ft. further to run and get under a shoot of ore on the No. 2 adit-level, 172 ft. above. On the No. 1 level are about two carloads of ore sacked and ready to be shipped.

Republic, March 11.

CANADA

BRITISH COLUMBIA

(Special Correspondence.)—The operations of the Consolidated company at its Trail smelter during the month of January resulted in a metallic production valued at $349,000, of which over 58% was gold. Over 34,500 tons of ore was received at the smelter, of which 32,958 tons was treated. During the seven months ended January 31, this company has produced metals valued at $2,645,000. A shipment of $50,000 worth of silver 0.999 pure was recently sent from the Trail refinery to Hongkong, where it will be used for coinage purposes. The January report of the Le Roi No. 2, Ltd., shows that 2010 tons of ore and 91 tons of concentrate were shipped to Trail smelter. The smelter receipts amounted to $32,308. The estimated costs for the same period were: Development, $8500; ore production, $9500; milling, $1500; a total of $19,500. The new Holywell vein in the Josie mine is proving up well. A recent assay from the East drift showed 9 dwt. gold 5½% copper, while an assay from the west drift showed 11 dwt. gold and 3⅜% copper. A two-shilling dividend was paid early this month. The Le Roi No. 2 owns a controlling interest in the valuable Van Roi mine near Silverton.

Rossland, March 10.

(Special Correspondence.)—Shipments of ore from the Granby mines were lower during the last two weeks, owing to break-down of the electric hoist at the Victoria. This has now been repaired, and the full battery of furnaces at the Grand Forks smelter is blown in again, and shipments are now about normal. In about two months ore will be available through the No. 3 adit which the Granby company is driving at the Phoenix mines. The Consolidated company, of Trail, is planning to build a cyanide mill to treat ore at Boundary Falls from the No. 7 mine. A crusher is being installed to break the ore at the Rawhide mine. The earnings of the British Columbia Copper Co. for January amounted to $17,034. The cost of producing copper was 11.59c. Smelter trouble increased the cost slightly above normal figure. The January production was 827,272 lb. copper, 2376 oz. gold, and 9545 oz. silver. The operating disbursements of the company for the fiscal year ended November 30, 1910, were $1,158,294; custom ore purchased, $51,894. The copper yield per ton of ore was 18 lb.; gold and silver, $1.23 per ton.

Phoenix, March 11.

MEXICO

SINALOA

The Mexican American S. & R. Co. has just taken a ten-year lease on the Carmen mine. The property is owned by German and American interests. A quiet campaign of development has put 150,000 tons of silicious silver ore in reserve. The Mexican American company expects to ship to its smelter at Guaymas at the rate of 100 tons per day. The smelter will probably be put in blast within three months.

Personal

Professional men are invited to send news of their engagements and travels. Such news is interesting to friends.

H. C. Hoover is at New York.

F. J. Estep was in San Francisco.

H. C. Nutter was in San Francisco.

S. H. Brockunier is in San Francisco.

W. S. Noyes will leave for Texas today.

Lewis T. Wright will be in Mexico next week.

A. B. Colwell, of Ely, was at Mason, Nevada, lately.

Courtenay DeKalb was in San Francisco this week.

S. F. Hunt, of Hamilton, Nevada, has gone to Alaska.

Howard D. Smith has gone to Los Angeles and Mexico.

Charles Helman, of Oroville, has been in San Francisco.

Duncan MacVichie was at the Palace hotel in San Francisco.

J. A. Holmes addressed the Southern Commercial Congress at Atlanta, Georgia.

Henry Krumb, consulting engineer for the Inspiration Copper Co., is at New York.

F. H. Bostwick, western manager for the Wellman-Seaver-Morgan Co., is at the Palace hotel, San Francisco.

D. E. Blake, who recently returned from the Philippines, has gone to the Yaco mines near Rosario, Sinaloa, Mexico.

Walter Douglas, general superintendent of the Copper Queen mines, Bisbee, Arizona, is at the Palace hotel, San Francisco.

J. B. Keating, manager for the Bully Hill Copper Mining & Smelting Co., operating in Shasta county, California, was at the property recently.

George F. Waddell, superintendent at the concentrator of the Steptoe Valley M. & S. Co., has been at Butte and Anaconda, Montana, for the week.

L. W. Armstrong has resigned as superintendent for the New England & Clifton Copper Co., at Clifton, and is now with the Ray Con. at Hayden, Arizona.

Sumner S. Smith, in charge of a U. S. Bureau of Mines rescue car, has been at Carson and Reno, Nevada, and will go to Ely before returning to Wyoming.

T. Lane Carter, of Chicago, is examining mines in Jalisco and Tepic, Mexico. His address for the next month will be, Zapopan mine, La Yesca, Tepic, Mexico.

The Utah Society of Engineers held its monthly meeting March 17 at Salt Lake. The paper for the evening was by A. S. Peters, on 'Protection at High-Tension Line Crossings.'

Herbert C. Enos has returned to Mexico City from Chihuahua, where he has been temporarily in charge of the Buena Tierra mine owned by the Exploration Company of London.

Francis K. Sewell, recently at Zacatecas, is now at Villa Escobedo, Chihuahua, where he has charge of the Kelley filter-presses in the new mill of the Veta Colorado M. & S. Company.

F. Curtis, who has been in charge of sampling and experimental work for the Steptoe Valley M. & S. Co., has resigned to enter the employ of the Miami Copper Co., Globe, Arizona.

L. Vogelstein & Co. give the following figures of German consumption of foreign copper in January 1911:

	Tons.
Imports of copper	13,329
Exports of copper	639
Consumption of copper	12,690

The consumption in January 1910 was 14,750 tons. Of the quantity taken in 1911, 11,714 tons was imported from the United States.

Decisions Relating to Mining

Specially reported for the MINING AND SCIENTIFIC PRESS.

LIABILITY FOR DEATH OF PERSON RESCUING IMPERILED MINERS

A complaint for damages for the death of a rescuer who perished in a mine, alleged that a fire had been burning for some days in a coal mine, and during such time one of the ventilating fans had been stopped for one day and by reason thereof gases accumulated in the mine through which men going in to subdue the fire must pass; that on the next day the fan was started in the mine, but had not been running a sufficient time to clear the passageways of the gases; that the corporation operating the mine did not examine to ascertain the condition of the passageways, but the superintendent and general manager for the company sent several miners in to subdue the fire without being informed as to the presence of these gases and being overcome with them were in peril of their lives; that at the request of the superintendent, the deceased, without knowledge of the prevailing conditions, entered the mine to aid in the rescue; that the defendants wholly disregarding their duty, negligently failed to inform the deceased as to the existence of the poisonous gases that had accumulated in the mine, that were existing from the negligent acts and conduct of the defendants, and negligently failed to advise the rescuer, the deceased, of the gases then existing in the mine, and that the said rescuer, ignorant of such lack of ventilation and suspecting and believing that the only dangers to which he was then exposing himself in the work of rescue, were the dangers and risks which arose from the gases then being created on account of the fire in the mine, and that he entered the mine for the purpose of rescuing the persons therein, and after so entering, and while so performing the work of rescue, was overcome by the gases, in consequence of which he died. The recovery was sought upon the theory that the defendants were chargeable with the death of the rescuer by requesting or permitting him to enter the mine for the purpose of rescuing the imperiled miners without informing him of the dangerous condition known, or which should have been known to them to exist therein, and thus exposing him to a peril of which he had no knowledge. The alleged peril did not exist by reason of the fire, nor of the gases generated by it, but the peril of the miners was due to the accumulation of gases spontaneously generated in the unused workings, and that the accumulation of such gases in the passageways was the cause of the death. It is a rule of law that one who, observing another in peril, voluntarily exposes himself to the same danger in order to protect him or save his life may recover for any injury sustained in effecting the rescue against the person through whose negligence the perilous condition was brought about, provided, however, the rescue is not made under such circumstances as to constitute rashness, in the judgment of prudent persons. The rule rests upon the principle that it is commendable to save life, and though a person attempting to save it voluntarily exposes himself to danger, the law will not readily impute to him responsibility for an injury so received. The incurring of the danger in such cases is not *per se* negligence, and the question of contributory negligence depends upon the proof of the circumstances surrounding the attempt to rescue, such as the alarm, excitement, and confusion usually present, the uncertainty as to the means to be used, and the liability to err in the exercise of judgment as to the best course to pursue, and great latitude of judgment is allowed to one who is impelled by the dictates of humanity to decide and act in the face of emergencies. The court, however, found that the death of the rescuer was caused, as shown by the evidence, from gases generated by the fire, and that inasmuch as the complaint alleged, and the case proceeded on the theory that the rescuer's death was due to the inhalation of gases other than those generated by the fire, and having failed to furnish evidence to establish, directly or indirectly, that the death was caused as alleged, there could be no recovery, as the divergence thus appearing between the cause of action as alleged and the evidence adduced to establish it, is such a variance that it amounts to a failure of proof, and brings the case within the rule that, unless evidence furnishes substantial proof of the cause of action as alleged, the plaintiff has failed to make out his case, even though the case shows negligence in other respects. The rule is that the evidence must tend, not only to show the negligence alleged, but also the causal connection between it and the injury.

Bracey *v.* Northwestern Improvement Co., (Mont.) 109 Pac. 706. June 1910.

Recent Publications

THE CONSTITUTION OF THE STATE OF NEW MEXICO. Pp. 41. A supplement to the New Mexican Review.

ABSTRACTS—ANALYTICAL CHEMISTRY. By E. Waller. Pp. 16. From School of Mines Quarterly, April 1910.

PROGRESS OF MINERAL INDUSTRY OF TASMANIA FOR THE QUARTER ENDING SEPTEMBER 30, 1910. By W. H. Wallace. Pp. 15. Hobart, 1910.

TRIANGULATION AND SPIRIT LEVELLING OF VANCOUVER ISLAND, B. C. By R. H. Chapman. Memoir 11-T. Department of Mines, Canada. Pp. 31. Ottawa, 1910.

PRELIMINARY REPORT UPON THE OIL AND GAS DEVELOPMENTS IN TENNESSEE. By M. J. Munn. Extract Bull. 2-E. State Geol. Surv., Tennessee. Pp. 45. Maps. Nashville, 1911.

FLORIDA STATE GEOLOGICAL SURVEY. Third Annual Report, 1909-1910. By E. H. Sellards. 8vo. Pp. 397. Ill., index. Tallahassee. 1910. Aside from an administration report, this volume includes valuable papers on phosphate deposits, lake, artesian waters, and peat deposits.

PROCEEDINGS OF THE AUSTRALASIAN INSTITUTE OF MINING ENGINEERS, Vol. VII, No. 1. The leading papers that have been presented before the Institute and included in this volume are: Notes on the Estimation of Zinc; Refining Bullion at Mt. Morgan; The Waihi Goldfield; Fires in Metalliferous Mines; A Safety Mine Car; Treatment of the Complex East Gippland Ores; and Steam Winding-Engines.

FEATURES OF PRODUCER-GAS POWER-PLANT DEVELOPMENT IN EUROPE. By R. H. Fernald. U. S. Bureau of Mines, Bull. 4. Pp. 27. Ill. Washington, 1911. This bulletin is the result of a trip of inspection of producer-gas power-plants in ten European countries where practice has been most successful in utilizing poor fuels. The writer does not say whether similar methods could be applied with advantage in the United States.

MINING AND METALLURGY ABSTRACTS. Journal of the International Institute of Technical Bibliography, Vol. II, Section IV, Pp. 350. Opinions as to the proper method of procedure in the making of a bibliography differ widely and it is difficult to obtain enough support for any proposed method to make it successful. This bibliography is the most comprehensive and extensive of any yet undertaken, and it is to be hoped that it may continue, for its usefulness is undeniable.

INTERNATIONAL CONGRESS OF PETROLEUM. Papers, Vol. II. Pp. 915. Ill., index. Bucarest, 1910. This volume contains some seventy-five papers presented at the third annual session of the Congress at Bucarest in 1907, by German, French, Rumanian, Russian, Italian, English, and American authors. With the exception of eight or nine in English, all the papers are either in German or French. Petroleum in all its relations is dealt with in this valuable series of articles, most of which have appeared elsewhere.

Market Reports

LOCAL METAL PRICES.

San Francisco, March 16.

Antimony	12—12¾c	Quicksilver (flask)	52½
Electrolytic Copper	14½—15¾c	Tin	45—46½c
Pig Lead	4.75—5.70c	Spelter	7—7¼c

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

METAL PRICES.

By wire from New York.
Average daily prices in cents per pound.

Date.	Electrolytic Copper.	Lead.	Spelter.	Silver, per oz.
Mar. 9	12.15	4.38	5.60	52⅞
" 10	12.15	4.38	5.58	52¾
" 11	12.15	4.38	5.58	52¾
" 12	Sunday.	No market.		
" 13	12.13	4.36	5.58	53⅛
" 14	12.13	4.36	5.56	53½
" 15	12.13	4.36	5.56	52⅞

ANGLO-AMERICAN SHARES.

Cabled from London.

	Mar. 9. £ s. d.	Mar. 16. £ s. d.
Camp Bird	1 13 0	1 12 3
El Oro	1 5 0	1 4 9
Esperanza	1 13 9	1 11 1½
Dolores	1 5 0	1 5 0
Oroville Dredging	0 7 0	0 7 0
Mexico Mines	7 7 6	7 6 3
Tomboy	0 15 6	0 15 6

(By courtesy of W. P. Bonbright & Co., 24 Broad St., N. Y.)

COPPER SHARES—BOSTON.

	Closing prices, Mar. 16.		Closing prices Mar. 16
Adventure	$ 5	Mohawk	$ 43
Allouez	34	North Butte	28½
Atlantic	4¼	Old Dominion	39½
Calumet & Arizona	50	Osceola	108
Calumet & Hecla	501	Parrot	12¼
Centennial	6	Santa Fe	1
Copper Range	65	Shannon	10¾
Daly West	4	Superior & Pittsburg	14⅞
Franklin	9¼	Tamarack	41
Granby	33	Trinity	4
Greene Cananea, ctf	6⅛	Utah Con	14¼
Isle-Royale	12¾	Victoria	1¾
La Salle	4⅜	Winona	7½
Mass Copper	6¾	Wolverine	113

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

MINING STOCK QUOTATIONS—NEW YORK.

(By wire from Catlin & Powell Co., New York.)

	Closing prices, Mar. 16.		Closing prices Mar. 16
Amalgamated Copper	$ 64¼	Mason Valley	$ 8⅞
Arizona-Cananea	3	Miami Copper	19⅛
A. S. & R. Co.	75⅞	Mines Co. of America	5
Braden Copper	3⅞	Montgomery-Shoshone	1/16
B. C. Copper Co.	6	Nevada Con	19
Butte Coalition	18	Nevada Utah	15/16
Chino	21¼	Nipissing	11
Davis Daly	1½	Ohio Copper	1 13/16
Dolores	5½	Ray Central	11 1/16
Ely Central	1/16	Ray Con	17⅛
First National	2 7/16	South Utah	15/16
Giroux	6¼	Superior & Pittsburg	14⅞
Goldfield Con	7 3/16	Tenn. Copper	38½
Greene-Cananea	5¼	Trinity	4⅛
Guanajuato Con	½	Tuolumne Copper	4¾
Inspiration	7¾	United Copper	4
Kerr Lake	6 7/16	Utah Copper	45
La Rose	4 9/16	Yukon Gold	3⅞

SOUTHERN NEVADA STOCKS.

San Francisco, March 16.

Atlanta	$ 13	Mayflower	$ 6
Belmont	6.05	Midway	15
Booth	7	Montana Tonopah	89
Columbia Mtn	3	Nevada Hills	2.85
Combination Fraction	11	Pittsburg Silver Peak	75
Fairview Eagle	45	Rawhide Coalition	3
Florence	2.10	Round Mountain	42
Goldfield Con	6.80	Sandstorm Kendall	9
Gold Kewenas	6	Silver Pick	5
Great Bend	1	St. Ives	16
Jim Butler	26	Tonopah Extension	1.20
Jumbo Extension	49	Tonopah of Nevada	8.25
MacNamara	14	West End	51

(By courtesy of San Francisco Stock Exchange.)

AUTOMATIC FUEL-OIL REGULATION

Practically all oil-fired boiler plants are controlled by hand. Steam as well as oil is regulated at each individual burner, and the dampers are also subject to hand-control. Results obtained are hardly ever satisfactory, and the efficiency of the boiler plant is correspondingly low. The first notable step in advance of hand firing was at the plant of the Pacific Electric Railway Co., Los Angeles, Cal., where under the direction of the chief engineer, one man stationed near the oil pumps, running at practically constant speed, controlled 18 boilers or 54 burners by opening or closing a bleeder valve on the oil-pump discharge-line, thereby increasing or decreasing the pressure in the oil main and simultaneously the rate of firing of all the boilers. After this it was a simple matter to substitute automatic regulation for hand-control, thereby developing the Moore patent automatic fuel-oil regulating system. This system controls the supply of oil to all burners, the supply of the atomizing agent to all burners, and the supply of air for combustion, for any number of boilers, all from a central point. The results include, increased boiler plant efficiency, the practical prevention of smoke, and the decrease in the maintenance cost of boiler equipment; all due to a more uniform manner of firing.

Under actual operating conditions this system of regulation has been found absolutely reliable. In 1909, or about two years after this apparatus was installed, A. C. Balch, general manager of the Pacific Light & Power Co., expressed his opinion in the following letter to the designers:

"Referring to your inquiry, we are pleased to advise you regarding results with your automatic regulating system. As you know, we have in our plant at Redondo, 18 Babcock & Wilson boilers, each rated at 604 hp., with three burners per boiler, or 54 burners in all. The entire boiler plant has now been equipped with the Moore automatic fuel-oil regulators for the past year, which control the steam pressure, the fuel-oil pressure, the supply of steam to burners for atomizing the oil, and the operation of boiler dampers for the purpose of regulating the supply of air for combustion. With this system we maintain practically a uniform pressure while in operation. One-third of the plant has been under automatic control for a period of over 18 months. The remainder, as stated above, was equipped with your regulators one year ago and the entire plant is now operating under this condition. During this time we have never suffered an interruption of service, or loss of steam pressure, due to failure of regulators to operate; they are simple in design and positive in action and we find them capable of ready adjustment by the operative firemen. Our plant is subject to widely swinging railway load and we find under all conditions the boilers respond to these fluctuations of load almost instantly. As the result of installing this equipment, we find the load is more equally divided among all of the boilers in service than under hand firing, and the boilers are free from abuses due to excessive rate of firing periodically experienced with hand regulation on variable load. It is usually the case, in attempting to hand regulate fires on reduced air supply, that the chimneys will smoke frequently on variation in loads; as a result of the automatic system of regulation the smoke nuisance has been reduced to a minimum. We consider the regulating system thoroughly practical, reliable, economical in operation and a demonstrated success."

At this time, 1911, after this system has been in operation a number of years, the Southern California Edison Co. is putting in a similar equipment. This in itself is conclusive proof that the Moore patent oil regulating system tends to make the operating conditions ideal, particularly in the plants where the load is variable and difficult to handle by hand regulating on account of frequent adjustments. A bulletin of 'Unnecessary Losses in Firing Fuel Oil and an Automatic System for Eliminating Them' can be obtained at any of the offices of Chas. C. Moore & Co., San Francisco, Los Angeles, Seattle, Portland, and Salt Lake.

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EDITORIAL

BUCKHORN is the name given to the new mining camp on Fort Sage mountain north of Reno. An old-time rush to the district is in progress, and in Nevada, at least, there is a general feeling that the State has again 'come back.'

PERUVIANS are planning to invite the American Institute of Mining Engineers to hold a session in their country. It would be a much appreciated compliment even if the officers of the Institute should find it impossible to arrange such a meeting.

ANGLO-AMERICAN friendship will be exemplified next week when an American woman will christen a British battleship, H. M. S. *Monarch*. Kinship does not always have friendship as a correlative, and international amenities can never be too frequent.

TELLURIDE ores are usually associated mentally with Cripple Creek and Western Australia, but in reality are of widespread occurrence. When present they have a marked influence on metallurgical processes, and in the abstract of the paper by Mr. Sharwood, which we present this week, these features are discussed.

APPROPRIATIONS for the work of the United States Bureau of Mines for the present year are the same as for last, and amount to $475,500. There is a possibility of $35,000 additional becoming available for testing coal. An increase of this amount was made in the Senate and, though disallowed by the conference committee, appears in the bill as printed.

AN ADVISORY committee on mineral statistics has been appointed by the American Mining Congress to promote co-operation between mineral producers and the Government and State bureaus engaged in collecting statistics. There is need for greater uniformity and for simplification of schedules. If the simple reform of requiring reports for periods ending at the same date could be brought about, much unnecessary work would be avoided.

NICARAGUAN conditions are becoming stable. The United States Government is now a powerful factor in the administration of that country, acting through an advisory committee. It is reported that New York bankers are to loan $12,000,000 to Nicaragua. In the meantime mining activities are reviving. Several properties have been bonded or leased and mining men in the United States are turning their attention to our southern neighbor.

PLATINUM has risen to double the value of gold, and search for new occurrences of platinum and platinum ores will be correspondingly stimulated. A rich concentrate is now being made at the Rambler mine in Wyoming, but the production in this country is still unimportant.

PRODUCTION at the Braden copper mine in Chile is expected to begin in April. Large ore reserves have been opened, a railway built, and a smelter erected; all to make available rock containing but 2.7 per cent copper. This gives some suggestion of the demand for that metal incident to modern industrial progress.

LABOR TROUBLES have taken a peculiar turn at Gillespie, Illinois, where rioting has threatened at the mines of the Superior Coal Company. The new manager, Mr. John P. Reese, undertook some reforms, introducing mining machines and attempting to break up a vicious surreptitious practice whereby the more ignorant of the foreign laborers had paid petty bosses for jobs or favored places in the mines. A large number of men were discharged, and the others promptly struck. Mr. Reese, who was at one time a prominent labor leader in Iowa, promptly laid the matter before the Union officials who as promptly sustained him and ordered the men back to work. A number refused to obey and attempted to intimidate the others, whereupon the Governor, Mr. C. S. Deneen, rushed troops to the scene, and the ensuing quietness was almost resonant. It would be better if troops were oftener sent at the first threat of trouble, instead of waiting until damage had been done.

THE OLD-TIME PROSPECTOR, it is said, never had time to make a mine. If he opened a good body of ore he seldom lingered beyond the time necessary to make a few assays. This trait of the prospector is, apparently, common to all humanity. The porphyry coppers have been the cause of more discussion than anything in copper mining for many years. The Ray Consolidated is just at the point of initial production, yet the price of its stock has declined to where it is probably proportionately cheaper than it ever has been. The precious metal camps fare no better. Tonopah has been making splendid records and developing big mines, yet there is more public interest in some of the Nevada camps where there are no mines, than there is in Tonopah. A still more striking illustration is a comparison between Cobalt and Porcupine. The former is sending out more real money to its shareholders in the form of big dividends than it ever has since the day of its discovery. The life of the camp has by no means been finally determined. Yet Porcupine, with its uncertainties and its unknown possibilities, and which is for the most part undeveloped, is more alluring to the public than Cobalt with its dividends. The public, like the prospector, is not particularly anxious to make mines, nor to receive regular dividend checks, but likes the zest of playing the game with nature.

Phosphate Claims

Whether lands containing phosphate rock should be entered as placer or lode claims has recently been much discussed in the technical press. Unfortunately, a number of the writers have gone wrong as to their facts. The best general statement of the case has been made by Mr. Carpel L. Breger, in *The Mining World*. His paper is too long to review, but we wish to express essential agreement with his conclusions. Phosphate rock, unfortunately, was not known to occur on public lands when the mining laws were enacted. As it differs essentially in mode of occurrence from the minerals that the law was framed to cover, no really adequate provision exists for the entry of phosphate land. As a result, entrymen have been put to much unnecessary expense both in doing double assessment work and in litigation, while there is even yet no certainty as to the correct form of entry. As a matter of fact the Western phosphate deposits occur in beds and are neither veins nor placers. Unfortunately this statement of fact does not solve the legal questions at issue. The first locations, both in Florida and in the West, were made under the placer law and patents were so issued. Instead of following up this advantage the early locators, feeling then sure as to results, held their ground by doing assessment work and were slow to proceed to patent. When Bradley Brothers bought placer locations in the West, they, with possibly an eye to the extremely valuable extralateral right involved, re-located the ground under the terms of the lode law and obtained patents. The Land Office has therefore given title under both lode and placer laws. In extenuation, it may be said that in neither case was there a real contest and also that the officials have stated that the giving of a lode patent is not to constitute a precedent. Apparently the officials of the Department have attempted to decide each case on its merits. The difficulties in such a course of procedure are evident. In one instance there is a lode patent on the outcrop of a given bed on one side of a syncline, and a placer location on the same bed on the opposite side. In many cases both lode and placer locations cover the same ground and are in different hands. A small group of speculators at Salt Lake has 97 lode locations, many of them overlying older placer claims. If these lode re-locations are allowed to patent, a practical monopoly of the phosphate land not yet withdrawn from entry will be created. That, of course, has no bearing on the legal question involved, but is of interest to laymen, since the impression has been created that the great corporations are attempting to 'grab' the phosphate land at small expense under the terms of the placer law. At the last session of Congress the House passed an act providing that in deciding the various contests, either lode or placer locations should be considered valid, and, in effect, that the contest should be determined on the basis of priority and good faith. It was defeated in the Senate, but may well come up again in the special session. The attempt to create prejudice against it as 'special legislation' does not

seem to us to take sufficient account of the equities of the case. The men who established the phosphate industry in the West, acting on the past decisions of the Land Office, pinned their faith to placer locations. If possible legally, their rights should be preserved as against later comers. Aside from this, and as a matter of broad public policy, there can be no doubt of the inadvisability of laying a basis for claiming extralateral rights on deposits that occur as beds and underlie many square miles.

Institute Meetings and Policies

The Canadian Mining Institute has come to have an enviable reputation both for solid worth and for the enjoyable character of its annual meetings. That held at Montreal early this month was evidently up to the standard set by its predecessors. We publish this week a lively account of the session written by an eminent American engineer who pays deserved tribute to the excellent program and entertainment. Incidentally he criticizes the American Institute of Mining Engineers and contrasts unfavorably the present meetings of the latter society with those held when, like the Canadian Institute of the present, both the American Institute and its members were filled with the fire of youth.

It is proverbial that beginnings are accompanied by great displays of energy and enthusiasm; the problem is to conserve some of this for later years when success brings size and responsibility. In this the Canadians have done better than have those of us who live south of the line. It will not do to credit this altogether to the fact that Canada itself is suffused with the spirit of youth, and the number of Canadian mining engineers is as yet so small as to permit of a larger measure of personal contact than between their brethren in the United States. These are powerful influences, but thoughtful planning, open-mindedness, and a touch of opportunism have contributed to the result. The Canadian Institute has more direct influence in governmental matters relating to mines than does the American Institute. This is because it has sought instead of refused responsibilities, rather than because of any difference in the character of the membership. The leaders of the American Institute have selected from among its possible fields one that is large and useful, but it does not include any attempt to influence the course of State or National legislation. Whether this be wise or not is a matter about which responsible opinions differ; but not having sought or accepted responsibility, the Institute has not acquired, or even held, a certain influence that should belong to it by right. In the conduct of the American Institute there are many things concerning which its members differ. It is useless to deny that there is much quiet criticism. Some of it we think justified. Our critic, however, writes with a caustic pen and we, among others, would not follow him the whole route. The large membership of the Institute we believe is a source of strength rather than of weakness; and as to excursions, we take with gratitude what the Gods and the management give, and regret only that professional duties too often prevent participation. It is true, however, that the annual meetings of the American Institute have become unimportant and formal. That this is not necessarily the consequence of a large, miscellaneous, and geographically scattered membership, is shown by the experience of the American Chemical Society. Neither is it a necessary consequence of the policy of opening the program only to professional papers, as is proved by the large and enthusiastic meetings of the American Society of Mechanical Engineers. Some way should be found, without disturbing the excellent work already being done by the Institute, to give to its annual meetings something of the admirable character of those of the other societies mentioned. We regret exceedingly that it is impossible to discuss the subject without seeming to pass criticism upon the eminent and much-loved secretary who has guided the Institute through so many years. His ability, his character, and the great sacrifices that Dr. R. W. Raymond has made for the Institute, demand that criticism of its conduct should not be lightly passed. That his policy has been generally sound, is the sense of the members as we know it, and has been proved by results; but it does not follow that improvement can not be made. The Institute belongs to its members. If they want a change of policy it is their privilege to enforce one. If they are interested in the meetings, the latter will become interesting; and it will not do to rest solely on the reverse of the rule. As members we can not fairly throw the whole burden on the secretary and then complain of the policy followed.

Yellow Journalism

The irresponsible character of certain portions of the daily press in America was never better illustrated than during the past week. The movement of a regiment or two to the Hawaiian Islands, in the course of ordinary transfer of troops from one point to another, was featured as a move by the War Department to meet a threatened attack by Japan. The silliness of this is only excelled by the potentialities for harm that it possesses. The severest critic of our War Department would scarcely go so far as to accuse it of being so footless as to send a mere handful of troops to repel an invasion, and no better way to precipitate a clash could be devised than the making of inadequate preparations for it. Japan possesses a press almost as irresponsible as our own, though more intelligently patriotic, and the constant agitation of such matters may at any time give rise to a situation as tense as that produced by the first blundering attempts at the regulation of Japanese immigration. The spectacle of a press so unintelligent and so unpatriotic as to deliberately incite international friction and imperil international relations for the sake of sensational news, is almost enough to make us wish for a censorship of Russian rigidity. Back of it all lies the fact that the hegemony of the Pacific presents a problem of pressing interest, and in a later issue we will discuss it more at length.

Pay-Streaks at Nome

By T. M. Gibson

Anvil Peak is a dome-shaped hill lying about four miles due north of Nome and rising to an elevation of 1050 feet above sea-level. If one should draw a circle of a five-mile radius with this peak as the centre, he would include an area that has already produced more than $50,000,000 in placer gold, and probably contains as much more, most of it awaiting improved and more economical methods of mining and more scientific methods of gold-saving to turn it to profitable account. This area includes the richest portions of the present and ancient beaches, all of Anvil creek and its old channels, Rock, Glacier, Dexter, and Dry creeks, with their old channels, Little creek, Center creek, Wonder creek, Holyoke, Bourbon, Newton, Otter, McDonald, and Tripple creeks, that portion of Nome and Snake rivers south of the foothills, and the vast body of tundra-covered gravel over which these several streams find their way from the foothills to the sea.

Map of Alaska.

The beach deposits at Nome have been the most important placers of their kind ever discovered. Nowhere else have the waves of the sea concentrated so much gold in so limited an area. There are now seven well recognized horizons between the foothills and the sea upon which surf-concentration has been carried on. Drill-prospecting through the ice, off shore, at the west end of Nome, has shown what appears to be another beach deposit 45 ft. lower than the present level of the sea. These beaches are known as the 'present beach', 'second beach', 'submarine beach', 'intermediate beach', 'Monroeville beach', 'third beach', and 'fourth beach'. The latest discovery is referred to as the 'offshore beach'. Their relative positions may be seen in the accompanying map and diagram.

The third beach was much the richest of them all, and the present beach was next in importance. The fourth beach has not, so far, shown any workable deposits, although a well defined shore-line, and having as large a body of surf-worn material as any of the beaches. All these beaches are more or less parallel with the present shore-line, and each lies on a plane sloping gently toward the sea. The present beach pay-streak lies wholly on a 'false bottom' which is usually clay or fine micaceous and sandy sediment, though sometimes there is no impervious parting layer between it and the underlying coarse coastal-plain gravel. Nevertheless, the gold does not penetrate below the average horizon, and the gold tenor does not seem to be affected by the absence of this impervious bed. The true bedrock, though varying somewhat, is approximately 45 ft. beneath the 'false bottom.' The surf-worn pebbles and sand are distributed over a width of 150 to 300 ft. from the shore-line at low tide and are walled in on the land side by a bank of gravel, muck, and tundra rising 10 to 20 ft. The beach deposit is usually from 7 to 9 ft. thick near the centre, and thins to about half this thickness both toward the water and toward the land. The thinning to landward is due to a steeper inclination of the inshore side of the 'false bottom,' while the surface inclination remains uniform; and a more gentle slope of the seaward side of the 'false bottom' relative to the surface, produces a like effect near the water's edge. Gold is present throughout the mass, but the pay-streak proper is usually within the first foot to two feet next above the 'false bottom,' and sometimes, even where it is richest, is confined to two or three inches lying on the 'false bottom.' This concentration is not uniform over the beach plane, but is richest on two and sometimes three horizons, as if representing high, mean, and low tide concentrations.

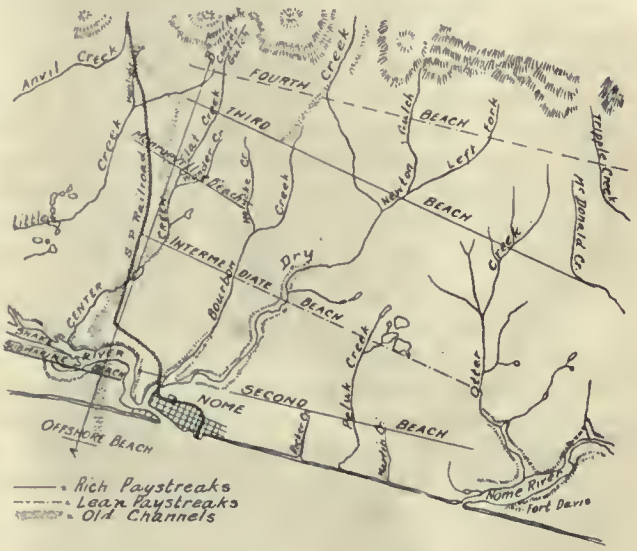
It is, however, more probable that it is due to seasonal variations in the water-level, consequent upon variable intensity of storms and direction of prevailing winds. These rich concentrations are lens-shaped deposits, usually 5 to 6 ft. in width, from 2 to 6 in. thick in the centre, and thinning to an edge both seaward and landward. In this respect they resemble in shape the beach deposit as a whole. Their extension parallel with the shore-line is always greater than their width, and is usually six to ten times as great. They taper to a rounded point at the ends. Near the ends, at either a slightly lower or higher elevation, another lens begins, and so makes the rich streak fairly continuous. These lenses consist very largely of magnetite and garnet sand, and in places have been so rich in gold as to tinge the bottom layer yellow. Five

hundred to one thousand dollars per day was taken from such spots with a single rocker.

The deposit as a whole consists largely of quartz sand and rounded quartz pebbles, with a moderate percentage of schist and limestone fragments, forming shingle. Probably 10% of the entire deposit is garnet sand, locally called 'ruby sand', and about 2% is black sand, which is largely magnetite. There are present also limonite, hematite, ilmenite, scheelite, and pyrite in small quantities. The deposit is stratified into layers, from an inch or less to a foot or more in thickness, the constituent particles being of varying degrees of fineness. The heavy minerals, while present in the uppermost, show an increasing percentage with depth, until near the 'false bottom' they sometimes make 90% or more of the mass. The beach was discovered to be gold bearing in the summer of '99 and more than a million dollars worth of gold was rocked and panned from it before the close of that season. Since, within the maritime limit of 60 ft. above mean high tide, no claims were allowed to be staked, it was open to every man to help himself to any spot not actually occupied by another. Lawyers laid down their briefs and doctors their medicine-cases, and, each procuring a rocker, hurried to find an opening in the line of human bees stretched along the beach, where he could set down his plant and have elbow room to use his dipper. Wages of $15 per day were offered for shovelers by claim-owners on the nearby creeks, but none could be had. The man who did not rock out $50 or more per day moved on to find a better spot. The inevitable result of this work was to hurry over a great deal of ground, rooting for the richest streaks and leaving many virgin spots between their pits. Though much of this rich territory has been gone over a second time, and some even a third time, using sluice-boxes and riffles or matting, there still remains a large amount of gold in the present beach which could be mined at a profit if one could get title to, or control over, a large area, and would install a plant with proper gold-saving appliances to handle the material by mechanical means, so as to reduce the labor cost to a minimum. The total output to the present time is estimated to be something over $2,000,000. A few outfits of two to five men each, with a line of sluice-boxes, a small gasoline engine and centrifugal pump may be seen scattered here and there along the beach every summer, but the yield from such work is just about equivalent to the wages paid.

The second beach lies about a half-mile inland from the present beach and at an elevation of 37 ft. above sea-level. It was discovered in the summer of 1902 at Pelnk creek, about two miles east of Nome, and was soon traced both east and west for several miles. It is nearly parallel with the present beach, but gradually converges upon it, both east and west from the point where first discovered. At Hastings creek, nine miles east of Nome, it is less than a quarter of a mile from the present beach, and at Penny river, ten miles west of Nome, it is about the same distance. It lies upon a 'false bottom' of sandy and micaceous sediment, locally called 'quicksand'. This quicksand is usually from 3 to 5 ft. thick at the upper side and thins down to an edge at the lower side. It is not always present under the pay-gravel, and where it fails the pay-streak lies on the coarse wash of the coastal plain. This beach is next in age to the present beach, and the deposit is of very similar character. It is, however, buried under 15 to 20 feet of overburden, except where crossed by the tundra streams, which in some cases have cut it away entirely within their valleys and in other cases have reduced the overburden to nothing or only a few feet. The overburden consists for the most part of bluish and black muck and decayed vegetation. Logs of drift-wood are quite commonly found near the upper edge of the beach, and these are frequently in a good state of preservation. A layer of peat from six inches to a foot thick is spread over the beach sand in some places, and this, when dried, burns fairly well in stoves.

The whole deposit is permanently frozen except



Beaches at Nome.

in the creek beds and a few isolated areas which, probably, are on subterranean drainage-ways. In Pelnk creek, where the beach was discovered, it was thought by Messrs. Bell and Dugan, who owned the creek claim which it crossed, to be a creek placer. While the first small pit was being opened I visited it and recognized its true character. This claim with others I soon after purchased for myself and my associates, and the first important operations conducted on this pay-streak were under my supervision. The second beach was by no means as rich as the present beach, but pans of 50 cents to $1 were commonly taken from the bottom six inches of the streak. The gold was of bright yellow color and amalgamated freely. Much of it was quite fine and difficult to save. Because of its flaky character it was carried through the sluices in suspension. After some experimenting, much of this loss was obviated by the use of a wide undercurrent with a series of drops and with carefully prepared plates. In a short stretch of the beach on the west side of Otter

creek from which more than $75,000 worth of gold was mined, approximately 25% of the gold was in pieces about the size and shape of gourd seeds. These were much in demand by the local jewelers for making nugget chains and other jewelry, and were sold for $3 to $4 per ounce more than they were worth when melted. Nowhere else in the district has gold of this character been found. On the inland side of this area, and only a few hundred feet distant, there is a ridge of schist bedrock which rises above the second beach-level and it is believed that veins in this schist are the source of these peculiar gold nuggets. Elsewhere throughout its length the gold was of the usual fineness of Nome beach gold, ranging from eight or ten colors to as many as two or three hundred colors to the cent.

The output from the second beach to date has been about $600,000. There still remains considerable unworked ground on this pay-streak, both east and west of Nome, but the richer parts of it have been exhausted.

The submarine beach lies almost directly under the second beach and at an elevation 56 feet lower. It is thus 19 ft. beneath the present sea-level, and its name is derived from this fact. It was discovered in the latter part of the summer of 1907 at a point about one mile west of Nome. It has been explored and definitely traced in a westerly direction about two miles from the point where it was discovered. About three-quarters of a mile to the eastward from this point, mining operations have disclosed deposits in the valley of Dry creek near the same level, and these are believed to be on the easterly extension of this old shore-line. The true bedrock surface is undulating, and where high, the beach deposit lies on it, while in the depressions it lies on a 'false bottom' of clay, sand, and gravel varying in thickness with the depth of the depression, the result being that the deposit lies on a gently sloping plane at a constant elevation, though sometimes as much as 10 to 12 ft. above true bedrock. It is overlain by 50 to 55 ft. of sand, clay, and gravel and 10 to 15 ft. of muck and tundra. Both the overburden and the beach deposit are permanently frozen. The pay-gravel is from 1 ft. or less to about 3 ft. in thickness, and the gold is quite uniformly distributed through it. It is never found highly concentrated in a thin layer on the bottom as was commonly the case in the present beach and the third beach, and less frequently on the second beach. It differs from these, also, in the character and quantity of the predominant heavy minerals associated with the gold. The most abundant heavy minerals are pyrite and arseno-pyrite. Garnets are common, but no well sorted layers of 'ruby sand' occur as in the other beaches, and the garnetiferous particles are of much larger average size. Magnetite and ilmenite also occur sparingly. The gold is of a bright yellow color and averages fairly coarse for beach gold, so that a close saving is made in ordinary sluices. The beach deposit is 300 to 400 ft. wide, and the bedrock slope is usually less than 2%. The gold tenor is from about $4 to $10 per cubic yard. The thinness of the pay-streak and a heavy, treacherous roof make mining difficult and expensive, and there have been at least as many failures as successes in the efforts that have been made to mine it. The total production to this time is approximately $300,000. There is still a large bedrock area to be mined within the proved territory, and there is a possibility of extension both east and west from the present known limits, but the poor showing so far made does not encourage exploitation. Its thickest and best bodies of pay are in the area where it was first discovered, and this, as I shall show elsewhere, is probably due to the old Anvil creek channel. This deposit is interesting as being the oldest of the known beaches in this district. It has been determined by the Geological Survey to be at least as old as the Pliocene.

The intermediate beach lies about one and three-quarters miles inland from the present beach. It was discovered during the winter of 1905-6 just east of where it passes under Center creek. It lies on the true bedrock and is 21 ft. above sea-level. This beach deposit is from 400 to 600 ft. wide and has been definitely traced from a point about a quarter of a mile west of Center creek eastward to Dry creek a distance of one and a half miles. Beach gravels on approximately the same level, and on an easterly extension of this line, have been disclosed in various prospect-shafts covering a distance of about six miles, but as none of these has shown workable deposits, they have not been definitely connected with the payable area. This deposit is peculiar, however, in having been the habitat of a numerous family of mollusks of the clam variety, and their shells are so abundant that it is often called the 'clamshell' beach. These shells are present in many of the prospect workings to the east and thus serve to identify it. The area that has shown workable deposits lies from about a quarter of a mile west of Center creek eastward to Bourbon creek a distance of about one mile. The widest pay-zone and richest gravels are in the vicinity of Center creek. The pay-streak is from 1 ft. or less to 3 ft. thick, and is easily distinguished from the overlying unpayable sand and gravel by the great quantity of clam shells that lie in the pay-zone. The total thickness of the surf-worn material is usually from 6 to 12 ft. The gold tenor is from $5 to $15 per cubic yard of pay-streak. The bedrock has an undulating surface, and the gold frequently penetrates the seams and crevices to a depth of a foot or more in the high points. The bedrock slope to seaward is very gentle, being usually about 1 ft. to 100 ft., or 1%. The average size of the pebbles is less than in the other beaches, and the proportion of fine sand greater. Garnet sand occurs much more sparingly than in the present or second beaches. Pyrite, arseno-pyrite, magnetite, and ilmenite are present in small quantities. The gold is bright yellow, and the particles will run from 8 or 10 to 200 or more to the cent. The gross output from the pay-streak to date is about $800,000. There still remains a large bedrock area of unworked ground along this old shore-line, but the pay-streak

is thin and the gold tenor too close to actual working costs to make the field attractive under present conditions. The deposit is overlain by 35 to 45 ft. of muck, sand, and gravel, all of which, including the pay-streak, is permanently frozen.

The third beach, so called because it was the third deposit of this character found near Nome, lies about three miles inland from the present beach and at an elevation of 70 ft. above sea-level. It was discovered near Little creek in the winter of 1904-5. It is a crescent-shaped line skirting the foothills back of Nome and converging toward the sea at Cape Nome on the east and Cape Rodney on the west. It has been definitely traced a distance of 15 miles from Sunset creek on the west to Hastings creek on the east. This stretch includes both Nome and Snake River valleys, and both have been eroded below the level of the beach. The gap thus made by the Snake valley extends from Little creek westward to near Sunset creek, and covers about five miles. In the Nome valley the gap is from McDonald creek to a point about a half-mile west of Irene creek, and covers two and a half miles. From Little creek to Dry creek, a distance of two miles, this pay-streak, including the so-called 'Slough-Over' pay-streak, which lies just under the south rim of the upper plane, has produced $9,865,000, and, from Dry creek to McDonald creek, a distance of three miles, $2,148,000. East of Nome river, from the neighborhood of Irene creek eastward for one mile, the output has been approximately $400,000, and west of Snake river approximately $175,000, making a total so far produced from this beach of about $12,588,000. The area between Little creek and McDonald creek is nearing exhaustion, the unworked portion being chiefly on the lower or 'Slough-Over' streak, with a few blocks of thawed ground on the main pay-streak. From Hastings creek westward, about two miles of beach-line remain unworked, but this portion is very low grade. West of Snake river no deposits remain which are known to be of workable value.

From Little creek eastward for three and a half miles the deposits lie on true bedrock which is mostly a black, slaty schist or phyllite with occasional narrow belts of limestone. Beyond this point the bedrock surface slopes gently to the eastward, and at McDonald creek, one and a half miles farther east, is 20 ft. below the beach-level. Continuing eastward, it drops 25 ft. more in the next mile and a half, and here Nome river has cut a V-shaped trough in the old valley floor about 50 ft. below sea-level. On the east side of the river the bedrock rises to within 12 ft. of the beach-level at Irene creek, one mile distant, and a half-mile farther east drops rapidly to at least 30 ft. below sea-level, and does not rise above sea-level until approaching the range of hills back of Cape Nome and east of Hastings creek. From the point near Otter creek where the bedrock surface dips below the beach-level, on to the eastward the beach lies on a 'false bottom' of fine sandy sediment, similar to that which underlies the second beach. It is of light-gray color and contains much mica in small thin scales. It lies only under the surf-line, and is 5 to 7 ft. thick at the high-tide line, breaking abruptly against gravels and coarser sands, and thins down to nothing and disappears at the lower rim of the beach. The material lying between this 'false bottom' and true bedrock, as shown by various shafts and drill-holes, appears to consist for the most part of stratified beds of marine gravels, sands, and silts. I have had unusual opportunity to ascertain the physical conditions that prevail along this famous pay-streak, as I have been identified with its development from the beginning, and have, for myself, and as manager of the Wild Goose Mining & Trading Co., been directly in charge of the mining operations covering more than one-third of the entire area mined to this date; and, in addition, have extended exploration, by shafts and drilling, much beyond these limits. This pay-streak is overlain by 20 to 120 ft. of overburden, being shallow in the valleys of the tundra streams and deep in the ridges that lie between them.

At the surface there is from a thin sheet to as much as 15 ft. of tundra vegetable matter and bluish and black muck. This is underlain by well-washed gravels and sand with beds of clay and silt. In some areas the clay and finer sediments are entirely absent, and again they make the major part of the deposit. It is interesting to note that the gravels are invariably gold-bearing, and in that portion lying between Little creek and Dry creek some shafts have shown an average gold tenor of between 25 and 50 cents per cubic yard in 40 to 50 ft. of gravel. The beach deposit is from 5 or 6 to about 12 ft. thick, and, including the lower or 'Slough-Over' pay-streak, is 300 to 600 ft. wide. There is often a barren zone between the lower and the upper pay-streaks, and this is sometimes 100 ft. or more in width. The gold in the 'Slough-Over' pay-streak has been concentrated on the seaward side of a bar that formed just off-shore. At extreme low tide a narrow lagoon existed between the two shore-lines, and this dead-water area is now the barren zone. The upper pay-streak is always much richer than the lower, and where the upper is lean the lower fails altogether. In such rich claims as the Portland, Three Star, Bessie, May Fraction, Cyrus Noble, and Bear Cub, the 'Slough-Over' is rich, but many claims lying between these and to the east and west, with leaner pay on the upper plane, have either a very lean 'Slough-Over' pay-streak or none at all. In the upper pay-streak the beach plane proper is about 100 ft. in width. There is usually an abrupt drop of 1 or 2 ft. at the lower rim of this plane. Lying immediately below this, and built up as high or higher than the edge of the rim, there is a zone of cannon-ball boulders of quartz, varying from the size of a baseball to 6 or 8 inches diameter and usually covering a width of about 20 ft. These are either marble-like in roundness or of oblate spheroidal shape, and the deposit is peculiar in that it often looks as if piled by hand; the interstices not being filled by sand and sediment as one would expect them to be.

(*To be continued.*)

History of the Homestake Lockout

By An Occasional Correspondent

The painstaking thoroughness and attention to detail which marks all of the Homestake company's undertakings was well exemplified in the way it handled the labor difficulties at its big South Dakota property a year ago. Trouble appeared to be in the air. There were rumors of war and impending difficulties early in the fall of 1909. The Western Federation of Miners was making a strong campaign for membership in its Lead City and Central City unions. Nearly all the members were Homestake employees. In October it became apparent that the Federation meant business. Membership was being solicited as never before in the history of the unions, and big mass-meetings gave evidence of the increase that was resulting from their efforts. Finally in order to clinch the matter the following notice was published by the unions on October 10:

Notice

Resolved, That we demand of all ex-members who are now in arrears, that they shall at once re-instate and place themselves in good standing in our union and that we demand and require all eligible men who are employed within our jurisdiction, to at once obtain cards certifying their membership in the proper local of the Western Federation of Miners.

Resolved, That any and all men within our jurisdiction who shall see fit to neglect or ignore these just demands and requirements, shall be dealt with in the near future accordingly as we may determine to act in each of their respective cases.

Lead City Miners' Union.
Central City Miners' Union.

Fifteen days later, or under date of October 25, the following self-explanatory resolution was given to the Lead City papers for publication:

At a mass meeting of the members of the Western Federation of Miners, held at Lead Miners' Union Opera House on Sunday afternoon, October 24, the following resolutions were adopted by a unanimous vote:

Whereas, A resolution adopted on October 10, calling upon all workers in the jurisdiction to join the W. F. of M. has been quite generally complied with, therefore be it

Resolved, By us, the members of Lead City Miners' Union No. 2, W. F. of M., and Central City Miners' Union No. 3, W. F. of M., in joint session assembled, that all men neglecting or refusing to become members in good standing of the local in whose jurisdiction they may be working on or before November 25, will be declared unfair to the W. F. of M.; and be it further

Resolved, That we, the members of the aforesaid unions, refuse to work with any and all men who become unfair to our organization by or through refusing to comply with the provisions of this resolution.

Central City Miners' Union No. 3, W. F. of M.
Lead City Miners' Union No 3, W. F. of M.

The publication of this resolution caused a generous number of men to join the unions, and to make it easy for those who were not in good financial shape to signify their intention of joining as soon as able, emissaries of the union issued a large number of the following cards:

Card

This card entitles the bearer, Mr. ....., who has worked in this camp for a period not to exceed 45 days, the privilege of working by the side of a man with a paid-up card until such time as he shall have had one pay day; after which time he hereby agrees to relinquish this card and be properly initiated into this, the Lead City Miners' Union No. 2, W. F. of M.

Name .....

Dated November 9, 1909.

Void after December 25, 1909.

In the face of all of these evidences of the intention of the Federation to thoroughly unionize the mine, speculation was rife as to the course the Homestake company would pursue. Knowing the general policy of the Federation, it was generally believed the company would refuse to recognize the union. Others believed that when the men showed the solid front it was expected they would present on November 25, the company would capitulate, and grant all demands. On November 17 the question was settled once and for all by the publication of the following notice, which, it may be remarked in passing, is still running in the *Lead Daily Call*, giving evidence of the company's intention to live up to it to the letter:

Notice

November 17, 1909.

Notice is hereby given that the Homestake Mining Company will employ only non-union men after January 1, 1910. The present scale of wages and the eight (8) hour shift will be maintained. All employees who desire to remain in the company's service must register at the General Office of the company on or before December 15, 1909.

T. J. Grier, Superintendent.

The publication of this notice acted like the explosion of a bomb-shell in the union camp. The officials immediately sought interviews with Mr. Grier. They were courteously informed that the notice meant absolutely what it said—not a word could be spared or added, if thus its meaning would be changed one iota. The Federationists presented a solid front, and said they would force the company to come to time. Trouble was on. The biggest gold mining company in the West had locked horns with the Western Federation. The one was as unyielding as the other. The eyes of the entire mining world were turned upon Lead City, as the victorious one in the fight would have good cause to be proud. Worthy foes were matched—a great mining company and a powerful union.

Much breath was expended in trying to show Mr. Grier the error of his way in refusing to recognize a union that numbered an overwhelming majority of his employees, but it was of no avail. His mind was made up, and made up to stay. On the evening of November 21, a strike was voted by the unions, the matter being referred to the executive board of the Western Federation, at Denver, for approval. The company's answer was a lockout.

The result was that on the evening of November 24, the day before the union resolution was to take effect, there was no night shift employed in mine or mill; men were laid off by the hundred, and for the first time in its history, the mills containing a thousand stamps were idle through a difference between

employer and employee. Next day a crew of the men who proposed to stick by the company was employed in pulling pumps, removing air-drills, motors, tools, and all perishable machinery from the mine, dismantling air-compressors, engines, and surface machinery, covering the whole with a generous coat of white lead to prevent rust. So thoroughly was this work done that it is stated the mines could have remained idle for years and no harm would have come to the expensive machinery with which the wonderful plant is equipped.

Having shut down, and shut down thoroughly, everything except work on the hydro-electric plant on the Spearfish river and the pumping-station at Hanna, where water is secured for the mills as well as the domestic supply of Lead and Deadwood, the company proceeded to play a waiting game. The property was fully guarded by posses of Pinkerton, International, and Thiel Agency men, and men who wanted to work for the Homestake. Dead-lines were established, and to cross one of them at any hour of day or night meant that one would be accosted by a burly man equipped with two or three miniature cannon. Meanwhile the company offices were doing business with men who were signing the following card, which, by the way, is still used:

Card

I am not a member of any labor union, and in consideration of my being employed by the Homestake Mining Company agree that I will not become such while in its service.

.....

Department .....

Occupation .....

In some manner the *Daily Register*, organ of the Federation, secured the names of a number of those who had 'signed up' with the company. The *Register* called them traitors to the cause of unionism and threatened to publish their names. This was done. Forty-nine men were on the first list published by the *Register*. Not only did the list appear in the paper, but it was printed on cards and tacked up on telephone poles, in public gathering places, and saloons. This action, really meant to discredit and cast odium on the men named, had a most disastrous effect, at least from a union standpoint. George B. McClellan, one of the 'forty-niners,' called a meeting of those whose names were placarded. They met once or twice and evolved a plan of an organization named the 'Homestake Loyal Legion.' A big meeting was held in Society Hall, Lead. Speeches were made by McClellan and others, and representatives of the company pledged protection to all men who would work. Intense enthusiasm prevailed, and the net result was that in three days the Loyal Legion was thousands strong. Its membership was not limited to workingmen, but included doctors, lawyers, merchants, and professional men who sympathized with the company.

Thus was the backbone of the strike broken. The Homestake Loyal Legion in three days solved the question, and by January 9, when the first shift went to work, the company had the sympathy and moral support of more than half of the camp. From the time of the resumption of work in a small way on January 9, until full capacity was reached on March 3, it was merely a question of securing the men. Employees were recruited from the lead mines of Missouri, Kansas, and Wisconsin, from the iron and copper mines of Michigan and Tennessee, from the gold mines of Colorado—in fact, from all over the United States. For several months it was necessary to practise elimination. In gathering a crew of nearly three thousand men, it was but natural that many idlers came to Lead. These have been gradually weeded out, until today the Homestake army is a body of sober, industrious Americans. The absence of foreigners is noticeable, whereas prior to the shutdown a large percentage of the employees were foreign-born. They included in their numbers Slavonians, Italians, and Greeks, the lowest classes of southern Europe. The change to Americans is reflected in greatly improved business conditions in Lead.

To cement the relations between employer and employee, the company established the 'Homestake Employees' Aid Fund' during the summer. Each employee contributes one dollar per month, and the company gives one thousand dollars. For sickness or disability through accident, one dollar a day is paid during the time of lay-off. For serious accidents—loss of foot, hand, or eye, $400 is paid. For total disability (loss of both hands, feet, or eyes), insanity, or death, $800 is paid. The fund has been in operation several months and has been entirely successful. T. J. Grier is treasurer, without salary (as are all other officers of the Fund), and all clerical work is done in the Homestake office without expense to the Fund. With such an organization to promote friendship between the company and its men, and the sincerity of the company's purpose attested by a substantial monthly contribution, a healthy condition is reflected. The Homestake won its fight with the Western Federation of Miners, and is keeping its men good-humored by treating them fairly. It will undoubtedly be years, if ever, before the Homestake has another serious disagreement with its employees.

The whereabouts of the Ophir of the Bible is as much a mystery today as it was 200 years ago. African travelers point out several localities as the ancient Ophir, each giving 'conclusive proof' of the correctness of his theory. Some profess to believe that Ophir was in Korea, and these also have convincing data to back their opinions. The fact is, no one as yet has been able to find an Ophir that is satisfactory to everybody. An ancient atlas, published in Amsterdam in 1705, describes a region south of the Zambesi river in South Africa as the undoubted Ophir of Solomon. There are the ancient ruins, the placer mines, and the old underground workings; but there are similar places elsewhere in Africa north of the Zambesi river, so the real situation of the original Ophir remains as great a mystery as ever, with no promise that it will soon be known.

The Corona Giant Blast

By G. B. Street

On Saturday, March 11, the Corona Rock Co. set off a most successful blast at its quarry at Corona, California, under the direction of Mr. A. H. Crane, a powder expert in the employ of the E. I. du Pont de Nemours Powder Co., of Wilmington, Delaware. The blast was for the purpose of obtaining rock for street-railway work, concrete, and street-paving, and was planned so well that the larger part of the 130,000

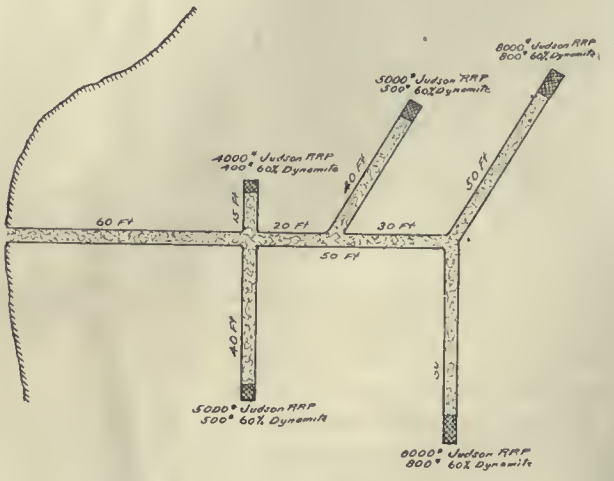


Fig. 1. Plan.

tons of rock broken will go to the crusher without any further preliminary breaking.

The rock appears to be a trachyte and is blocky and very tough, so that the most careful judgment was required in arranging the explosives in order to get the maximum amount of fine material and to avoid scattering the broken rock. Having only 80 ft. of overburden made the problem more difficult.

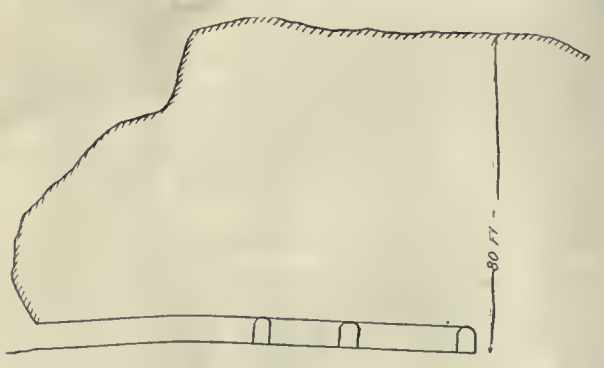


Fig. 2. Section.

The explosives used were 30,000 pounds of Judson R. R. P. powder and 3000 lb. of 60% dynamite. Judson R. R. P. is a special powder adapted for large blasts and is efficient in this class of work, as its action is quicker than ordinary blasting powder and slower than dynamite. The 60% dynamite is used to detonate the Judson R. R. P. powder, which furnishes the force to shatter the rock. The quantity of explosive used and the proportion of dynamite must be carefully estimated in each case, taking into consideration the height of overburden, the contour of the hill, the formation of the rock, and the quantity and quality of material desired. Fig. 1, 2, 3, and 4 show the plan of the preliminary exeavations and the method of placing the explosives and fuses; they are self-explanatory.

The greatest care was taken in placing the explosives, both on aeeonnt of safety and to avoid any deterioration of the powder by absorption of moisture. The laborers who stowed away the powder in the cross-cuts were first carefully searched for matches or anything else that might possibly generate a spark or flame in the neighborhood of the powder, and they were made to wear rubber shoes or else wrap their feet in gunny sacks or some similar material. Electric torches were used in place of lanterns or candles to furnish light in the tunnel, for

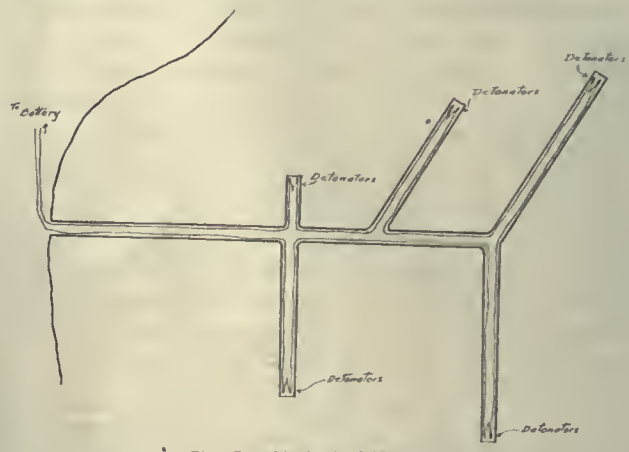


Fig. 3. Method of Wiring.

the same reason. When the above precautions are taken there is, contrary to the general opinion, no danger in handling even such a large quantity of explosives. The charge was fired by electricity, as in a blast of this character it is absolutely essential that all the powder be detonated at the same instant. Two specially-constructed detonators were placed in the dynamite in each cross-cut and all connected up in series. Each fuse was tested with a galvanometer before placing it in the dynamite, and each connection was similarly tested to make sure that there was no break in the circuit. The connecting wires were carefully laid on the floor of the cross-cuts and main adit, and covered with sand or fine gravel to

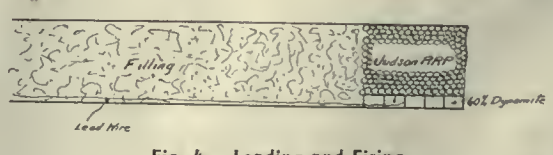


Fig. 4. Loading and Firing.

prevent damage. After the wires were strung to the portal of the adit and covered they were again tested with the galvanometer, and this test was repeated at frequent intervals during the loading and filling of the tunnel. The galvanometer used was one that is manufactured for the special purpose of testing the wiring and connections in a circuit used for electric detonation. The galvanometer reads in ohms, and shows the actual resistance between connections. Therefore, if the reading on the galvanometer, when connected to the wires at the mouth of the tunnel, did not equal the sum of the readings made when connected separately to each fuse with

its lead-wire, it would indicate a short-circuit or poor connection. On the other hand, a break in the circuit is indicated by no movement whatever of the galvanometer needle. Either fault may be readily found and corrected by the proper use of the galvanometer.

The firing was done by an electric current generated in a wound magneto, operated by hand, and placed at a sufficient distance from the adit for the operator to be out of danger from flying rocks. The lead-wires were tested with the galvanometer for the last time just before connecting to the magneto battery. When this final reading of the galvanometer is correct, there is absolutely no possibility of a failure of the blast. The correct voltage and amperage must be used, as otherwise there would be no detonation. If the voltage and amperage are too high the wires will be burned out, and if too low there will not be enough current to set off the fuse, and in either case there will be no explosion. At the same instant that the operator pushed down the lever of the magneto battery the hill trembled, raised in the air a few feet, and fell forward as though it had been pushed by a giant force, leaving 130,000 tons of rock available for the crushers. Fig. 5 and 7 show the quarry face before the explosion, and Fig. 6 and 8 are taken from the same points immediately after the explosion. The thoroughly-broken character of the rock, and the water-tanks, standing unharmed close by, are features of special interest.

Fig. 5. Before Firing Blast.

Fig. 6. After Firing Blast.

Fig. 7. Before Firing Blast.

Fig. 8. After Firing Blast.

Ore-feeders require no power to operate them. They are almost invariably actuated by blows from a tappet on a stamp-stem.

Canadian Mining Institute Meeting

By Our Special Correspondent

*The first session of the meeting was called to order at 10 a.m. on the morning of March 1, by the president, F. D. Adams, of Montreal. In the absence of the Provincial Premier, Sir Lomer Gouin, the address of welcome was delivered by the Hon. C. R. Devlin, an Irishman who quickly won his auditors by an honest cordiality seasoned with native wit. Mr. Devlin called attention to the practical usefulness of the Institute in public matters relating to mining and allied interests; that the Government of the Province of Quebec had had occasion to seek its counsel and advice in the selection of officials charged with technical duties and in the equipment and personnel of exploring expeditions. He intimated that his Government was likely, in the near future, to avail itself of such services even more frequently than ever before. Following this came the presidential address of Mr. Adams, annual report, and other matters relating to the Institute. The president's remarks were noteworthy for the'r good taste, appropriateness, and informing character concerning the development of the mining industry in the Dominion. Reports of mineral statistics for 1910 were presented by different provincial officials, and, while of interest to some persons, were as dreary as such documents usually are. Thomas W. Gibson, the Deputy Minister of Mines from Ontario, called

*Thirteenth annual meeting, Chateau Frontenac, Quebec, March 1 to 3, 1911.

attention to the decreased production of petroleum in Canada, especially in Ontaria, and the desirability of conserving the natural gas supply for domestic purposes. Mr. Gibson's remarks were eminently sensible and interesting.

Then followed a communication by L. Reineeke, of the Geological Survey of Canada, on 'The Ore Deposits of the Beaverdell, West Fork of Kettle River, B. C.' Wednesday afternoon was devoted to an excursion by electric car to the Montmorency Falls, with tea and luncheon at the Kent Inn of that place. Although the afternoon was stormy and the falls solidly frozen, the hospitality of our hosts more than compensated for the forbidding climatic conditions outside. Wednesday evening was devoted to a paper by our old friend, J. F. Kemp, of Columbia University, on 'The Engineering Problems of Geological Nature Afforded by the New Catskill Aqueduct of New York City,' in which he showed how useful the geologist may sometimes be to the civil engineer as well as to his more closely allied brother, the miner. Mr. Kemp was followed by A. E. Barlow, of Montreal, on 'The Economic Geology of the Chibougamou District.' Mr. Barlow won all hearts by his dry humor and good fellowship. His paper epitomized the results of the Quebec government expedition to this district last summer, and incidentally showed the good sense of Mr. Devlin, the Minister, in its despatch, for the results obtained by Mr. Barlow's party were most disappointing in view of the exaggerated reports that had previously come out from that country. Certainly no railroad building is justified as yet into that desolate region, cursed with a brutal climate, possessing poor timber, and indifferent mineral resources.

Copies of the preliminary report of the Commission were handed around at the meeting. On pages 13 and 14 of this document it is stated that, "the whole area examined by the Commission is of Archean or pre-Cambrian age. This, therefore, in common with other similar areas of our hinterland, is very promising from a mining geological standpoint. The large areas of Keewatin schists present precisely similar rock types as have been found associated with the gold of the Porcupine and Larder Lake gold districts in Ontario, while the geological relations so far as known are not dissimilar. In addition, the almost invariable presence of gold in the quartz and its occurrence over such a wide area, although usually in a small amount, is distinctly encouraging and should stimulate prospecting if the region was not so usually and deeply covered with peat and moss, and if it was not so remote from civilization and thus difficult of access. The sulphide deposits of Copper Point are also worthy of further development. This occurrence seems to have puzzled the earlier mining engineers at this place and under these conditions. None of the discoveries of copper and gold are in deposits of such magnitude or promise as would enable your Commission to state, without a considerable degree of hesitation, that they would with further development become 'mines' in the strict meaning of this term." The asbestos occurrences of which so much was expected were found to be essentially different from those at Thetford and Black Lake, "for whereas at these places the differentiation in the magma as shown by the various rock types extends to the most acid phases, and is therefore very complete, the most acid rock type noticed at Lake Chibougamou is only at most of intermediate composition as exemplified by the feldspathic dikes already mentioned as cutting the serpentine. * * * The deposits of iron ore (magnetite), which are perhaps large and more typically exposed on the southern face of Sorcerer mountain than elsewhere in the region, are not of any great importance at the present time."

Thursday morning's session was wholly occupied by the reading and discussion of papers relating to asbestos. As may not be generally known, the Province of Quebec possesses the most valuable deposits of this mineral in the world. The principal mines are situated at Thetford and Black Lake, about eighty miles south of Quebec on the line of the Quebec Central railroad. In 1910 this district produced asbestos to the value of $2,553,277, as compared with $2,317,052 in 1909, or probably about 85 to 90% of the world's entire production. The occurrence of this mineral is well described by John A. Dresser, of the Dominion Geological Survey.* This subject is of peculiar interest because of the comparative rareness of asbestos and the great industry which has been built up upon the mines of the Thetford district. Here there are associated with pre-Cambrian igneous and sedimentary rocks, isolated intrusions of granite, supposed to be of Devonian age. On the southeastern flank of the low range of hills composed of these rocks there are a series of basic intrusives with a northeast and southwest trend that are generally known as the Serpentine Belt. It is in this that the asbestos and chromite deposits of the eastern townships are found.

During the discussion of asbestos it was brought out that the Bell mine at Thetford worked all winter and much if not most of its mining was done underground. The cost of mining the 'mill rock' is about 50c. per ton; the milling cost varied from 50 to 80c. In other words, this work resembles mining of low-grade ore, and large quantities must be handled to make a profit. Considerable interesting divergence of opinion regarding the origin of asbestos developed during the discussion. According to A. E. Barlow, "asbestos or chrysotile is really a fibrous serpentine, a rock which in its purest form results from the alteration of olivine. The fresh rock is called dunite, and much of it is made up almost wholly of the mineral olivine, with sometimes a little chromic iron ore and pyroxene as accessory or accidental constituents. Olivine is very alterable in the presence of water, especially heated water, so that it is seldom that a perfectly fresh dunite is found. Thin sections under the microscope show all stages of this alteration as a result of the secondary action already described. The grains of olivine are converted into fibrous serpentine or chrysotile just around the edges and then along certain lines of fracture, which traverse the various individuals in

*Jour. Canadian Min. Inst., Vol. XIII.

different directions. This alteration proceeds until the whole individual is replaced by the secondary serpentine. Some of these small fractures filled with fibrous serpentine (veinlets) are very irregular in their development, while others follow certain well defined and more or less regular structural planes of the mineral. Now, if one of the microscopic thin sections is taken and studied, we have on a minute or microscopic scale what actually takes place on a larger scale in the working face of a quarry. We find, moreover, as Mr. Woolsey has so well pointed out in his paper, and as Mr. Dresser has emphasized, that the formation of asbestos really commences along a line, and extends outward from this as a centre. Again, most of the previous descriptions of this mineral, it is observed, give expression to the idea that the asbestos-bearing serpentine has undergone contraction, whereas the very reverse has been the case, and the secondary serpentine is really from 20 to 35% greater in volume than the original or fresh dunite from which it has been derived. The so-called veins are really cracks formed almost if not quite in place, and growing in direct proportion to the amount of magmatic water or granitic juice supplied in the later stages of their formation. The asbestos or chrysotile has not been transported from a distance, and has, therefore, in this respect no relationship with ordinary veins. These minerals owe their presence in such purity and abundance to the great purity of the original rock and the presence of an ample supply of magmatic waters, due to the pronounced differentiation of the whole rock mass, especially toward the acid or granitic types which is a marked and almost unique feature of the Thetford and Black Lake fields. * * * The commercial asbestos of Quebec, or chrysotile, as it is known to the mineralogist, is in reality the crystalline form of serpentine. It is the best attempt that serpentine can make in the way of crystallization, the various fibres being, perhaps, a greatly exaggerated form of the prismatic crystals. The large 'veins,' so-called, are but the giant form or expression of the minute fibrous serpentine. * * * If the asbestos is formed quietly, and with a minimum of motion, the longest, silky, uninterrupted 'cross' fibre is produced; whereas if the rock is subjected to violent and prolonged stretching or dislocation, abundant picrolite (the hornblende of the miners) or 'slip' fibre is produced. My first studies of picrolite of serpentine inclined me to the belief that this variety was really undeveloped asbestos. As a matter of fact it really represents both the under-developed and over-developed asbestos."*

The views of John A. Dresser, of the Dominion Geological Survey, appear to be similar to those of Mr. Barlow. His idea is that the original joint planes in the dunite rock were the source of many, if not most, of the asbestos veins. A careful examination of the fracture lines of the original rock frequently shows the beginnings of serpentinization, due to meteoric waters. According to Mr. Barlow, a fissure is not essential, the asbestos could begin to grow at a mere line or fine crack, and that this mineral owed its origin more to magmatic than to meteoric waters. Mr. Barlow appears to place more stress upon the action of magmatic waters than does Mr. Dresser, who emphasizes the potency of meteoric waters in the genesis of asbestos. Fritz Cirkel, of Montreal, differed quite markedly in his ideas in regard to the origin of asbestos. While perhaps I did not hear him distinctly, his opinions do not appear to have been based upon sound chemical and physical hypotheses. Mr. Cirkel does not believe the asbestos began to grow outward from a line, but must necessarily have been formed in a pre-existing fissure, the fibre or crystals growing out from each wall. All were agreed that asbestos is a derivative of serpentine, which in turn is an altered dunite. Mr. Cirkel spoke most entertainingly upon the occurrence of asbestos in the island of Cyprus, in South Africa, and in Siberia. He said the Siberian deposits resembled those north of Ottawa, which have been known and worked to some extent during the past twenty years, but have not been especially productive, as compared with the Quebec mines. An excellent paper was read by C. H. Richardson, of Syracuse, N. Y. on 'Asbestos Deposits of the New England States,' and another by J. S. Diller, U. S. Geological Survey, on the 'Types and Modes of Occurrence of Asbestos in the United States.' This was followed by a paper on 'Occurrences of Serpentine and Asbestos on the Beresovsky, Kamensky, and Monoten Estates in the Ural Mountains, Russia,' by V. J. Kryanaisky, St. Petersburg. This paper did not appear to have been well translated; certainly it was not especially interesting. The Russian asbestos is inferior and may be likened to shoddy as compared to the Quebec asbestos wool. This symposium was followed in the afternoon by an excellent paper on 'The Slate Industry in Southern Quebec,' by John A. Dresser, Geological Survey, Ottawa. Mr. Dresser recounted the difficulties in developing this industry, but seemed hopeful of its ultimate success. After Mr. Dresser, Mr. David T. Day, of Washington, discussed the 'Recent Developments in Petroleum in the United States.' He was followed in turn by Eugene Coste, of Toronto, on the 'Structural (Anticlinal?) Theory of Oil and Gas Deposits Explained by the Volcanic Origin of Petroleum.' As was to be expected, our Canadian friends exhibited but an academic interest in petroleum; their country as yet producing little, but possessing hopes for more. Mr. Coste's paper was chiefly a review of different theories respecting the origin of mineral oil, and its author suffered the penalty of his industry and good fellowship by having lots of fun poked at his theories. At this point the tobacco-smoke of the hall became unbearable to your correspondent, who being constrained to take a walk in the open, missed hearing several interesting papers that followed. Personally, I approve of smoking at these unconventional and masculine meetings, and join in the practice, but I must say the ventilation of the room on this and subsequent afternoons would have shamed that in a mine as deep as the source of Mr. Barlow's 'magmatic waters.'

The 'Smoking Concert' of Thursday evening was

*Jour. Canadian Min. Inst., Vol. XIII, pp. 439-441.

a delightfully informal affair, good cheer and sandwiches, interlarded with song, stimulated our bodies and lightened our minds. Once more our friend, Mr. Kemp, showed himself the possessor of versatility as well as a keen sense of fun. Friday morning and afternoon were devoted to the reading and discussions of papers. There was a refreshing spontaneity and seriousness in the discussions which was delightful, quite unlike the prosy meetings of some other societies, where papers are 'read by title.'

The annual dinner Friday evening at the Chateau Frontenac was the crowning event of this notable meeting. Here fun was mingled with eloquence, spiced with politics, and served to an essentially North American assemblage of men typical of much that is best and most substantial in our race. On the whole, this gathering of mining men forcibly reminded me of some of the meetings of the American Institute of Mining Engineers during its best days, 25 years ago; before conservatism and unwieldy membership of nobodies in mining swamped this organization. The Canadian Institute gatherings are essentially assemblages of men desirous of meeting and knowing others of similar tastes and occupations, not simply social gatherings of a few more or less idle rich, who make a pretense of being mining engineers that they may enjoy the opportunities and privileges a large and experienced organization affords its members in the way of pleasant and exclusive excursions or junkets at reduced rates. Busy engineers who are doing the real work of the profession seldom have time to attend such gatherings, however delightful they may be. To take a week or two from an active life one must expect in return some compensating advantages other than social, such as renewing old and making new professional acquaintances, and learning of things that will be of real assistance in daily life. The Canadian Mining Institute in this respect seems to be eminently successful and destined to have a future worthy of the great Empire of Canada and its Anglo-Saxon nation in the making.

GEOLOGICAL SURVEY APPROPRIATIONS.

The following represents the amounts appropriated by the third session of the 61st Congress for the U. S. Geological Survey for the period ending June 30, 1912.

Mineral resources of Alaska	$100,000
Rents	37,400
Salaries office of Director	35,340
Salaries scientific assistants	29,900
Topographic surveys	350,000
Geologic surveys	300,000
Mineral resources of the United States	75,000
Chemical and physical researches	40,000
Preparation of illustrations	18,280
Books for library	2,000
Skilled laborers	20,000
Geological maps	110,000
Gauging streams	150,000
Surveying national forests	75,000
Engraving illustrations for monographs; printing and binding monographs	165,000
Daniel E. Willard	400
Total appropriation	$1,508,320

Notes on Tellurium-Bearing Gold Ores

By W. J. Sharwood

*The frequency of the association of gold and tellurium has been emphasized by Kemp in the résumé concluding his excellent bibliography and list of localities of telluride gold ores,† that "tellurium is more widely distributed and more common associate of gold than has been generally appreciated." By grinding successive faces on a specimen of ore, examining them with a lens, and picking out minute particles of individual minerals for direct qualitative tests, or by selecting single grains from concentrated material, I have detected tellurium in a majority of such ores examined as have contained visible free gold.‡

The conditions under which these elements occur together admit of a division into several well-marked groups.

Classification of Tellurium-Gold Occurrences.—1. Gold tellurides proper (which may also contain silver and sometimes other elements). 1*a*. Product of partial alteration of these gold tellurides, yielding free gold on the surfaces or in cracks. Both of these modes of occurrence are well illustrated in specimens from Kalgoorlie and Cripple Creek (see Riekard, *Trans.* A. I. M. E., XXX, 708, and XXXIII, 567), and in some from California.

2. Tellurium minerals having free gold deposited on their surfaces, presumably precipitated by reaction with gold solutions. The surface of the original mineral may or may not show signs of oxidation. This condition is observable in specimens of tellurides containing lead or bismuth (usually somewhat altered) from certain veins or spurs of the Mother Lode of California, and in scattered instances in Montana.

3. Free gold associated with tellurium minerals, apparently deposited either contemporaneously or alternately. This condition has been noted in some specimens of crystallized gold intergrown with altaite from the 'pocket belt' of Sonora (Tuolumne county, California), and in the coarse free gold with bismuth sulpho-telluride of the Cable mine, Montana. To this class also belong the deposits of Goldfield, Nevada, where free gold (some of it almost absolutely pure) is associated with a complex antimonial sulpho-salt of copper containing bismuth and tellurium, named goldfieldite by Ransome. An occurrence of wire gold at Carson Hill (Calaveras county, California), mentioned by Ransome in an earlier publication, and an instance from Western Australia (Kemp, *loc. cit.*, p. 319) afford other examples.

4. Free gold associated with tellurium minerals, generally not in contact, and bearing no evidence of either having influenced the deposition of the other.

*Abstract from *Economic Geology*, Vol. VI, No. 1, February 1911.

†*Mineral Industry*, VI, 295-320. 1897.

‡*Mining and Scientific Press*, January 26 and June 8, 1907, CXIV, 117 and 731.

As instances of this class may be cited several ore samples obtained from 'true fissure' quartz veins of California, ranging from Siskiyou southward to Tuolumne county; some specimens from Mother Lode mines may also be referred to it. In most cases a lens or microscope is necessary to recognize the scattered grains or scales of the tellurium minerals.

5. Ores containing small amounts (rarely exceeding two or three-hundredths of a per cent) of gold and tellurium associated with sulphides (especially of iron and copper), and which can only be recognized after concentration by analytical or metallurgical processes. The copper ores of Australia, Arizona, and Montana represent this type, and some of the 'Potsdam' ores of the Black Hills.

6. Free gold associated with tellurium oxide, tellurites, or tellurates. These may result from oxidation of tellurides in either of the other classes. The gold may be non-amalgamable and sometimes is finely divided; the surface is sometimes distinctly 'rusty' or may be coated with an almost imperceptible film of foreign matter.

Location	Ag Per Cent.	Au Per Cent.	Te Per Cent.	Se Per Cent.	Bi Per Cent.
1. Ore, Wallaroo Mine, South Australia	0.0023	0.0002	0.001	...	0.0012
2. Average of six ores with free gold, Goldfield, Nevada	0.26	1.34	2.13	?	1.12
3. Matte, Copper Queen, Arizona	0.02	0.0035	0.0088	0.0113	0.0044
4. Matte, Butte, Montana	0.05	0.0003	0.001 to 0.01	0.001 to 0.01	0.03 to 0.05
5. Anode mud, Great Cobar, New South Wales	15.725	1.450	0.654		0.707
6. Anode mud, Butte, Montana	25	0.05 to 1	2 to 3		2 to 3
7. Typical anode mud	40	2	5		...

7. Occurrences of tellurium in detrital deposits with gold. These are, as mentioned by Lenher, so rare as scarcely to deserve recognition in a scheme of classification; they are, however, not entirely unknown. One of the earliest recorded finds of tellurium in Montana is quoted by Kemp as having consisted of scales occurring in a placer. I once found a particle of a gray crystallized tellurium mineral in a small open cavity in a grain of placer gold from Butte creek, Butte county, California, where it had been protected from wear by the gold.

While the presence of tellurium in veins has in some districts been adduced without reason to indicate their persistence in depth, its association in others with deposits of a pockety or irregular character has led to the opposite view. That it is not incompatible with persistence in depth is evident from a consideration of its occurrence in the ores of the California Mother Lode, and of the great depth attained by some mines on that lode. In the Morro Velho of Minas Geraes, Brazil, the ore-shoot is of remarkably uniform gold content and has been followed to a depth of over a mile, measured on the dip. Though tellurium is present only in minute proportions in the copper ores of Montana, Arizona, and Australia, it often far exceeds the gold in amount, as is evident from analysis of metallurgical products, especially of the slime or 'anode mud' obtained in the electrolytic refining of the copper, from which part of the tellurium has been removed during the converting or blowing of the matte.

Copper and Gold Ores and Products Containing Tellurium.—Selenium occurs in appreciable quantities with tellurium in the Goldfield ores, its presence being evident from its deposition from sulphuric acid that has been used in parting, on the large scale, the bullion obtained from southern Nevada mines. It is also present in traces in Western Australia gold ores, as well as in the copper ores previously discussed, and (also with tellurium) at the Waihi gold mine in New Zealand. It has also been found in the Republic district of Washington and exists in considerable quantities in certain silver-gold mines of Sumatra.

In testing for tellurium in minerals by the familiar sulphuric acid method there is a possible source of error, which I believe is not mentioned in the literature on the subject. Some time ago a sample presented for examination was passed on to an assistant who soon reported that it gave a strong reaction for tellurium, which seemed improbable from its general appearance. Further tests proved it to consist largely of manganese peroxide, although a fine purple color developed when it was heated with strong sulphuric acid and then allowed to stand a few minutes. The tellurium test requires that the particles be moistened with the strongest sulphuric acid and cautiously heated nearly to the point at which white fumes rise, the colored compound forming only between rather narrow limits of temperature. Several other specimens containing manganese peroxide were found to yield a similar color when similarly treated and then cooled and exposed a short time to a moist atmosphere; the color could generally be brought out by breathing on the sample while cooling. It is probably due to the formation of permanganic acid.

While this test is an excellent one for clean particles of unoxidized tellurium minerals, it often fails in the presence of large amounts of sulphides such as pyrite, and is useless in the case of oxidized compounds unless previously reduced. G. T. Holloway has described a method of isolating tellurium from ores for testing purposes, by concentrating it with the gold and silver in a lead button obtained by the ordinary fire assay, it being possible to treat as much as 50 to 60 gm. of ore in this way. The lead button is then dissolved in nitric acid, diluted, and the tellurium precipitated by means of lead foil, the deposit thus obtained being then cleared and tested by concentrated sulphuric acid.

The first important bill introduced in Congress having for its object the creation of a Federal Department of Mines was that presented by Mr. Osborne, representative from Oregon, in 1899. The bill failed of passage, though it was not without friends, even at that time. The nearest to realization to this is the recently created Bureau of Mines.

Discussion

Readers of the MINING AND SCIENTIFIC PRESS are invited to use this department for the discussion of technical and other matters pertaining to mining and metallurgy. The Editor welcomes the expression of views contrary to his own, believing that careful criticism is more valuable than casual compliment. Insertion of any contribution is determined by its probable interest to the readers of this journal.

Sinking the Lightner Shaft, Angels, California

The Editor:

Sir—Responding to your request, I give the following details regarding the work recently done at the Lightner shaft:

The shaft dimensions in the rough are approximately 8 by 17 ft. The drilling is done by four machine-men, each supplied with a 'Pacific Baby Drill,' made by D. D. Demarest & Co., of Angels Camp, that requires no chuck tender. These machines are mounted on two single-screw column bars that cross the narrow dimension of the shaft, each bar holding two drills. The total number of holes drilled on each round is 24 to 30, in rows of three each. With the first setting of each column bar, the three flat cut-holes and the two rows of back cut-holes are finished. The bars are then moved and re-set for the row of vertical wall-holes. The minimum depth of these drill-holes varies from 8 ft. 6 in. in the flat cut-holes to 6 ft. in the vertical wall-holes. Each machine man completes six holes on his shift of eight hours. At times, owing to various setbacks, the drilling requires a shift and a half. The time consumed in mucking then completes the 24 hours. Our greatest record for one round of drilling and mucking was 244 buckets of broken rock, each bucket holding about 800 lb., or a total of about 97 tons. This round advanced the shaft depth about 7½ ft., and is to be accounted for by the fact that a slip crossed the shaft in such a way that the ground broke out deep on the back holes. The drills ran well, were easily handled by one man, were economical in operation, and did what we consider remarkable work. The self-tightening chuck is a splendid feature, as it cuts out all of the lost time usually spent on tightening chuck bolts and nuts.

D. C. DEMAREST.

San Francisco, February 24.

[With reference to the question raised by 'Superintendent' in our issue of February 11, the management authorizes us to say that the labor costs quoted in our issue of February 4 are correct and cover all costs properly chargeable to the work, including a pro rata of general costs.—EDITOR.]

The Clancy Process

The Editor:

Sir—I will again have to ask the patience of your readers, as a number of statements in Mr. Clancy's reply to my letter, 'The Clancy Process,' in the February 18 issue of the *Mining and Scientific Press* demand correction. The following respecting the value and application of calcium cyanamide, or its more valuable equivalent, calcium cyanide, for use in the cyanide and ammonia cyanide treatment of ores will, I trust, enlighten the cyanide-engineering profession. What is of most value to the cyanide operator in the arguments presented both by Mr. Clancy and myself, is the cheapening of cyanide: to be had at a cost of 3 to 5c. per pound, as against sodium cyanide costing 18c. Mr. Clancy wants cheap cyanide and believes he has it in calcium cyanamide. I want cheap cyanide and I feel certain I have it in calcium cyanide. Since I first presented and patented the idea, by all the laws of common-sense, I am entitled to priority in its application in ore-treatment. I am certain that the cyanide engineer is already sufficiently overburdened by an ever-increasing number of new mechanical devices and appliances, and to be successful, must these days be pretty well versed in inorganic chemistry. He can scarcely desire to be still further drawn into the more occult domain of organic chemistry as Mr. Clancy is apparently attempting to do.

When Mr. Clancy says that "the Messrs. Frank and Caro many years ago attempted to produce cyanides by this means, but found it was not a commercial success" he is only begging the question: for the process of producing the calcium cyanamide and calcium cyanide, is a mere matter of chemical control, and not of failure on the one hand in producing calcium cyanide and success achieved on the other, in manufacturing calcium cyanamide. Calcium cyanamide, due to its fixed nitrogen being readily convertible into urea and kindred organic nitrogen products, has become of great value as a 'fixed nitrogen' fertilizer, for which it is chiefly now being manufactured; while the related product, calcium cyanide, would prove poisonous in the soil to plant life, and therefore inapplicable. Even cyanamide works havoc in many instances and must be used with care. For gold and silver extraction work, calcium cyanamide has only half the cyanogen value of that of calcium cyanide, and in the commercial cyanamide, the percentage of cyanogen is so low that its use in cyanidation, even at 3c. per pound, is hardly advisable, as I will also prove. The theoretical percentage of nitrogen in calcium cyanamide, (NCa)CN, is 34.22%, while the theoretical percentage of nitrogen in calcium cyanide is 31.5%, the formula being $Ca(CN)_2$. The atomic weights entering into their respective compounds taken from the latest figures are as follows:

	Atomic weights.
Calcium	40.09
Carbon	12.00
Nitrogen	14.01

In calcium cyanamide there is one atom of uncombined nitrogen and one molecule of cyanogen. The free atom of nitrogen uncombined with carbon present in calcium cyanamide, forms, on slaking the product in water, NH_2, or amide, of no known value as a gold and silver solvent. But if this nitrogen atom be united with carbon (which is readily feasible), another molecule of cyanogen is gained or, plainly speaking, real calcium cyanamide is only of half the value, in gold and silver extraction, of c.p. calcium cyanide, due to double the quantity of cyanogen (CN) existing in the latter.

The cyanogen percentage in the various salts that are at present of interest to the cyanide engineer is given below.

	Cyanogen, per cent.
Sodium cyanide, NaCN	53.07
Potassium cyanide, KCN	39.94
Calcium cyanide, $Ca(CN)_2$	56.47
Barium cyanide, $Ba(CN)_2$	28.00
Calcium cyanamide, (NCa)CN	32.06
Sodium sulpho-cyanide, NaCNS	32.07

A typical analysis of the commercial calcium cyanamide is as follows:

	Per cent.
$CaCN_2$	57.0
Carbon	14.0
Lime	21.0
SiO_2	2.5
Fe_2O_3	4.0
Sulphur, phosphorus, and calcium carbonate	1.5
Total	100.0

Multiplying 34.22% nitrogen present in the real product by 57% the amount of c.p. cyanamide existing in the commercial salt, a percentage of 19.5% nitrogen is obtained. Since only half of this is present as cyanogen, of value in gold and silver extraction, and is equivalent to 9.75% nitrogen, and since this corresponds to 19% cyanogen, it will be seen that even at 3c. per pound calcium cyanamide is by no means a cheap cyanogen product. On an average of a 15% basis of cyanogen contents, calcium cyanamide in comparison with sodium cyanide works out as follows: 1 lb. NaCN 48 to 52% cyanogen is equivalent to 3⅓ lb. (NCa)CN of 15% cyanogen. At 3c. per pound, 3⅓ lb. (NCa)CN cost 10c., additional freight on 2⅓ lb. probably 2c., total 12c. per pound, as against 19c. for NaCN. With this comparison and the possibility of cheaper sodium cyanide, cyanamide offers for the cyanide operator not much inducement, when the impurities in the calcium cyanamide are taken into account. It is different with calcium cyanide, of a nitrogen content of 19.5%, equivalent to 36.6% cyanogen, and produced at a cost of 4c. per pound. This would make it equivalent to sodium cyanide at 6c., or one-third the present price; at that figure it will certainly prove of value on account of its cheapness, and in ammonia cyanidation of the greatest value due to the fact that in boiling off the ammonia the cyanogen goes along and is practically recovered without loss for continued re-use; or is transformed into ammonia (NH_3) and thus replenishes the ammonia losses in the mill. Calcium cyanamide when dissolved in water forms cyanamide and a host of organic nitrogen products. But returning to first principles and for easy explanation, I will reverse the appellation of cyanamide and call it amide cyanide NH_2CN. This is produced from calcium cyanamide according to an equation which may be written as below:

$$CaCN_2 + 2H_2O = Ca(OH)_2 + NH_2CN$$

To the cyanide operator amide cyanide will easily compare with ammonium cyanide, NH_4CN, a powerful silver and gold solvent. Instead of calcium cyanamide I will call it calcium-nitrogen cyanide; it will be seen at once that the nitrogen in calcium cyanamide uncombined with carbon forms amide or amidogen and cannot dissolve gold; it may perhaps silver. The real value of the product is therefore in its cyanogen content, as previously explained. Unless Mr. Clancy has found some special effect in the use of cyanamide in his researches, I can only see a slight commercial value in its adoption in cyanide treatment.

Mr. Clancy claims that he uses cyanamide *per se*. I can not see of what value this can be, even when subjected to electrolysis. It is true that Mr. Clancy protects his cyanide solution through redneing the cyanate by means of the NH_2 gronp present in cyanamide. The addition of the NH_2 to cyanate and subjecting it to the electric current, by which Mr. Clancy effects its oxidation, forms water and nitrogen, and the cyanate is thus reduced. But, after all, cyanamide is an expensive cyanide product even in its apparent cheapness, and, furthermore, lacks simplicity in its application.

Mr. Clancy forces the suggestion upon me of aiming to manufacture calcium cyanide rather than employ it for cyanide treatment. To this I will reply that I am not directly interested in a process for making calcium cyanide, as that is a matter for manufacturing chemists, but only in applying the product to the treatment of ores.

Mr. Claney, in his letter, says that I proposed to use an electric furnace product, which contains calcium cyanide of about 80% cyanogen content, prepared by secondary electric furnace treatment of cyanamide. This is contrary to the facts. In the *Electrochemical and Metallurgical Industry*, July 1909, in an abstract, the following is stated regarding the manufacture of calcium cyanamide, and it will be apparent to anyone that it is an electric-furnace process, pure and simple. "The furnaces have hence to be heated; but if the heat were applied from outside, the temperature would rise too high on the walls and decompose the formed cyanamide. The heating is, therefore, effected in the mass itself in heat-insulated furnaces by means of electrically heated rods of carbon; after a while the heating can be interrupted and will proceed automatically, all the more readily the purer the carbide."

In conclusion, I will say that I am the last one who would attempt to discourage or disparage Mr. Claney; for he certainly has done a great deal of research work in cyano-metallurgy, and by all means is entitled to the support of the cyaniding fraternity. But, at times, Mr. Clancy forgets to give credit to others who are also working on similar lines, and in his proposal to apply ferric oxide electrodes for use in cyanide treatment does not even mention the original inventor or patentee of these iron oxide electrodes, H. Speckter, U. S. patent No. 931,513, August 17, 1909. The patent is assigned to the Griesheim Electrode Co., of Griesheim, Germany. These electrodes are intended for use in the electrolysis of salt for the production of chlorine and caustic soda.

D. Mosher.

San Francisco, March 14.

Concentrates

Most of these are in reply to questions received by mail. Our readers are invited to ask questions and give information dealing with the practice of mining, milling, and smelting.

Prospectors should test every kind of rock without prejudice. Often most unpromising rock proves, upon investigation, to be valuable.

Flint, such as is often seen as nodular masses in limestone, is sometimes gold bearing, and jasper is not uncommonly rich in gold and silver.

Alamo gold district is in Lower California, about 75 miles southeast of Ensenada. The first discoveries were made in the gravel by panning. The gold-quartz veins were found later.

The black diamonds, or carbons, used in diamond-drilling, are worth almost as much as the fine brilliant diamonds, the present price being $80 to $90 per carat, according to quality.

The exhaust from a steam-engine which is so loud as to be annoying, is probably due to the exhaust-pipe being too small. A larger pipe will usually give satisfactory results in the way of relief.

White Pine, Nevada, was typically a silver camp, scarcely any gold being found in the ores of the district. The richest mines were the Hidden Treasure and the Eberhardt, both on Treasure Hill. A little mining is still being done in the old district.

In order to ascertain what type of condensing plant to employ, it is necessary to compare the fixed charges with the operating expenses. The former have a relative greater importance compared with the latter when the load-factor is low, and vice versa.

In blasting, the primer should be placed near the top of the charge, and not well down toward the bottom of it. If placed too deep, there is always likelihood of the burning fuse setting fire to the powder, thereby losing the hole and causing the powder to burn, filling the workings with deadly fumes.

Potash salts of many kinds are imported into the United States from Germany, where a score or more of mines are in operation. These salts are used for many and diverse purposes—in gold mining, glass making, soap making, bleaching, dyeing, photography, medicine, in making explosives, in fertilizing, and in many other ways.

Geological age of rocks bears small relation to the value of the ore deposits which occur in them. Valuable mines are known alike in the oldest formations and in the latest Tertiary rocks, as well as in those of all the ages between them. Also, paying mines are found in rocks of almost every description regardless of their geological age.

Clay in placer mines will rob the sluices of gold if it comes in contact with it. For this reason the clay should be well puddled before it is allowed to run through the sluices. Clay is also likely to give trouble in prospecting by panning. It must either be laid aside or dissolved by rubbing between the hands in water before proceeding with panning operations.

Water-jacketed furnaces must have a constant and sufficient quantity of cold water supplied to the jackets to prevent injury to the plates comprising the furnace. Some years ago at Oro Grande, California, water being scarce, the superintendent of a small smelter at that place tried the experiment of filling the jacket of the furnace intermittently, with the result that the furnace jacket exploded during one of the periods of low water.

In concentration, to secure the best results on machines, it is important that the feed be regular and sufficient in quantity to give the machine a suitable load. The clear water must be added in proper amount and must not be allowed to vary in volume. To insure a constant and regular feed of pulp it is necessary that the water-supply reach the mortar or other crushing device in unvarying amount, and to do this the water should come from a tank in which the head is not permitted to vary, being controlled by means of a valve operated by a float.

Fluorspar was mined in the United States in 1909, according to a report just published by the United States Geological Survey, to the amount of 46,198 short tons. At the close of 1908 there remained unsold 16,864 tons of fluorspar, so that the sales in 1909, which amounted to 50,742 short tons valued at $291,747, were supplied partly from stock on hand. These figures show an increase of 11,947 tons in quantity and of $65,749 in value over the sales of 1908, which were 38,795 short tons, valued at $225,998, and are about 2½% higher than those for 1907, the next preceding normal year of business.

Wulfenite is lead molybdate. It is a common mineral in the Great Basin region, in southern California, Arizona, and throughout the Southwest. It is yellow in color, and in the pan is mistaken for gold more frequently, perhaps, than any other mineral. It is easily fusible, and dissolves readily in hydrochloric acid. If it be boiled in this acid to dryness and the residue moistened with water, upon the addition of zinc it assumes a deep blue color. Wulfenite is rarely utilized as an ore of molybdenum.

In hydraulic mines having high banks it is extremely dangerous as well as less economical to carry the face, or cut, in the form of a horseshoe. When this is done the giant soon becomes surrounded on both sides and in front by a high bank of gravel, and great falls of earth and landslides are likely to occur at any moment, overwhelming men as well as the giants and pipes leading to them. Carry the bank in as nearly a straight line as possible, or, even better, cutting to the sides so that there is a projection opposite each giant rather than a recess. Side-cutting excavates a larger amount of gravel for the quantity of water used than when the stream is directed straight at the bank.

Special Correspondence

BOSTON, MASSACHUSETTS

Comment on the Ely Central Affairs.—Report of the Ahmeek. — February Output of the First National.

Last November J. H. McMurray, of Ely, made application to be appointed receiver for the Ely Central Copper Co. At the same time an effort was made to have A. B. Witcher, of the Ely National Bank, appointed, but owing to the close relations between Witcher and C. B. Lakenan, manager for the Nevada Consolidated, his appointment was successfully opposed by the attorneys for the Ely Central, and Ed Millard of Ely was appointed, whose bond of $80,000 was indorsed by Witcher's bank, the Ely National. Chandler & Quayle, attorneys for the Nevada Consolidated, were named as attorneys for the receiver, but they were removed from that position at the request of the attorneys for the Ely Central. When an attempt had been made previously to sell certain surface rights of the Ely Central to the Nevada Con., the officials of the latter stated that their company needed no further surface rights or rights-of-way, and the sale was not made. Soon after this, it is claimed, and after H. Ellerton Lodge of Boston had undertaken the reorganization of the Ely Central, a letter was received in the East stating that Mr. Witcher and Mr. Lakenan had carefully gone over the Ely Central property with maps and surveyors, and following this a telegram was received stating that the receiver had filed with the court a petition for an order to sell to the Nevada Consolidated about 60 acres of surface rights of Ely Central ground, with certain additional rights-of-way. This was looked upon by Ely Central stockholders as an attempt to obtain valuable property rights for a pittance. The receiver, in his petition for an order to sell, stated that a minimum valuation of the Ely Central property was about $500,000. The court denied the petition on the grounds that, as an attempt was being made to reorganize the company, the rights of the stockholders should not be jeopardized by a sale at that time.

In the last annual report of the Nevada Con., Pope Yeatman, consulting engineer, asserted that the company does not require any further rights-of-way, nor additional dumping ground; nevertheless, the company became a party to the proposal above mentioned, and had the court granted the petition, the value of Ely Central holdings would have materially decreased, and the Nevada Con. would have secured the much-sought right-of-way through the Juniper claim, so necessary in enabling it to mine the deeper-lying ores in the steam-shovel pit. Further, the additional dumping ground is needed by the Nevada Con., owing to the limited space now available for that purpose. The reorganization committee becomes trustee for the stockholders, and the whole plan is being carried out for the benefit of the stockholders. The Federal Trust Co. of Boston is acting as depository and treasurer.

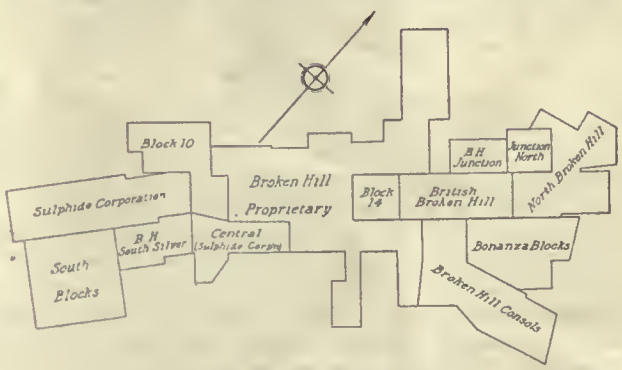
The annual report of the Ahmeek M. Co. for 1910, the second issued under Calumet & Hecla management, shows gross profits for the year of $646,520, a construction expense of $219,405, and an expenditure of $184,725 for the equipping and sinking shafts No. 3 and 4, leaving a net profit of $229,320. In this connection attention is called to a net loss of $198,996 in 1909, and $22,355 in 1908. The cost of producing copper in 1910 was 11.05c. per pound, as against 15.48c. in 1909, and 12.66c. in 1908. The cost, including taxes, of mining, transporting, and stamping a ton of ore in 1910 was $1.42; it was $1.72 in 1909, and $1.78 in 1908. The cost per pound of copper at the mine, not including construction, was 6.37c. The cost, including construction, equipment, and interest paid, was 7.53c., as against 8.71c. in 1909. The cost of smelting, freight, commission, Eastern office expenses, was 1.16c. per pound. The copper content of the ore mined in 1910 was 22.3 lb. per ton, as against 22.7 lb. in 1909. The ore broken during 1910 aggregated 568,935 tons, of which there was rejected 38,570 tons, or 6.8%. The output of refined copper for 1910 was 11,884,954 lb., or 28% increase over that of 1909.

The First National Copper Co., operating its mine and smelter at Coram, Cal., produced in the month of February 676,705 lb. copper, 28,373 oz. silver, 526 oz. gold, which was a slightly lower production than that of January. The Cottrell system for collecting the furnace fume is working satisfactorily, though the Farmers' Association seems still dissatisfied. Development with diamond-drills is in progress, with the result that the tonnage of available ore is being increased.

LONDON

Minerals Separation and T. J. Hoover.—Zinc Corporation and Elmore Process.—R. Gilman Brown Re-Opens Tin Mine.—Korean Gold.

In my letter published in your issue of February 11 I mentioned that another unfortunate lawsuit had been commenced in connection with flotation processes, the suit consisting of an action brought by Minerals Separation, Ltd., against Theodore J. Hoover, the retiring engineer for the firm. I did an unwitting injustice to Mr. Hoover by mentioning this suit, for it consisted of an *ex parte* statement in court made in the absence and without the knowledge of Mr. Hoover. In the English courts it is the custom not to report *ex parte* proceedings. In this case somebody distributed to the press a short summary of the proceedings. The fact that the papers received the information in this way is indicated by the identical phraseology of all the reports published. What actually happened was this: Mr. Hoover terminated his engagement with Minerals Separation Ltd. on December 31, after having spent three or four years improving the flotation process, and he proceeded to Russia on petroleum business. The directors of Minerals Separation Ltd. objected to his having taken away records of information in connection with the process, that they claimed were their property and not his. This application was made while he was in Russia, and he knew nothing of it for some time. On his return he soon showed that "what was his was his own", and the action was withdrawn. The offending paragraph mentioned above may have led some people to believe that some sort of unprofessional conduct was attributed to Mr. Hoover. It did not strike me personally in this way; on the contrary, I imagined that it was a dispute between employer and employed, the former claiming that the latter should forget or unlearn everything he had done during his years of service. I was expecting it to lead to a pitched battle which would settle this much vexed question. While writing of matters in connection with Minerals Separation Ltd., I may as well tell something about the fight between this company and the Zinc Corporation. It will be remembered that the latter company was formed to treat dumps of zinc tailing at Broken Hill, five years ago, and that after trying the Potter process it adopted that of the Minerals Separation. This did not work either; for it was in those days quite a crude affair. It was rejected, and the Elmore plant installed instead. This has been highly successful, as I have several times recorded already. Things went swimmingly for some time



Claim Map at Broken Hill.

until Minerals Separation Ltd. brought the original contract to the notice of the directors of the Zinc Corporation, pointing out to them the alarming provision that the Corporation should never use any other flotation process than that of Minerals Separation. Rather than risk a lawsuit, the directors of the Corporation have thought fit to gradually change the plant once more, and for the last three of four months they have been slowly substituting new Minerals Separation plant for the Elmore plant which has done so much good work. The reason for this change is ostensibly that the tailing now treated is more amenable to the new plant. This may be so or not, but it should be definitely stated that the change is being made, not on account of superiority of plant or on account of disputes in connection with patent rights, but solely because of that remarkable clause in the agreement. It is probable that it will be quite six months before the whole of the plant has been altered. It is of course not quite fair to compare the working of a new plant with one that is well established or 'tuned up'; but, for all that, I cannot help recording that the monthly profits have dropped in a rather unpleasant way since the alterations began. Further trouble is now in store for the Zinc Corporation, for the Elmore companies have commenced an action in Australia demanding a continuance of the payment of royalty on the whole output. They claim that the Minerals Separation process infringes their patents, and as this matter has not yet been settled in the Australian courts, this action against the Zinc Corporation is just one more addition to the group of actions.

The work done under the direction of R. Gilman Brown at one of the old tin mines in Cornwall has been watched with considerable interest. The various methods of reopening old mines always form a useful study. The mine in question is the Geevor and it is situated on the west Cornish coast immediately adjoining the Levant and Botallack mines. The company formed to undertake the work was floated in 1906 by the West Australian Goldfields, and it is now being reorganized by the West Australian Goldfields Assets Co. Oliver Wethered, of London, is chairman. He is also vice-chairman of the Dolcoath. A feature in favor of the enterprise is that the lodes have not been worked by previous owners to any great depth. Much development has been done during the last three years, and recently a new shaft was started. The sinking of this shaft is being conducted concurrently from two points, one part from the surface and the other from the deep adit. The surface plant consists of two Holman air-cushion stamps, Wilfleys, and vanners; plant for treating slime is to be erected. Altogether £24,000 has been spent. The company is being reorganized with a capital of £50,000 in 10s. shares, of which 64,500 will be allotted to the shareholders in the old company, and 34,893 shares are now being offered for subscription; 20,893 have been underwritten.

Some interesting work is being done in Korea by the Collbran-Bostwick Development Co., a company organized under American law, but practically directed from London. Some time ago I gave details of the Suan gold mine that it has re-opened. Information is now available relating to its work at the Ko Djin Dong copper mine. This mine was worked by the Koreans above adit. The deposit consists of lenses of copper sulphide in crystalline limestone, which also contains some sulphides disseminated through it. In order to develop the deposit at depth, A. R. Weigall, the manager, has sunk a vertical shaft, the top of which is 127 ft. above adit. At a depth of 191 ft. this shaft reached the hanging wall. As far as has been proved the deposit contains large amounts of copper ore. The ore in the lenses and in the limestone consists of chalcopyrite, arsenopyrite, and pyrrhotite, and no secondary minerals, such as native copper, bornite, or chalcocite, are found. For this reason it is considered that the ore is primary, and that therefore there is a good chance of the grade continuing in depth. The average copper content of the sulphides in the lenses is 18%, and of the limestone ore 5 per cent.

FAIRBANKS, ALASKA

Mill Tests Show High Returns. — Preparations for Placer Mining. — New Pay Channels.—Recovering Stream Tin.

In the last thirty days several mill-runs have been made at the local test-mill. The best ore was shipped from the Golden-Sherrard lease at the head of Cleary creek. One of every ten sacks was laid aside for the test, these aggregating 1½ tons, from which 9 oz. of bullion, worth $17.36 per oz., was extracted; this was equivalent to $100 per ton recovered by amalgamation. The tailing contained $13.14, while the concentrate was worth $928 per ton. The vein on this lease is 2 ft. wide. A shipment of 100 tons has been made to the Chena custom mill. The shaft is 100 ft. deep, and driving is in progress to develop the ore-shoot. Another run of 6 tons of ore was that received from Gels & Thompson, on Fairbanks creek. The recovery was 31 oz. of gold, worth $16.67 per oz., making an average of $86 per ton in free gold. Tailing contained $3.65, mostly in silver, and the concentrate assayed $130 per ton. At the 110-ft. level, 3 ft. of lead-carbonate ore occurs next to the 2 ft. of free-milling ore. The lead ore assays high in silver. The owners probably will erect a small mill this summer, thereby saving $25 per ton in transportation and milling charges. While prospecting the Pioneer Quartz Co.'s property on Chatham creek, Mr. Calvin has succeeded in finding the old vein first worked by the former company. The vein has a width of 16 in., a part of which contains high-grade ore. A shipment of 6800 lb. of this ore was made to the Fairbanks mill, the net recovery from which was 18 oz. gold, worth $17.28 per oz.; the concentrate obtained assayed $157 per ton. This was the first mine to be operated in the district, but work was stopped by an excess of water at the 100-ft. level. Work is progressing at the Peterson lease, on the Friedrich property, at the head of Vault. After reaching a depth of 130 ft., driving both east and west was started, and good ore was found in both directions, that on the west side assaying as high as $150 per ton. It is probable that a mill may be erected on this property. The Fairbanks Quartz Development Co. is raising funds to start work when the sealed proposals of mine-owners are opened. Ten proposals on favorable terms are already in. The trustees of the Fairbanks test-mill rendered their report for the six months ended January 1, 1911, which showed a total of 158 tons of ore milled, that returned bullion of the value of $15,000, or an average of close to $100 per ton. Of this ore, 48 tons was milled free of charge, while for the rest a charge of $15 per ton was made. Since February 1, only one ton from each property is being milled free of charge. The assets of mill and equipment amount to $4873, with no liabilities.

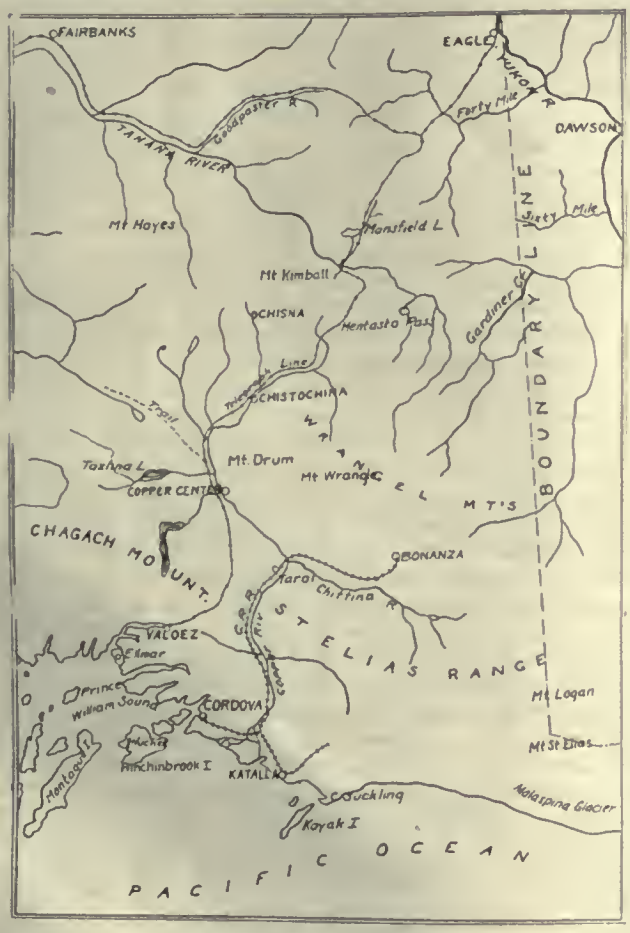
The placer miners are locating lost pay-streaks, and general success is reported. Lushbaugh and Sandstrom have just reached bedrock in their working-shaft, opening the extension on the pay-channel worked by Walter Fisher on the Niggerhead association ground at the mouth of Dome creek. The material in the shaft prospected $4.50 per square foot of bedrock. Other prospect-holes put down by Fisher show that the paystreak is at least 400 ft. wide at this point. Jerry Paulson, who has the lay below, is installing a big plant and starting a working shaft. The pay-gravel found on the benches opposite 7 and 8 Below Goldstream still holds out, and considerable money will be taken out by laymen this season. The ground owned by Bigelow and Berry is about blocked out for summer work. Reid & Co., who have a lay on 7 Below Goldstream, are in good pay. A picked wheelbarrow-load of dirt yielded $125, while $5 per pan is common. Another missing paystreak has been found on Fairbanks creek, in the left-limit benches opposite 4 and 5 Above Discovery. Holes put down by Peterson and Smallwood on one claim, and Noeller and Gustafson on the other, show the pay to extend through these two claims. The ground is 30 ft. deep, and samples show a value of $4 per square foot. Joe Eglar, of Hot Springs, recently shipped 3000 lb. of stream tin to the Tanana assay office, in Fairbanks, to be cleaned

for gold and sampled for the tin content. While over $200 in gold was recovered from the sand, a sample of the whole lot showed 60% metallic tin. Much interest is being shown in seeking the source of the placer tin, and many prospectors will be on the ground next summer. Much of the tin ore occurs in large pieces, encouraging the belief that commercial ore will be found at the source. It is thought that the placers are rich enough in tin to warrant dredging.

SEATTLE, WASHINGTON

Mining in the Cascades.—The Tacoma Smelter.— Interest in Valdez, Seward, and Iditarod.—Coal Situation.—Native Copper in Olympic Mountains.

Mining in western Washington has been quiet during the winter, due principally to heavy snow in the Cascade range; only a few mines have operated through the winter. The owners of properties in the lead district around Cascade pass are again encouraged this year by promise of the railroad being extended to tap the district. This



Southern and Central Alaska.

camp will be a large producer of lead and silver if transportation is ever obtained, but at present the nearest railroad is 60 miles distant. There have been persistent rumors of the old Monte Cristo mines being taken over by strong operators, but so far they remain idle. The Everett smelter, built principally to handle the ores of Monte Cristo, has been dismantled, and the débris is being cleaned up and shipped to the Tacoma smelter. In the Miller river district the Apex mine continues to ship a good grade of ore, and the Seattle Cascade company built a concentrating plant on its property last season. The Tacoma Smelting Co. has made a number of changes, and evidently anticipates a good year's business. The electrolytic refinery has again been put in operation, and this company is now shipping electrolytic copper.

The Valdez and Seward camps in Alaska have attracted much interest in Seattle this winter, and the idea seems to prevail that there will be a stampede in that direction this spring. A number of mills have been shipped from here this winter, and these will be erected as soon as weather conditions permit. There has been a lively sale of these stocks on the Seattle Exchange, and everything seems to point to a busy season for the two camps. In the placer field, the Iditarod country is attracting its share of the attention. A deposit of graphite is being opened near Nome, and a mill is being erected at Everett, Washington, to refine the output. Foundry facing, lubricant, and paint will be the principal products.

The coal situation is reported dull, the large production of California oil causing a stagnation in the market. However, it is not thought that the California wells will gush forever, and the Washington coal will come into its own again some day. Seattle is much interested in President Taft's recently declared intention of effecting a settlement of the Alaska coal lands controversy, and Alaskans who have been alternately in hope and despair for the last decade, again see a glimmer of light ahead. This matter is one of great interest to the whole West, which should unite in demanding a speedy settlement of the question. The cruiser *Maryland* has been making steaming tests of Washington coal, in comparison with Eastern steam coals. There has been some agitation lately to compel the Navy Department to make use of Western coal on the Pacific. The result of the test has not been announced as yet.

Reports are continually heard of the native copper in the Olympic peninsula, this State, and it seems to be well established that a native-copper district exists there, but not enough work has been done to demonstrate its value. The Olympic mountains are perhaps the least-known region in the United States today, and this fact is all the more remarkable when their nearness to the large cities of the Sound country is considered. They are inaccessible, due to the lack of roads, or even trails, the dense covering of brush and timber, and their steep slopes. Rich samples of native copper have been brought out from time to time, and the district would seem to be one well worth prospecting.

TORONTO, CANADA

Activity in Porcupine Stocks. — Electric Power Being Provided. — Development News.—Cobalt Lake.

The past week has witnessed a very decided revival of stock-market activity, the extent of the transactions in Porcupine shares recalling the earlier days of the Cobalt boom. The entrance into the field of the Bewick-Moreing syndicate, which, in addition to undertaking to develop some 50 claims, has purchased a block of Hollinger stock, gave a sudden impetus to speculation. Hollinger rapidly advanced and several other stocks in which there had been little trading previously also took a spurt hardly warranted by any evidence of intrinsic value. The market was, however, quickly steadied by the usual rush of profit-takers, indicating the purely speculative character of the movement. The Cobalts suffered considerably, many holders selling for what they could get in order to invest in Porcupine. At present it looks as though the prestige of the Hollinger and one or two other concerns on a fairly substantial basis may be the means of foisting the usual proportion of worthless or doubtful propositions on the public. Porcupine is promised electric power by about June 1. A power-plant is being installed at Sandy Falls on the Metagami river, and 70 miles of transmission wires are being strung to connect it with the camp. When complete, it is proposed to develop 8000 hp. The Hollinger has already contracted for 1000 hp. At the Rea mines, operated by the Consolidated Gold Fields of South Africa, the shaft is down 103 ft. and will be driven to 230 ft. before a level is cut. The diamond-drill shows free gold at a depth of 239 ft. The Preston East Dome company is putting its machinery in place, preparatory to beginning operations. Four shafts will be put down on the Golden Rose vein, considered one of the most promising in Porcupine. There are in all 26 veins on the properties of the company in which gold has been found. Alexander Gray, of Montreal,

who has attained considerable prominence as a writer on Canadian mining topics, has purchased the McDougall claims, north of the Scottish Ontario group, for $50,000. The Bewick-Moreing syndicate is pushing work on the Pearl Lake claims, and building camps for the accommodation of a large force. H. C. Anchor, formerly of California, has been engaged to take charge of work on the Dome Extension. The Swastika, situated some miles south of Porcupine, has a 150-ft. shaft on a vein which at this depth has widened to about 12 ft. A five-stamp mill is in operation.

The Cobalt Lake company is reducing its capital from $5,000,000 to $3,500,000 by the purchase of stock. Its position has considerably improved within a year. At the Nipissing rich ore has been opened on the 170-ft. level at about 300 ft. from shaft No. 122. The vein is from 2 to 5 in. wide. The largest individual shipment of bullion so far made from Cobalt was made by the Nipissing this week, amounting to 106,430 oz. The Hudson Bay recently opened two more high-grade veins, the principal find being on the second level 300 ft. from the shaft and about 3 in. wide. The Rochester company is increasing its capitalization from $1,500,000 to $2,500,000.

NEW YORK

Amalgamated Copper Co. to Absorb the United Metals Selling Co. — Calumet & Hecla, and the Merger. — All Mexican Proposals in Abeyance.—Porcupine Interests.

Some weeks ago the contemplated absorption of the United Metals Selling Co. by the Amalgamated Copper Co. was announced, though it was expected that it would be some time before the move was made. Now, however, the National City Bank of New York City announces that it has arranged to purchase on its own behalf and that of the Guaranty Trust Co., $12,500,000 of two-year 5% notes of the Amalgamated Copper Co. The proceeds of the sale of such issue are to be used in the purchase of the stock of the United Metals Selling Co., at $246 per share. If approximately all of the stock of the United Metals Selling Co. comes in under the arrangement, the latter will be liquidated and a selling department will be organized by the Amalgamated Copper Co., which will handle its metal products. This step is one of many looking toward a closer organization in copper circles. The movement is one which has extended from the mine operator to the metal broker. In the acquisition and liquidation of the United Metals Selling Co. the Amalgamated adds much to its present strength in the smelting industry, owing to the fact that among other assets the United Metals Selling Co. owns 40,000 shares of International Smelting & Refining Co. stock, carried on the books at par and selling in the open market at $130. This item alone would require, at market price, more than $5,000,000 of the money to be received from the sale of the short-term notes. The resignation of Urban H. Broughton as general manager of the United Metals Selling Co. is expected to be followed at an early date by his relinquishment of other official duties and in all probability his departure to England. The United Metals Selling Co. has long been known as the largest metal broker in the world; it was originally organized by Adolf and Leonard Lewisohn, before the Lewisohn family became at all prominent in mining enterprises, and Adolf Lewisohn is the largest personal beneficiary in the present transaction. At the time of the formation of the Amalgamated Copper Co. a close connection was formed between the two companies, and very soon thereafter the influence of 26 Broadway became dominant in the affairs of the company.

Matters pertaining to the Calumet & Hecla merger are at a standstill at present. All of the companies, except the Isle Royale, which is organized under the laws of New Jersey, and the Gratiot, organized under the laws of Maine, have informally voted in favor of the acceptance of the terms of the merger, as at present outlined. As to the two mentioned, if there are no legal obstacles intersposed, the new Calumet & Hecla will acquire them by purchase later. The next important step will be a hearing in the Federal Court upon the temporary injunction recently secured. None of the various steps of elimination in the different copper groups is having any effect upon the copper market. The metal market is slightly better in tone, with prices ruling around 12½ cents.

The unsettled conditions in Mexico have upset mining plans in the East. The interest in Mexican mining properties and oil lands in New York has grown rapidly in the past few years. The properties at El Oro, while held largely in England, have many stockholders in New York. The purchase of the Santa Gertrudis by the Camp Bird company was a matter of almost as much interest on this side of the water as in London. The new oilfields near Tampico have interested many New York people. All of the plans for development and further investment are now in abeyance.

Porcupine is bidding for market prominence. The Northern Ontario Trust Co. has been organized with a capital of $500,000 to operate in the new goldfield. The most important deal announced during the past few days is that of F. A. Heinze, who is said to have succeeded in interesting Sir Henry M. Pellatt, Robert E. Smith, and Daniel Mann with him in the Foster property. Sir Henry is a man of many activities in Canada, while Mr. Mann is one of the firm of Mackenzie & Mann. Mr. Heinze's organization is to be known as the West Dome Mines Co. The first money that went into the project was advanced to Mr. Heinze by himself out of the funds of the Davis Daly Copper Co.; it is now said that the new financing of the concern will permit of this money being repaid into the Davis Daly treasury. Other Porcupine properties are being brought to public attention and the investment of English capital has made the impression that the claims of the new goldfield are based on something more tangible than surface showings. There is some buying of shares of the newly promoted companies.

Smelter-fume troubles are acute in nearly every smelter district in the country. The Attorney-General, Mr. Wickersham, and the representatives of the Anaconda Copper Co. have been in consultation trying to arrive at an adjustment of the suit brought by the Federal Government against the Washoe Smelting Co. Terry & Tench, the contractors, who are known the world over, wherever engineering and construction works are under way, are backing a reduction process using superheated steam, by which it is claimed all smelter fumes can be absolutely collected and all fume trouble averted. An experimental plant capable of treating small shipments of refractory ores is to be built on the Jersey meadows, and engineers will have ample opportunity to inspect the workings of the plant. The entire operation is simple and the apparatus can be put in without detriment to present plants. There are so many visionary 'reduction processes' that for the most part mining men are skeptical in their attitude toward any such claims.

DENVER, COLORADO

Proposed Legislation. — Resumption at Leadville. — Cripple Creek Drainage Tunnel and El Paso Mine.

The mines inspection bill is suffering from too much political tinkering by legislators who are unfamiliar with coal mining. This bill was framed from the recommendations of the committee appointed by the Governor to inspect the coal mines of the State. The committee did so and made a very commendable report, suggesting changes which would reduce the loss of life in this industry. Perhaps the worst change in the original bill is the omission of the clause requiring the use of permissible explosives. When it is an established fact that the flame from black powder is the most prolific cause of dust and gas explosions, it is beyond comprehension how legislators can omit this clause. The minimum quantity of air to be circulated for efficient ventilation has gone unspecified. If the 100 cu. ft. per man per minute originally specified is too much, then a smaller quantity should be definitely stated instead of leaving it all to the mine inspector and

his subordinates. The power of the Governor to appoint the mine inspectors has been limited to appointing only the chief inspector, who will select his own assistants. This unlimited power to appoint inspectors is wrong. Rigid, efficient inspection can not be expected until the inspectors are under civil service regulations. The proposed levy of one cent per ton on all coal mined, to provide revenue for the support of the inspection service, and for the establishment of miners' classes in the respective coal camps, has been reduced so that the necessary expenses of inspection only will be covered. The question as to whether this levy may not be considered double taxation and hence unconstitutional has not been raised.

The project to put a State tunnel through the continental divide, from Tolland to Arrow, is still a live topic around the Capitol. One faction counsels delay sufficient to consider the question as befits its importance. The other faction is clamorous for an appropriation of $5,000,000, and a careful consideration afterward. It is to be hoped that the legislators will take the middle course of appropriating a few thousand dollars to cover the expenses of a thorough preliminary examination. This is a matter of vital importance to Denver and should be handled as a business proposition.——Leadville is again enjoying the smile of prosperity. The recent cut of $2.50 per ton in the price of zinc ores, which caused most of the mines to shut down, was due largely to an agreement between the local ore-buyers. When they found that the mines would not operate at that price, they changed their attitude and have made several long-term contracts at practically the old figures. The Waterloo, Maid of Erin, Henrietta, Adams, Wolftone, Castle View, Iron-Silver, and Carbonate of Zinc mines have all resumed shipment.——The directors of the Roosevelt Deep Drainage Tunnel Co., of Cripple Creek, have just let a peculiar contract to the management of the El Paso Consolidated Gold Mining Co. The El Paso company is to extend the Fuller cross-cut 125 ft. to open more completely the C. K. & N. fissure. If the flow from the tunnel is increased 1000 gal. per minute, the tunnel company will pay half the cost of the work. If the flow is increased 2000 gal. per minute, the tunnel company will pay the whole cost. There is little doubt in the district about the success of the work. The bottom level of the El Paso mine is now accessible.——The Portland Gold Mining Co. is having a model of its properties constructed in its Colorado Springs offices. The model is of the conventional glass plate type. The dimensions of the enclosing frame are: width, 8 ft.; length, 16 ft.; height, 5 ft. This is one of the largest models on record.

BLACK HILLS, SOUTH DAKOTA

Re-Opening of the Golden Slipper Mine.— Wasp No. 2 Mill-Work.— Golden Reward to Erect Mill. — Building Smelter at Galena. — Maitland District.

With the opening of spring the mines of the Black Hills region are beginning to show more activity, and new work is being undertaken. One of the most interesting ventures is the re-opening of the Golden Slipper mine, near Hill City. This property had been shut down for a number of years, operations having been suspended at a time when there was a burden of debts. A number of attempts had been made to interest investors in the re-opening of the mine, but no one was found who was willing to assume the obligations. During last winter business was quiet in Hill City, and C. E. McEachron, a merchant creditor, D. W. Webster, receiver, and Dell Canfield, a mining man well acquainted with the property, secured an order from the court to enter and work the mine, with the understanding that no further indebtedness would be allowed to lie against the mine. These men secured a crew of miners who were willing to be paid from the profits of the ore milled, and the shaft was unwatered. Results of clean-ups so far have been successful, and while the vein is small, the ore is high grade, and nearly all of it free milling. Their efforts have had such a satisfactory outcome that it is expected capital will be secured for further sinking and modernizing the antiquated 5-stamp mill. The Forest City mine, Hill City district, is producing free-milling ore that yields $10 to $15 per ton. This ore is taken from a vein 5 to 7 ft. wide, at a depth of 250 ft. Further sinking is contemplated. Alfred Damy is superintendent.

The Wasp No. 2, near Lead, is operating steadily. The mill is treating an average of 400 tons of ore per day by dry-crushing and cyanidation. For the month of February the cost of mining and milling amounted to 75c. per ton. The mill was started in December, and within a month or two it is expected that dividends will be declared. A cave of an old stope on the 200-ft. level of the Rattler vein made an opening to the surface on Gold street, in Lead, undermining and taking away a corner of the Campbell House annex and a corner of a steam laundry. The Homestake company, owner of the caved stope, immediately put in a belt-conveyor and set men and teams to work hauling rock to fill the cavity. No further trouble is anticipated. The Golden Reward company has announced that a mill of 500 tons daily capacity will be erected near the site of the present plant, in Deadwood, to handle the ore from the recently opened ore-

North Homestake Mill, Maitland, South Dakota.

shoot, mention of which has been made in these columns. This will give the company a capacity of close to 800 tons per day, as the present plant is now treating about 275 tons each 24 hours. H. C. Osterman, of Chicago, who is building a smelter in the old camp of Galena, is expediting work as fast as the weather will allow. The site of the plant is 2000 ft. below the present terminus of the C. B. & Q. railroad, and the grading for an extension to the plant is completed, and the laying of rails has commenced. Grading for the smelter foundations is practically finished, and construction work is to progress rapidly. Some machinery, stacks, and structural steel were bought from the Golden Reward company, being equipment of the old D. & D. smelter, in Deadwood, and this will be moved to Galena as soon as the railroad is completed. It is estimated that it will make 25 narrow-gauge carloads. The Gilt Edge-Maid company is to erect a concentrator to treat its pyritic ore, as this company has a contract to supply Mr. Osterman with a large tonnage of concentrate. The Altia company may resume work, as the new smelter will afford a market for its concentrate. C. B. Harris, who is making ore-shipments to outside smelters from the Richmond-Sitting Bull mine, at Galena, is preparing to put in more machinery to facilitate work and increase production by the time the smelter is started.

The Echo company, Maitland district, is cutting a station at a point 600 ft. from the mouth of the cross-cut tunnel, where an electric hoist is to be set. By means of this adit a large vein of ore similar in character to that of the Homestake has been opened, and further development at depth, it is hoped, will disclose a pay-shoot. The North Homestake, at the same camp, has been kept in good condition during the two years it has been idle. The water has been kept pumped out during that time. Recently a small air-compressor was installed which will make it unnecessary to run the 600-hp. compressor when sinking

is started. A supply of shaft timbers has been delivered and framed, a new electric mine-pump put to work, the entire mill roof shingled, and a comfortable house erected for the superintendent, L. M. Maitland. It is believed that when pending litigation is settled, the first work undertaken will be to sink the shaft deeper, in order to make available ore which has been disclosed by diamond-drilling from the present bottom, 220 ft. in depth. The ore on this level is in the Cambrian quartzite and shale, but the underlying slate has been found to carry veins of Homestake type. The Reliance company, at Portland, is remodeling the mill and putting in 10 stamps. These will be given a thorough try-out, and possibly some of the troubles arising during former milling tests, when Chilean mills were used, will be overcome. The plant may be working within 30 days. The last mill operations gave a margin of profit, but a suspension was necessary in order to relieve the property of debt which encumbered it when milling was commenced. This has been accomplished by a reorganization of the corporation.

JOHANNESBURG, TRANSVAAL

Discussion of Problems in Deep Mining. — Milling Methods on Rand. — The Sheba Mine. — The Tin Mining Industry Active. — The Occurrence of Tin Deposits.

The problem of winding from great depths has long been regarded as one of the principal difficulties with deep mining on the Rand, but as the mines gradually increase in depth the prospects of solving the difficulty, now that electrical power is likely to become generally adopted, are becoming more encouraging. The question was recently mentioned in a paper read by Alpheus Williams, general manager of De Beers mine, before the South African Institute of Engineers at Kimberley, on 'Handling Large Quantities of Ground.' The author pointed out that the success at Kimberley centred in the concentration and winding of the blue ground from one point, the cost of lowering it from the upper levels and re-loading being only 0.2d. It was also mentioned incidentally that something of the same kind was contemplated at the Crown Mines, Johannesburg, where a much larger tonnage was to be hoisted in the future from two shafts than was already hoisted from ten. This idea has long been urged here by Tom Johnson, who has frequently pointed out that concentration of work is one of the features connected with the handling of large outputs of coal at low cost in England. Mr. Williams pointed out that at the Crown Mines it was contemplated to hoist between 9000 and 10,000 tons per day from two shafts, which would be a great step forward, seeing that probably on the Rand today no one shaft succeeded in hanling more than 2000 tons per day. Another question incidentally mentioned in the paper was the large amount of time necessary for lowering the persons employed underground at these mines, where the work was concentrated on few shafts and the necessity that existed therefore of doing everything possible to increase the efficiency of the underground workers so as to keep down the number to the lowest possible minimum. In this respect it was shown that owing to the introduction of tube-mills the duty had been increased at the stamp-mills in some instances four-fold, and to keep the mill going four times as many hands as before were required below ground. Clearly, the present day tendency was to increase the difficulties connected with the lowering and raising of men, which would only be overcome by increasing the number of engines set aside for handling men alone.

The Butters vacuum-filter seems to be meeting with acceptance on the Rand; for several months it has been in use at the Crown Mines, and it is now decided to introduce it at the New Modderfontein, Robinson, and other mines. In treating the accumulated slime at the Crown Mines a liberal use of lime has been found necessary, running from 20 to 35 lb. per ton, and the cost of treatment is expected to run under four pence per ton. For the New Modderfontein two 1000-ton presses have already been ordered, while the capacity of that for the Robinson mine will be 1300 tons per day. At several ore-reduction works on the Rand, notably at Randfontein Central, fixed amalgamating plates are being used in place of shaking plates. It is found necessary, however, to nearly double the inclination of the plates when stationary, 18° being quite a good grade; in fact, it is found that a better extraction is obtained by the stationary plates as compared with shaking plates. The Sheba mine, in the Barberton district, is an extensive property and is known in parts to contain some highly payable ore, but being scattered and somewhat difficult of access, is expensive to get to the mill. During the past year operations have been largely confined to the best parts of the property, with the result that the ore sent to the mill has increased from 6.17 dwt. to 8.88 dwt., with a slight addition to the working costs. The tributing of the lower-grade sections of the property has not been taken up by tributors to the anticipated extent; no discoveries can therefore be attributed to their operations; but the modified system of handling the property as carried out during the year has been to the advantage of the company. The extraction was low, only averaging about 78%. It is purposed to reduce the nominal capital of the company to something approaching the market value of the shares, at which reduced figure it is hoped the profits earned will suffice to allow the payment of dividends to be resumed.

Map of South Africa.

Owing to the higher price of tin and the important discoveries made in the north of Pretoria, the Transvaal tin industry is attracting some attention. Prior to the working of the northern tinfields in 1907, the annual production was only valued at £4474, and that was a record production obtained from the Swaziland alluvial tin deposits. The opening of the northern tinfields brought the value up to £27,184, and in 1908 to £81,677. In 1909 it was £148,336, and for the year ended June 30, it again doubled, being returned at £303,210. Since that date it has steadied somewhat, but the industry is only in its infancy, and this year there ought to be a marked improvement in the value of the output. One mine alone is already producing more tin than the celebrated Dolcoath mine, the Zaaiplaats output for last month being 160 tons of concentrate, containing 70% tin, valued at £18,000, of which £14,000 is estimated as profits. Last year the property paid 80% in dividends, and in January another 50% dividend was declared. The mode of occurrence of the tin deposits in the northern Transvaal is somewhat peculiar. Generally they occur in the shape of pipes or chimneys in the red granite of more recent geological age than the old gray granites. They occur in various shapes, often running at a low angle. In one instance, at least, they are found in the shape of lodes, such as, for instance, at Rooiberg, west of Warmbaths. The resources of these northern tinfields are somewhat difficult to estimate, but so far the Zaaiplaats mine shows no falling off in depth,

General Mining News

ALASKA

HAINES DISTRICT

The Porcupine Gold M. Co., whose well equipped placer mine is situated on Porcupine creek, 38 miles westerly from Haines, recovered gold of the value of $65,875 during part of the 1910 season, at a cost of $22,438. According to statements made by S. C. Hunter, the company's manager, the gravel that was washed yielded $5 per cubic yard. Its high-line flume, now finished, has a length of 8172 ft., and is 240 ft. higher than bedrock. In its course it passes through a 170-ft. tunnel and crosses a deep ravine over a bridge. The bedrock sluice, started in 1909, was extended

Main Flume, Porcupine Mine.

2000 ft. during 1910, the head of which is necessarily kept up to the face of the banks being hydraulicked. Additional derricks are provided for lifting the boulders. Steam hoists and trolley lifts are used in elevating the gravel from bedrock to the sluiceways in some parts of the property. The company anticipates doing a full season's work in 1911, as all equipment is complete.

JUNEAU DISTRICT

The report of the Alaska Treadwell Gold M. Co., for the month ended February 15, 1911, is as follows: The 240-stamp mill ran 29 days, 21 hr., 57 min., crushing 34,720 tons of ore, producing 630 tons of concentrate. Estimated gross value of free gold saved, $49,781; estimated gross value of concentrate, $36,237; total, $86,018. Estimated total realizable value, $81,741. Operating expenses, $78,568; net operating profit, $3172. Construction expense, $14,408. Yield per ton of ore milled, $2.47; stock of broken ore, 32,364 tons. Development work performed, 844 ft.—97 ft. in ore, 747 ft. in waste.

Report of Alaska Mexican Gold M. Co. for the month ended February 15, 1911, shows that the full mill of 120 stamps operated 30 days, 16 hr., 12 min., crushing 17,853 tons of ore, and saving 390 tons of concentrate. Estimated gross value of free gold recovered, $34,842; estimated gross value of concentrate, $38,421; total, $73,263. Deducting $483 as value of 648 tons of ore from 700 Claim mine, leaves a total production of $72,780. Estimated total realizable value, $70,147. Operating expenses, $34,105; net operating profit, $36,042. Construction expenses, $2883. Yield per ton of ore milled, $4.07. Stock of broken ore, 4814 tons. Development work, 602 ft.—290 ft. in ore, 312 ft. in waste.

THE KUSKOKWIM

It is announced that the Northern Navigation Co. is arranging to put steamships in commission to ply between Seattle and the head of navigation on the Kuskokwim. By this route it is planned also to deliver supplies to points on the Innoko, as the two streams are separated by narrow tracts of country in various places over which portage roads are established. Falcon Joslin, having large interest in the Fairbanks country, has promoted a company which is to establish wireless telegraph stations at Iditarod, on the Innoko, at Georgetown on the Kuskokwim, and at Nulato on the Yukon. Nulato is situated not far downstream from the mouth of Koyukuk; Georgetown is the principal town on the upper course of the Kuskokwim.

ARIZONA

COCHISE COUNTY

Plans have been drawn by C. H. Repath and others for the reconstruction and enlargement of the Calumet & Arizona smelter at Douglas. The plans are to be submitted to the board of directors next month. It is not expected that actual construction work will begin for some time.

GREENLEE COUNTY

The Calumet & Copper Creek M. Co., having a mine and mill at Copper Creek, has issued first-mortgage bonds, the proceeds of their sale to be used in building a mill of 1000 tons daily capacity.

MARICOPA COUNTY

The Mazatal Development Co. has 20 mining claims situated in Mazatal mountains, 67 miles northeast of Phoenix. The locations cover a mineralized zone, in which is found ore containing gold, silver, and copper, the last named being of most importance. Theodore Phillips, John Munger, and C. W. Jayred organized the company. The claims were purchased from B. V. Davis, Charles Slaukard, and E. W. Lightner.

MOHAVE COUNTY.

The Klondike Gold M. & M. Co. has been organized by J. S. Withers and L. J. Lassell, of Kingman, to develop the Klondike group in Weaver district, in Blue ridge range, west of Chloride, and near the Colorado river. The property was partly developed and a small mill was built a few years ago by Charles Gracey and Joseph Wharton. A. F. Muter and John Hall later cyanided the mill tailing. The main vein is to be opened by driving a cross-cut. The ore is said to be well adapted to cyanide treatment. The Tennessee mine, situated at Chloride, and in control of one of the subsidiary companies of the United States company, has a new shaft, which has reached a depth of 500 ft. A drift from the 500-ft. station broke into the old workings, tapping a large volume of water, which soon filled the new shaft to the 200-ft. level, where the pumps are set. Three pumps are kept in operation, and a bailing skip, capable of lifting 18,000 gal. of water per hour, is in use unwatering the mine. Sinking is to be resumed as soon as this is accomplished, and when 600-ft. depth is reached another drift will be driven to connect with the old workings at that depth. This is a lead-zinc mine, which was formerly productive.

CALIFORNIA

AMADOR COUNTY

The California Con. Mines Co. has executed a trust deed to the United States & Mexican Trust Co., and is to issue bonds of the amount of $500,000, the proceeds of their sale to be used in paying the company's indebtedness. The

company owns the Keystone mine at Amador City, and the Wildman at Sutter.

CALAVERAS COUNTY

The Easzy Bird mine and 10-stamp mill, near San Andreas, are operating. The ore being milled is of good grade, and the force in the mine has been increased. It is claimed that three defined lodes have been intersected in driving a cross-cut at the Ariel mine.

ELDORADO COUNTY

A vein of telluride ore has been opened on the Limpinsel mine. Some new machinery is being put in position at the Kum-Fa mine, at Smith flat, and connection is being made with the electric-power line. In exploring the Georgia Slide mine, near Georgetown, the present owners have discovered a vein in which rich ore was found, some samples assaying $100 to $250 per ton. This ore was found 80 ft. below the surface. A force of 16 men is employed on the Landecker mine, at Placerville, 3 machine-drills being in use. Ore for a 48-hour mill-run yielded 55 oz. gold. This property is now owned by the Hope M. Co., for which Dr. Burger is superintendent.

INYO COUNTY

The Mortimer M. Co., for which Asa B. Hall is superintendent, is developing the Union mine, out from Owenyo. A 500-ft. adit has been driven, 200 ft. of which is on a vein in which there is gold and silver ore worth about $9 per ton. A force of 18 men is employed.

KERN COUNTY

Litigation concerning the affairs of the Hamilton Gold M. Co. has ceased, and the company has been reorganized under the name of the Antelope Gold M. Co., the directors of which are A. E. Wiley, Alfred Solano, David Goldberg, and C. S. Bartholomew. Mr. Wiley is superintendent, and has a force of 25 men at work mining ore and operating a 5-stamp mill. The mine, situated at Rosedale, has been opened by a 900-ft. adit. It is thought that the capacity of the mill will be doubled. The Pine Tree mine, in Tehachapi district, is reported as having been sold recently. This property has been worked intermittently for 30 years, and has a mill equipped with stamps and concentrators. W. H. Boison and Roy Baker, mining on the Santa Ana, in Stringer camp, near Randsburg, cleaned up $1200 in gold as the result of milling 17 tons of ore. The property belongs to the Stanford Mining & Reduction Co. W. A. Wickard, having a tungsten mine near Randsburg, has accumulated a lot of ore which is to be concentrated at the Red Dog mill in Stringer camp. The ore contains gold and tungsten.

NEVADA COUNTY

It is announced by the *Grass Valley Union* that M. I. Dow of Boston, and Mrs. B. R. Shankland of Colorado Springs, have become interested with W. H. Martin and others in the Mayflower mine, situated at Canada hill, and that new equipment is to be provided, including an air-compressor and machine-drills. The compressor and other machinery are to be electrically operated, and to obtain power for this purpose a line is to be extended to the Mayflower from the Pittsburg mine where it is to connect with the Bay Counties power system. A small force of men is now employed, and operations are to be more extensive later. The Mayflower was formerly a producer.

RIVERSIDE COUNTY

Morgan & Bradley have shipped three carloads of ore from their mine in Riverside mountain district since Jan. 15. This is said to have sampled $100 per ton. The Calzona Mines Co., operating in the same district, has ordered a gasoline hoist for its property. The principal supply point is Parker, Arizona.

SAN DIEGO COUNTY

The Golden Chariot M. Co., which has been organized with George B. King, Charles T. King, J. H. Isham, R. P. Trainor, and J. W. Elder as directors, is to develop and operate a mining property at Julian.

SHASTA COUNTY

(Special Correspondence.)—The Bully Hill Copper Co. has decided to undertake the smelting of zinc at its Delamar smelter. The plant will be altered and remodeled, the cost of which is expected to approximate $75,000. In this zinc smelting the copper and gold in Bully Hill ores will also be recovered. The chief advantage claimed for the zinc process is that it will eliminate the poisonous fumes attending copper smelting, thus permitting the company to resume operations with both of its furnaces. The Bully Hill plant embraces two blast-furnaces, copper converters, and other equipment, and was completely overhauled and remodeled about four years ago. The mines are situated near the town of Delamar, the ore lying in the rhyolitic belt, on the east side of the Sacramento river. The 3-compartment shaft is over 900 ft. deep, and the properties have been developed to greater depth than any other copper mine in the county. Considerable of the ore assays high in copper, its gold and silver content being $2 to $3.50 per ton. Large quantities of zinc also occur, which in the past has caused considerable trouble in treatment. It is understood that D. M. Riordan, the manager, will arrive from New York early in April to direct operations at Delamar. It is reported that the Afterthought Copper Co., owning the Afterthought mine at Ingot, will commence the building of a 14-mile railroad from Ingot to Bella Vista

Bully Hill Smelter.

shortly. The Afterthought lies in the same ore-zone as that of the Bully Hill group, and the success of the latter with its new smelting process will have an excellent effect on future conditions at the Afterthought. The Spread Eagle group has been bonded to the Shasta Exploration Co. for $125,000. The bond runs for 18 months. A one-tenth payment has been made. The group embraces 22 claims and is situated a short distance north of Redding. The property has been opened by shafts, tunnels, and raises, approximately $65,000 having been expended in this work by the Onn family, the original owners. Representatives of the Farmers' Protective Association are making extensive tests of the smoke issuing from the Cottrell fume-controller at Coram. It is expected that a report will be made within a few days, and upon this will depend the future attitude of the farmers toward the First National Copper Company.

Redding, March 20.

SIERRA COUNTY

The Sovereign mine, in charge of F. O. Richardson, will be active this season. A new lode of pay-ore was opened last December, and this is to be thoroughly developed. Ore-bins are to be built, and if the supply of ore made available during the next four months warrants it, a mill is to be erected later in the year. John W. Deal, John Tournay, and Ben Hagen lost their lives in a snowslide while going on snowshoes from the White Bear mine to the Monte Cristo gravel mine on March 7. Other men were in the party, but they escaped the avalanche.

TRINITY COUNTY

The Trinity Gold Mining & Reduction Co., operating the mine and mill locally known as the Headlight, near Carr-

ville, spent last year $25,686 in developing the mine, and $158,449 on its mill and power-plant. The mill, consisting of eight 5-stamp batteries, amalgamating-plates, and a cyanide plant, was fully described in the *Mining and Scientific Press* of December 31, 1910. It is estimated that the ore reserves amount to 400,000 tons.

COLORADO

David H. Moffat, of Denver, Colorado, died at New York on March 18, at the age of 72 years. He went to Colorado in 1860, and from 1870 to 1890 he was active in mining operations at Leadville, where he attained great success. He held large interests in mining properties in other parts of the State, and throughout his career he was recognized as a factor in the mining industry. He was a financier, and developed mines with his own funds and those of his close associates. During the fifty years of his residence in Colorado, Mr. Moffat was influential in projecting and building railroad lines, the South Park road, extending from Denver to Leadville, via Breckenridge and Kokomo, having been built by a company that he organized. This was accomplished in the seventies, and it afforded the first outlet for Leadville ores. The building of the Florence & Cripple Creek railroad was greatly due to his energy; but the culmination of his achievements was the building of the Denver, Northwestern & Pacific road, now operating between Denver and Steamboat Springs, Colo., but destined to be extended to Salt Lake.

GILPIN COUNTY

(Special Correspondence.)—W. E. Renshaw, of Idaho Springs, has taken over the Crown Point mine. The water is receding since the vein was intersected by the Newhouse adit, and by the time the repairs are made the workings will be dry. The mine was formerly a producer of high-grade ore. J. Stephens, leasing on the 700-ft. level of the Topeka mine in Russell gulch, is stoping a body of ore that is 2 ft. wide. Returns of from $20 to $25 per ton are being realized. The water in the Phoenix-Burroughs mine has been lowered from the 300 to the 500-ft. level. Shipments of mill-dirt are to be started to the various custom plants. Seven feet of ore, exposed on the Beliman vein, assays about $30 per ton in gold and silver. Operations are through the Central adit. Water is being lifted from the Hubert shaft on Quartz hill. The shaft is down 1200 ft. and as soon as the workings are dry drifts will he started from the 1050 and 1200-ft. levels. The First National T. Co. is carrying on development, a body of low-grade ore being in evidence. Within the next two weeks connection will be made between the workings on the Gunnell vein and the Newhouse adit. At that time the scope of operations will be enlarged.

Central City, February 20.

The Frontenac mill, recently finished, is operating and treating 250 tons per day of ore being taken from the Frontenac and Adduddel mines, where 20,000 tons of milling ore is available. The cost of transporting the ore to the mill and treating it is given as $1.85 per ton. The mines are close to Central City, and the mill is at Black Hawk.

LAKE COUNTY (LEADVILLE)

A small tonnage of zinc ore is being shipped from the Colonel Sellers mine, on California gulch. The property is in control of the Empire Zinc Co., which expects to greatly increase its production in the next few weeks. A body of lead ore, 4 ft. wide, has been opened in one of the drifts on the 300-ft. level of the Helena mine, situated on Iowa gulch. The ore is said to be 40% lead. The Little Johnny mine, the greatest on Breece hill, continues to produce high-grade gold ore. The Cofield lessees, at No. 2 shaft, are especially fortunate in finding such ore. Several sacks of ore were taken from narrow streaks which contained 200 oz. gold per ton. This stuff is pulverized and melted at T. D. Kyle's assay office. This No. 2 shaft was retimbered recently, and now operations are going on with a good force. The Little Johnny belongs to the Ibex M. Co. N. Hill and associates are shipping 1000 tons of ore per month from the Baby shaft, California gulch. The ore contains lead, principally, and is of good grade. Ore-shipments to the amount of 75 tons per day have been resumed at the Garbutt mine, on Breece hill. The New Monarch Mining Co., operating the New Monarch and Cleveland mines, near Big Evans gulch, shipped during February 87 carloads of ore, and the March shipments are expected to reach 100 carloads. David Harris, who has acquired an interest in the Forest City lease, Carbonate hill, has taken charge of the work. It is probable that this shaft will be sunk deeper in order to get at the orebodies believed to exist in the lower planes.

PITKIN COUNTY

Approximately $250,000 has been expended in unwatering the Mollie Gibson and Smuggler mines, retimbering, and cleaning out the workings, and mining operations are to begin. These are among the oldest mines at Aspen, and have been great producers of lead and silver ore. The management has 250 miners on the payroll. Good ore has been found on the twelfth level, and future development is to be on and below this level. The Morning and Evening Star mines, at Tourtelotte park, near Aspen, owned by Jerome B. Wheeler, have been leased to the Chicago M. M. & D. Co., which is to re-open those properties.

SAN MIGUEL COUNTY

The shipments of ore and concentrate from Telluride during the month of February amounted to 68 carloads, as compared with 88 cars in the corresponding month of 1910. The *Journal* of that place attributes the decrease partly to the greater concentration of ores and partly to the closing of several mines due to heavy snowfall.

SUMMIT COUNTY

The Miami Mines Co. has given a bond and lease on its holdings at Kokomo to the Elk Mountain Mining & Leasing Co. of Colorado Springs. The mine has been opened by a 1670-ft. adit. In a 90-ft. drift on the vein a body of ore 2 to 6 ft. wide is being developed. This is 800 ft. below the surface, affording plenty of stoping ground. The ore contains silver, lead, and gold. T. Connors is in charge of the work, and shipments of ore are to begin soon.

According to reports from Breckenridge, dredging operations are to begin early this season. The Reliance Gold Dredging Co. will operate a dredge on French gulch; the Colorado Gold Dredging Co. may operate two Bucyrus boats on Swan and Blue rivers; and the French Gulch Gold Dredging Co. is expected to have its Reilling dredge at work in April.

TELLER COUNTY (CRIPPLE CREEK)

The El Paso Con. Gold M. Co. has re-elected its officers, who are as follows: President, A. L. Burris; vice-president, J. N. Beatty; secretary and treasurer, Daniel Thatcher; mine superintendent, John H. Nicholls. The gross production of the mine for 1910 amounted to $505,233, the larger proportion of which resulted from the output of lessees. During the year 8262 ft. of development work was performed, including the sinking of a new shaft. The company contributed $32,800 toward the expenses of driving the big drainage tunnel in 1910. The dividends for the year amounted to $49,000. At present there are 25 sets of leases in force in El Paso ground, 15 of which are productive. The company is reserving to itself the development of all ground below the 400-ft. level. The draining of the C. K. & N. water-channel into the Roosevelt tunnel has resulted in lowering the water in El Paso workings down to the 1000-ft. station, and the orebodies at that depth are to be mined.

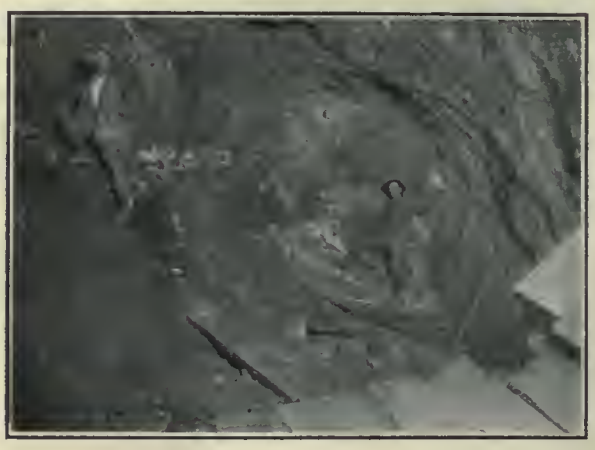
The Cresson Con. Gold M. & M. Co. is reported as producing 2500 tons of ore per month, of an average value of $18 per ton. It is estimated that the costs of mining, shipping, and treatment aggregate $10 per ton. The Elkton company is said to be mining and hoisting ore at a cost of $2 per ton, which is probably as low as any in the district. About 9000 tons of ore per month, of an average value of $3.25 per ton, is being treated in the mill

of Stratton's Independence, Ltd., and this ore was taken from the dump.

IDAHO

SHOSHONE COUNTY

(Special Correspondence.)—During the last three months ore of the gross value of $30,000 per month has been shipped from the Caledonia mine at Wardner. The west drift on the 500-ft. level has been extended 200 ft., and this resulted in opening a body of mill ore, accompanied by streaks of ore containing 1200 oz. silver per ton. The raise from the 500 to the 300-ft. level is finished, and was driven in ore the entire 200 ft. The 2800-ft. adit-level is being driven with air-drills; the heading is in over 700 ft. on the vein. This is to serve as a level for ore haulage when finished, and will give a depth of 700



Taylor Stope, Caledonia Mine.

ft. below what is now the lowest level. This adit starts in Deadwood gulch, which leads into the Coeur d'Alene river below Kellogg. Eventually a concentrating-plant may be erected near the adit's portal. Regular shipments of high-grade ore have been made during the last year, and a considerable tonnage of mill ore has accumulated. The ore comprises lead-carbonate and chloride of silver in the higher workings, and galena, sulphide of silver, and tetrahedrite in the lower workings. Charles McKinnis of Wallace has charge of the property.

Kellogg, March 18.

MONTANA

DEER LODGE COUNTY

(Special Correspondence.)—It is claimed that the money necessary to build an electric railway from Anaconda to Georgetown and Cable district has been subscribed. At present there are 10 or 12 mines operating in this district, and it is predicted that six other mines will be active in the next few weeks. The present activity is greater than it has been for several years, and it is believed there would be profitable business for the projected railroad, especially in the transportation of ore. The length of the proposed line is about 20 miles.

Anaconda, March 16.

MADISON COUNTY

(Special Correspondence.)—The discovery of rich ore near Sheridan is attracting prospectors and mining men to that place. The find was made by two miners who shipped six tons of ore to the Washoe smelter from which they realized $13,250.

Sheridan, March 15.

NEVADA

LYON COUNTY

The Nevada-Douglas Copper Co. has taken steps to raise a fund of $80,000 to be expended in properly equipping the mine and getting it ready for producing a certain tonnage of ore by the time the Mason Valley smelter is completed at Wabuska. It was decided to sell 40,000 shares of the company's treasury stock at $2 per share, in order to provide the sum required. The directors and other large stockholders entered into an agreement to take the entire amount, but the other stockholders are first offered the right to subscribe *pro rata*, and are allowed until May 1 to exercise that right, but subscriptions are limited to 5% of present holdings.

NYE COUNTY

The Round Mountain M. Co. is milling about 3000 tons of ore per month, of a gross value of $30,000. The property is controlled by Loftus & Davis, and is situated at Round Mountain, 75 miles north from Tonopah.

WASHOE COUNTY

A discovery of high-grade gold ore is reported having been made on the side of Fort Sage mountain, situated in Nevada, 18 miles southeast of Amadee, a station in Lassen county, California, on the N. C. & O. railroad. The find was made by S. J. States, C. C. Boker, A. M. Barron, F. W. Wagner, John Mouck, and D. C. Price, who located claims. Surface quartz taken from the vein cropping is said to have assayed $80 to $100 per ton in gold and silver. Others are known to have shown but a trace. The camp is about 80 miles north of Reno.

NEW MEXICO

GRANT COUNTY

Of the 45,000,000 tons of copper ore estimated to be available in the mines of the Chino Copper Co., it is figured that 70% can be mined by the steam-shovel method. The construction of the concentrating plant is well advanced. The steel framework is complete, and the concrete floors are being laid; the foundations for the power-plant are about finished, and the 4-mile pipe-line required to convey water from the supply source to the mill has been laid.

SOCORRO COUNTY

(Special Correspondence.)—The Gold Dust Mines Co. is employing 25 men, whose work is confined to the new shaft and the drifts on the vein. The development work performed amounts to about 1000 ft. The property has good surface improvements, including office, storehouse, blacksmith-shop, and residences. Some work is in progress on the Hard Luck claims. The last clean-up at the Deadwood mines amounted to 3500 oz. gold and silver. During the last week 250 tons of ore was milled, and 45 sacks of concentrate was produced. The Ernestine M. Co., for the week, milled 690 tons of ore. The changes recently made in the Socorro mill will give it increased capacity. Good progress is being made in mine development. The Oliver filter, which has been on trial in the mill of the Treasure M. & R. Co., is reported having proved satisfactory, as it resulted in an increased saving of metals. The company's air-compressor is to be driven by electric power, generated at the hydro-electric plant, 3 miles from the mine.

Mogollon, March 18.

OREGON

BAKER COUNTY

The lessees of the Goiconda mine, near Sumpter, have a force of men at work putting the mill in condition to operate, and pumps are to be put in position to unwater the lower workings. J. C. Haas, of Spokane, has taken charge of the work. The Columbia Gold M. Co. is shipping several lots of sorted ore in sacks.

TEXAS

(Special Correspondence.)—The mining bill failed to become a law at the recent session of the legislature. The measure was generally favored by the members of both Houses, and would have passed had the session extended a day or two longer. Some criticism is being made by mining men of the lack of aggressiveness on the part of the legislators who had the bill in hand in not pushing it through promptly. Governor Colquitt will convene a special session of the legislature in July or August, and

pressure is being brought to bear to get him to submit the proposed mining law as one of the subjects for consideration at that session.

Austin, March 15.

UTAH

BEAVER COUNTY

A new ore-shoot opened in the South Utah, on the 600-ft. level, contains ore averaging 4% copper. Its extent has not been determined, but three cross-cuts are being driven, and cross-cutting will be done on the 700-ft. level to find it there. The annual report of the Horn Silver shows a net profit for the year of $10,342, and total cash balance of $47,358. Production was 3,170,146 lb. lead, 52,229 lb. copper, 337,776 lb. zinc, 20,644 oz. silver, and 174 oz. gold. Work is to be resumed on the Utah United, out from Milford, the intention being to sink the shaft from 420 to 500 ft. depth, and drive for a vein that has been followed from the surface to the present lowest workings. The Revenue company is trying to place 330,000 shares of treasury stock in the East to provide a fund in excess of $100,000 to enable it to enlarge and modernize the old mill. This should give the mill a capacity of 200 tons per day. The plans include putting on a traction engine to haul the ore to the railroad at Newhouse.

JUAB COUNTY

New equipment, recently purchased and partly put in position, at the mine of the Chief Con. at Eureka, cost the company $75,000. It includes an air-compressor having the capacity of 1500 cu. ft. of free air per minute, and a double-drum hoist. Development work on the lower levels is being extended into the territory under the town of Eureka, as well as in the opposite direction. Ore-shipments are being made regularly.

SALT LAKE COUNTY

The Utah Copper Co. has 22 steam-shovels at its property in Bingham canyon, 18 of which are in constant use. Twelve of these are used in stripping, two for loading ore, and others are used alternately in loading and stripping. It is reported that 12,000 tons of ore per day is being concentrated at the two mills near Garfield. This ore is said to assay an average of 1½% copper, and for the month of February the extraction was 71%. The Garfield & Bingham railroad, being built by this company, is expected to go into service by June or July, when the ore will be hauled to the mills in trains of 40-ton cars. According to calculations, the cost of transportation will then be 10 to 12c. per ton less than the present cost.

Another victim has been added to those who lost their lives in the snowslide at the property of the Utah Mines Coalition Co. six weeks ago. One of the men who was buried under a mass of snow contracted pneumonia from the exposure and died in the hospital recently. The Columbus Consolidated has levied an assessment of 10c. per share, to bring in $28,000, which is to be used to pay outstanding debts and install a pumping plant, whereby the workings may be unwatered and the orebodies below the 400-ft. level can be reached. Ore shipments from the Burro mine are to be commenced a month earlier than usual, owing to the light snowfall. This property is only eight miles north of Salt Lake, in the Wasatch mountains. It is well equipped to produce on a small scale. A discovery of 'Utahlite' has been made in the western part of Box Elder county. This mineral was so named by George F. Kunz, an expert lapidary, because so far it has been found nowhere except in Utah. It resembles turquoise in appearance and composition, but is higher in alumina and lower in phosphorus and water. It was found in a circular lode which has been opened to a depth of 20 ft. The Utah & Nevada Prospecting Co. has been organized in this city, with the intention of prospecting and exploring in Utah and Nevada.

SUMMIT COUNTY

The Daly-Judge Mining Co. has entered into a contract with the International S. & R. Co., whereby the output of the Daly-Judge mine and mill will be shipped to the plant of the latter company near Tooele. Last year there was shipped from this Park City mine 9106 tons of crude ore, 47,002 tons of concentrate. The former had an average of $26.14 and the latter an average of $28.45 per ton.

WASHINGTON

SPOKANE COUNTY

(Special Correspondence.)—W. C. Gates, of Spokane, Washington, has acquired 2228 acres of placer ground, situated on the Rio Torredamba, 600 miles inland from the Peruvian coast, and is organizing a syndicate to take over the property and operate it. He claims his ground will average 20c. per yard, and that much of it will sample as high as 80 cents.

Spokane, March 15.

CANADA

BRITISH COLUMBIA

(Special Correspondence.)—Ore from the Toad Mountain Consolidated at Nelson is being tested by the Elmore oil process in England. If the tests show this process to be effective, it is likely that it may be used for treating local ores. Another payment has been made to the Hall M. & S. Co. on account of the Nelson smelter and local mineral properties. The zinc-lead miners of this district are trying to effect reciprocity between Canada and the United States on zinc-lead and like products. A few politicians with ulterior motives are stirring up the fruit-growers of this section against reciprocity. It is doubtful if it would affect the fruit-growers here at all, and the zinc-lead and coal miners favor reciprocity with the United States. An offer of $25,000 has been made to the Great Northern for the abandoned Kaslo & Sandon railway, by a syndicate of local lead miners who wish to put the road in running order again so that they may get the ore from their mines to the lake. The new orebody in the Rambler-Cariboo mine has been opened on the 700, 800, 900, and 1050-ft. levels. A 4500-ft. adit will serve as an outlet for this ore, and raising from this level is in progress. On the 1050-ft. level the orebody has been penetrated for 200 ft., showing for more than 60 ft. in length an average width of 5 ft. of clean ore, of as high as 250 oz. silver and 70% lead. Steps are now being taken to move the Rambler-Cariboo concentrator from its upper site to a point near the outlet on the 4500-ft. level.

Nelson, March 11.

The Standard Silver-Lead M. Co., controlled by Patrick Clark and associates, has let a contract to B. C. Riblet to build for that company an 8500-ft. aerial tramway from the portal of No. 6 adit of the Standard mine to the ore-bins, the latter being situated at the site of the proposed concentrator at Silverton. The plan is to build the mill this season and have it ready for work as soon as the tramway shall be completed. The intention is to ship first-class ore and concentrate to the smelter at Trail. Mr. Clark has an option on the stock of J. A. Finch, of Spokane, and that of George Aylard, of New Denver, which if taken up will give him 65% of the entire issue.

MEXICO

SONORA

(Special Correspondence.)—The Mines Company of America has finished the re-treatment of the old tailing at La Colorada, and is now operating entirely on ore from the Creston and La Colorada mines. The aerial tram system has been rearranged so as to distribute the ore as required to either the Butters or the La Colorada mill, from either mine. The use of electrolytic precipitation at the Butters mill, installed because of the presence of copper salts in the tailing from the pan-amalgamation process, has been abandoned, and the loaded solution from this mill is piped to the La Colorada slime-plant for zinc-dust precipitation. J. E. Clennell, of London, is at La Colorada engaged in making investigations of some of the rebellious ore from the district and in cyanide experiments.

Minas Prietas, March 18.

Personal

Professional men are invited to send news of their engagements and travels. Such news is interesting to friends.

FRED F. FREDLUND, of Longyear & Hodge, was in San Francisco this week.

ALEXANDER LEGGAT, recently in Arizona, was in San Francisco, on his way back to Butte.

W. W. WILLIAMS has gone to Nevada to look into the reported gold discovery north of Reno.

J. T. TERRY, who spent some time in cyanide work in Montana, has returned to San Francisco.

FRANK J. DAVEY, lessee of the Bonanza mine, near Bossburg, Washington, was recently at the Tacoma smelter.

JESSE J. MACDONALD will be in Riverside and San Bernardino counties for a week, making mine examinations.

THEO. E. DICKEL has left the Minas de Tajo, and has gone to the Republic Mines Corporation of Republic, Washington.

OLIVER REECE, superintendent of the Economic mine, near Angels, California, started March 21 for the new gold camp in Washoe county, Nevada.

E. W. KING, J. H. BARRETT, and H. S. CHAPMAN, of the Rawhide Coalition and Rawhide Queen mines, of Nevada, were in San Francisco this week.

FRANK J. MURPHY, formerly superintendent of the Yampa smelter, Bingham, Utah, goes to Australia to become superintendent of the Great Cobar smelting plant.

Among the passengers sailing from Seattle to Alaska on March 16 were the following: WILLIAM HAWKINS, for Kenai peninsula; S. F. HUNT, for Knik; W. G. CASSELS and wife, and A. MCVICKER, for Fairbanks; W. A. STEEL, for Cordova; ANDREW NERLAND and a party of five, for Iditarod.

OBITUARY

A. D. GASSAWAY, who died at Berkeley, California, March 19, after an illness of several months following a severe operation, was one of the most capable of mining engineers who obtained their experience in the California placer mines. He was born and raised in Nevada county, and was familiar with hydraulic mining methods from his youth. Later he turned his attention to dredging, becoming the first superintendent of the Lava Beds Dredging Co., and still later he devoted himself to making examinations and reports on placer properties. To this work he brought a high and deserved reputation for ability and integrity, and his services were much in demand. He returned last year from Siberia where he had been in the service of the Lena Goldfields Ltd. He was not entirely well when he reached home, and lived quietly at Berkeley up to the time of his death. Mr. Gassaway was a thorough student, a hard worker, and one who took the duties of his profession seriously. He will be much missed by his friends and professional associates.

H. P. GARTHWAITE, who died on the Isthmus of Panama, March 17, as a result of congestion of the brain, was a well known Californian mining engineer who first became interested in mines through business relations with Charles Butters. Mr. Garthwaite was at that time a banker, but after joining Mr. Butters, he devoted his whole time and energy to mining. First in South Africa, and later in Salvador, he operated with unusual success. He was constructive by instinct, and enterprises under his charge built up rapidly. He found time for much besides business and was an important factor in public affairs in Salvador. Probably his largest piece of public service was the reconcilement that he, mainly, effected between Nicaragua and Salvador at the time he served as special commissioner for the latter country in connection with a boundary dispute. He was largely influential, also, in straightening out the tangled financial affairs of Salvador, and that Government and its people join Americans and mining men everywhere in regret at his death.

Market Reports

LOCAL METAL PRICES.

San Francisco, March 23.

Antimony	12—12¾c	Quicksilver (flask)	52½
Electrolytic Copper	14½—15¾c	Tin	45—46½c
Pig Lead	4.75—5.70c	Spelter	7—7¾c

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

METAL PRICES.

By wire from New York.
Average daily prices in cents per pound.

Date.	Electrolytic Copper.	Lead.	Spelter.	Silver, per oz.
Mar. 16	12.15	4.37	5.55	52½
" 17	12.15	4.37	5.54	53
" 18	12.15	4.37	5.51	52¾
" 19	Sunday.	No market.		
" 20	12.18	4.38	5.56	52⅝
" 21	12.18	4.38	5.56	52⅝
" 22	12.18	4.38	5.56	52⅝

ANGLO-AMERICAN SHARES.

Cabled from London.

	Mar. 16. £ s. d.	Mar. 23. £ s. d.
Camp Bird	1 12 3	1 13 10½
El Oro	1 4 9	1 5 0
Esperanza	1 11 1¾	1 14 4½
Dolores	1 5 0	1 5 0
Oroville Dredging	0 7 0	0 7 0
Mexico Mines	7 6 3	7 10 0
Tomboy	0 15 6	0 15 0

(By courtesy of W. P. Bonbright & Co., 24 Broad St., N. Y.)

COPPER SHARES—BOSTON.

	Closing prices, Mar. 23.		Closing prices, Mar. 23.
Adventure	$ 5	Mohawk	$ 42
Allouez	33	North Butte	28¼
Atlantic	4	Old Dominion	38½
Calumet & Arizona	50	Osceola	108
Calumet & Hecla	485	Parrot	11
Centennial	12¼	Santa Fe	1
Copper Range	64¼	Shannon	10¾
Daly West	4⅛	Superior & Pittsburg	14⅛
Franklin	9	Tamarack	40
Granby	32½	Trinity	4
Greene Cananea, ctf	6½	Utah Con	13½
Isle-Royale	14½	Victoria	1¼
La Salle	4¼	Winona	7½
Mass Copper	6⅜	Wolverine	112

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

MINING STOCK QUOTATIONS—NEW YORK.

(By wire from Catlin & Powell Co., New York.)

	Closing prices, Mar. 23.		Closing prices, Mar. 23.
Amalgamated Copper	$ 81¼	Miami Copper	$ 19⅛
Arizona-Cananea	3	Mines Co. of America	5
A. S. & R. Co.	76⅛	Montgomery-Shoshone	1/16
Braden Copper	3¾	Nevada Con	18⅝
B. C. Copper Co.	8	Nevada Utah	1
Butte Coalition	17¾	Nipissing	11
Chino	22¼	Ohio Copper	1⅛
Davis Daly	1½	Ray Central	1¾
Dolores	5⅛	Ray Con	17⅛
First National	2¼	South Utah	⅞
Giroux	6¼	Superior & Pittsburg	14⅞
Greene-Cananea	6¼	Tenn. Copper	38¼
Guanajuato Con	⅛	Trinity	4⅜
Inspiration	7¾	Tuolumne Copper	5
Kerr Lake	6⅜	United Copper	4⅜
La Rose	4⅜	Utah Copper	44¼
Mason Valley	8⅛	Yukon Gold	3⅞

SOUTHERN NEVADA STOCKS.

San Francisco, March 23.

Atlanta	$ 10	Mayflower	$ 5
Belmont	5.75	Midway	14
Booth	9	Montana Tonopah	88
Columbia Mtn	3	Nevada Hills	2 95
Combination Fraction	11	Pittsburg Silver Peak	75
Fairview Eagle	45	Rawhide Coalition	3
Florence	2.00	Round Mountain	49
Goldfield Con	6.50	Sandstorm Kendall	9
Gold Mewenas	6	Silver Pick	5
Great Bend	1	St. Ives	16
Jim Butler	24	Tonopah Extension	1.12
Jumbo Extension	41	Tonopah of Nevada	8.25
MacNamara	14	West End	50

(By courtesy of San Francisco Stock Exchange.)

Decisions Relating to Mining

Specially reported for the MINING AND SCIENTIFIC PRESS.

FORFEITURE OF CLAIM—NONPERFORMANCE OF ASSESSMENT WORK

The nonperformance of assessment work by the locator of a mine will not forfeit his claim thereto unless there has been a valid location by another, and a person who did not himself make a valid location cannot question the sufficiency of the assessment work done by the original locator.

Knutson *v.* Fredlund, (Wash.) 106 Pac. 200. Jan. 1910.

RIGHT OF STOCKHOLDER TO VOTE ON RATIFICATION OF MORTGAGE

The statute of California provides that for all corporate elections there must be a majority of the subscribed capital stock or of the members represented, either in person or by written proxy, and that each person acting in person or by proxy must be a bona fide stockholder having stock in his own name in the books of the corporation at least ten days prior to such election. This statute is construed to apply to a vote taken at a meeting of the stockholders of a mining corporation called to ratify a mortgage of its mining ground proposed to be made by its directors, and a bona fide stockholder within the provision of this statute need not necessarily be the owner of the stock, but it is sufficient if the stock stands in his name in good faith for a proper purpose either for himself or in trust for another.

Royal Consolidated Mining Co. *v.* Royal Consolidated Mines Co., (Cal.) 110 Pac. 123.

RATIFICATION OF MORTGAGE BY STOCKHOLDERS OF MINING COMPANY

Under the statute of California requiring the mortgage of a mining company executed on its mining lands to be ratified by the holders of two-thirds of the stock of the corporation, it was held to be a sufficient ratification where one of the directors of such a corporation was the bona fide holder of two-thirds of the corporate stock, and his act as such director in executing the mortgage operated as a ratification by two-thirds of the holders of the stock as required by the statute, to give the mortgage validity. In determining who are the holders of the legal title to two-thirds of such stock, in order to ratify such a mortgage, the courts may look behind the apparent ownership and sustain a ratification made by the beneficial owners of the required amount of the stock. But such a mortgage lacking the requisite ratification can not be rendered valid by estoppel.

Royal Consolidated Mining Co. *v.* Royal Consolidated Mines Co., (Cal.) 110 Pac. 123.

MINE APPLIANCE OR FIXTURE—SALE ON EXECUTION

Engines, boilers, mills, pumps, and electric hoist firmly bolted to the substructure on which they rest and the superstructure and engine house surrounding them, sufficiently affixed to the soil for mining purposes, and a head-frame at the mine, the base of which was originally sunk into the earth to make it level and substantial for use for mining, together with the hoist and transformers, forming integral parts of one mechanism essential to the operation of the mine, are fixtures and are not subject to sale on execution as personal property under the laws of Nevada. This rule applies where a buyer of chattels, under a contract stipulating that the same shall be regarded as the personal property of the seller, with the right of removal until paid for, and thereupon attaches such property to real estate so as to make the same fixtures, they do become fixtures as against every other person except the seller, and cannot be sold as personal property on the execution against the buyer. A sale of property as personal property at an execution sale is invalid where any of the articles sold were fixtures.

Arnold *v.* Goldfield Third Chance Mining Co., (Nev.) 109 Pac. 718. July 1910.

Recent Publications

PRODUCTION OF PLATINUM AND ALLIED METALS IN 1909. By Waldemar Lindgren. Adv. Chapter, Mineral Resources U. S., 1909. U. S. Geol. Surv. Pp. 9. Washington, 1911.

PRODUCTION OF FLUORSPAR AND CRYOLITE IN 1909. By E. F. Burchard. Adv. Chapter, Mineral Resources U. S., 1909. U. S. Geol. Surv. Pp. 8. Washington, 1911.

PRODUCTION OF FULLER'S EARTH IN 1909. By F. B. Van Horn. Adv. Chapter, Mineral Resources U. S., 1909. U. S. Geol. Surv. Pp. 6. Washington, 1911.

POTASH SALTS; THEIR USES AND OCCURRENCE IN THE UNITED STATES. By W. C. Phalen. Adv. Chapter, Mineral Resources U. S., 1910. U. S. Geol. Surv. Pp. 24. Washington, 1911. An interesting general account of the salts.

MINERAL PRODUCTION OF ONTARIO FOR 1910. Bureau of Mines, Bull. 7. Pp. 8. Toronto, 1911. This bulletin, issued by T. W. Gibson, deputy minister of mines, shows a total yield valued at $39,232,814. Silver to a value of $15,436,994 was the largest single item.

DENUDATION AND EROSION IN THE SOUTHERN APPALACHIAN REGION AND THE MONONGAHELA BASIN. By L. C. Glenn. U. S. Geol. Surv., Prof. Pap. 72. Pp. 137. Ill., index. Washington, 1911. A scientific study of the causes of erosion and effects of lumbering, mining, farming, and other industries. Especially timely and valuable.

OIL RESOURCES OF ILLINOIS WITH SPECIAL REFERENCE TO THE AREA OUTSIDE OF THE SOUTHEASTERN FIELDS. By R. S. Blatchley. From Bull. 16, State Geol. Surv. Pp. 138. Ill., maps. Urbana, 1911. This is a concise but helpful summary of existing information with suggestions regarding anticlines and terraces, such as are of great interest to oilmen.

PRELIMINARY REPORT ON THE MINERAL PRODUCTION OF CANADA, 1910. By John McLeish. Dept. Mines, Mines Branch, No. 102. Pp. 21. Ottawa, 1911. A brief summary report issued with commendable promptness and showing a production valued at $105,040,958; an increase of $13,209,517 over 1909. Of the total, Ontario produced 40.95% and British Columbia, 23.37.

ANNUAL REPORT OF THE DIRECTOR OF THE MINT, for the fiscal year ending June 13, 1910. By George E. Roberts. 8vo. Pp. 288. Washington, 1911. This volume includes the usual tables and detailed account of the operations of the Bureau of the Mint, supplemented by some unusually interesting monetary statistics of foreign countries, compiled by Mr. Roberts through direct correspondence.

ANNUAL REPORT OF THE SMITHSONIAN INSTITUTE. By C. D. Walcott. Pp. 751. Ill., index. Washington, 1910. This volume, like those preceding, consists of the annual report of the Institute bound together with some thirty-five reprints from various sources of papers and addresses by leading men of science, dealing with the progress of science during the year under review. It is a mistake, however, to include in a large collection of reprints a few original papers of value, and thus bury them from easy access by the workers along these lines. It would be an improvement to publish the report of the Institute in a separate volume and thus decrease somewhat the size of the present too bulky volume, and a further improvement would be to include in each volume a statement of at what price and where the volume can be obtained. With the present wide diffusion of knowledge the articles here gathered together would be read with interest by a notable proportion of the general public, and if the obtaining of the volume were made more easy large numbers of them would undoubtedly do so.

THE VULCAN IRON WORKS

From the standpoint of economical shop management possibilities, the new plant of the Vulcan Iron Works in Seattle, has been pronounced by experts in construction and operation, a model to be emulated. It was not built piece-meal, but stands today the result of an intelligent, skilful plan, carefully worked out in full before a single pile was driven for any part of the foundation from which it rises.

In the original outlay, economy was not considered, not that money was squandered; but the whole thought was to design and erect a plant, completely equipped with time and labor-saving devices as well as with extraordinary regard for the comfort and well being of its employees. To accomplish this combination, no expense was spared. As it stands, the plant called for an outlay of $2,000,000, aside from the cost of the twelve-acre site. The plant was designed by and constructed under the personal supervision of H. P. Strickland, president and general manager for the company. The thirteen buildings are so grouped as to facilitate inter-communication. Raw material starts in at one end, progresses through the various departments, and comes out at the other in the finished product, without doubling back on itself. To make a tour of this shop is a liberal education in factory management. Waste motion has been eliminated in a hundred different ways. Pig iron is unloaded from a spur at the rear of the cupola. It makes the round of the shop with all possible dispatch, passing from the foundry to the machine shop, by means of an overhead electric crane, which makes deliveries at every machine. All machinery is of the latest type. There is no great amount of belting to be kept up, as each machine is directly driven by its own motor.

Glimpse of The Vulcan Iron Works, Seattle, Giving Idea of Exterior, the Floral Decorations and General Cleanliness.

The railroad siding runs into a pit, leaving the flat-car top flush with the floor-level of the loading platform. This makes it possible to handle all heavy stuff on rollers and does away with raising or lifting. From the standpoint of economy, this feature in itself is of great importance. The plant has direct communication with six transcontinental railroads and easy access to the water-front on Puget Sound. An industrial railroad runs through the entire plant. It consists of 24-in. gauge trackage, connecting all parts of the different shops direct with the shipping department. There are fifteen turn-tables, so arranged that the shortest cross-cuts can be made, when desirable.

Crude oil is used for fuel under the boilers and in the forges, because it has been found much cheaper and cleaner. No labor is required to feed the fires. Electric power is used extensively, and wherever practical, compressed air has been adopted in the foundry and structural and machine shops. The plant is equipped with eight overhead cranes, which transfer the heavy materials to any part of the plant. This feature alone is a great promoter of shop economy, as it does away with a lot of labor. Then, there is a 25-ton stiff-legged derrick to load the motor trucks for making city deliveries.

Sheet metal and ribbed glass have been used throughout so as to get the maximum amount of daylight. No employee of the Vulcan Iron Works ever has to use a candle to see any part of the work he is engaged on. The results for this reason are much more satisfactory than in a dingy iron and steel works, as they are generally found. Neither is there any débris or dirt to be seen anywhere, for Mr. Strickland has found that cleanliness is as desirable about the shop as in the home. As a result of the attractive washrooms, reading quarters, and recreation provisions, the Vulcan Iron Works finds itself able to draw on the best mechanics in the Northwest. It enjoys the self-satisfying novelty of having applications from the most skilled mechanics on file, all the time. Aside from the necessities, the plant has been beautified. The exterior is embellished with flowers, plants, and shrubs, that remain green the whole year around, owing to the mildness of the Puget Sound climate.

Machine Shop View, The Vulcan Iron Works, Seattle, Showing How Light it is.

With this splendid equipment, the Vulcan Iron Works is able to build the most efficient mining machinery. Its stamp-mills, ore-chushers, tramways, hoists, ore-cars, etc., are giving general satisfaction wherever adopted. The brand, 'Vulcan-Made,' has come to mean 'past the experimental stage.' The same applies to all of the logging supplies and sawmill equipment that the company builds. In addition, it is turning out large amounts of structural steel. The fact is, Mr. Strickland has so systematized his new plant that experts who have recently visited it, declare that for scientific and economical operation and for the comfort of its men, the Vulcan Iron Works is without equal. For that reason it is able to turn out adequately and most economically anything in the line of fabricated iron and steel.

The Prospector

This department makes a charge of 25 cents to subscribers not in arrears and $3 to non-subscribers for each determination. To ensure promptness in publication of the determinations, payment must be forwarded with specimens.

W. Q., Gilmore, Idaho: Massive vesuvianite with a little carbonate of lime.

D. H. P., Leastalk, California: No. 1, quartz pieces with clay; No. 2, quartz rock stained with hematite.

R. C. C., Round Mountain, Nevada. Compact clay material stained with hematite which has been deposited in quartz cavities.

F. G., Elk City, Idaho: No. 1, quartz containing pyrite; No. 2, cavernous quartz containing tarnished pyrite; No. 3, quartz somewhat cellular from the action of solutions; No 4, quartz with oxidized pyrite.

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EDITORIAL

GEOLOGISTS and mining engineers around the world join in extending sympathy to the family and friends of S. F. Emmons, who died at Washington, March 28. At another time we shall speak more in detail of him and his work.

THE American Electrochemical Society meets in New York this week. The principal subject to be discussed is the use of electric furnaces in the iron industry. The Claney cyanide process will also come up for consideration.

ILLINOIS coal operators and miners have joined in urging better support of the State Geological Survey and the Department of Mining of the University. Evidently both have commended themselves to those most directly concerned. We are especially glad to see that funds are asked for establishing miners' institutes comparable to those maintained for the benefit of teachers and farmers. More intelligence in the ranks is needed.

CIVIL SERVICE examinations will be held April 12 and 13 to secure a list from which appointments may be made to positions of junior mechanical and junior mining engineers in the Bureau of Mines. Candidates must have the equivalent of four years training in a reputable technical school. Application should be made to local civil service boards, and the law requires that each person be examined within the State of which he is a citizen.

FEDERAL authorities have raided the various offices of A. L. Wisner & Company and charges of using the mails to defraud have been lodged against the principals. Among the companies that this firm has been promoting were the following: Thirty-three Consolidated Oil Company, Mutual Oil Company, Homestake Gold Mining Company, Little Badger Mining Company, Sycamore Oil Company, Valencia Copper Mining Company, Black Oak Gold Mining Company, Eureka Oil & Gas Company, Mount Jefferson Mines Consolidated, Empire Gold Mines Limited, California & New York Oil Company Consolidated, California Monarch Oil Company, United Tonopah & Goldfield Mines, Manhattan-Nevada Gold Company, Philippines Plantation Company, California Diamond Oil Company, Murchie Extension Gold Mining Company, and the Amalgamated Mining & Oil Company. This is a glittering array of names well calculated to lead small investors into thinking that wealth could be had for the asking.

FOR the autumn meeting of the American Institute of Mining Engineers in San Francisco arrangements have been made to secure a special train to bring the visiting members from the East. The start will be from Chicago on September 30, and a day or two each will be spent at the Grand Canyon of the Colorado, Los Angeles, Santa Barbara, and Del Monte, the party reaching San Francisco October 10. The local committee will hold a meeting today to plan for the meeting.

MEXICAN conditions seem likely to improve shortly, as negotiations looking toward peace are evidently in progress. The resignation of the entire Mexican Cabinet is a striking evidence of the desire of the Government to conciliate public opinion. The men who retire have been large factors in the making of modern Mexico. In the years to come their names will be remembered and honored by all. They have given much to the public service and in now sacrificing personal ambition to the public good, they give proof of the deep-seated and wide-spread patriotism which actuates the ruling class in Mexico. It has been all too common to impute to the President alone the great work that has been done south of the Rio Grande. Those familiar with conditions in Mexico, however, know of many cases of disinterested public service by men of classes that in the United States have too often held aloof. There have been many who have served quietly and effectively, recognizing the faults of the present system, but putting their faith in the God of things as they are, to the end that in time the God of things as they should be shall reign.

BUCKHORN in Eureka county, Nevada, will have no need to get out an injunction to protect its own. The new camp that so boldly attempted to appropriate the name is no more. The story is short. For years Fort Sage mountain has been given up to sheep, sagebrush, and silence. February 15 canny herders and ranchers located a group of claims, but preserved the silence till March 19. Sunday afternoon Reno was filled with rumors of a great 'strike,' of veins 200 feet wide, of assays showing $80 to $100 in gold, of a nugget of $6000! Telegrams flew and the rush was on. Monday people flocked into the district from all sides. Tuesday a New York 'capitalist' bought two claims for $1200. Wednesday morning preliminary steps were taken at Reno for organizing a $1,000,000 corporation to operate in the district, and more strangers arrived on every train. The same afternoon the McCullom Company at Reno completed assaying four samples taken across the lode by Mr. W. W. Williams, an experienced San Francisco mining man. Anxiously the results were awaited. They showed no silver and but a trace of gold. Wednesday night the Pullmans and chair cars were crowded going out from Reno, from which place late arrivals returned without going farther north. The New Yorker has his claims; there has been an increase in the amount of money in local circulation; and sheep, sagebrush, and silence reign again.

Industrial Safety Association

Editors and other representatives of the technical press were guests of Mr. David Williams at a dinner at the Engineers Club in New York recently, where the work of the newly organized Industrial Safety Association was discussed. Mr. Williams, in introducing Mr. F. R. Hutton, president of the Association, sketched its purpose, and mentioned that its ultimate object is to create a better feeling between employee and employer by the safeguarding of the former from injuries which simple expedients in many cases would avoid. Mr. Williams went on to say that the idea of the Association was not exactly philanthropic, as it was the intention to encourage corporations and other employers to adopt means for insuring the safety of workmen, and thereby to anticipate, and perhaps forestall, legislation influenced by labor, making for the same ends. Reference was made to a company controlled by Mr. Williams which had felt justified in permitting its employees' insurance to lapse by reason of the ideal conditions under which the mechanics worked. Mr. Hutton, who is consulting engineer to the Department of Water, Gas, and Electricity of New York City, illustrated his talk by pictures taken under actual operating conditions in various large industrial establishments which had adopted devices making for the safety of the workmen. Many of the pictures thrown on the screen were of simple devices and expedients, costing little, but obviously of great value in protecting men against injuries which so often result from carelessness on the part of those injured. He mentioned that one of the principal objects of the Association was to secure the adoption, if possible, of a standard set of shop rules. This object, if attained, would result in complete familiarity with working conditions when employees went from one works to another. His talk met with very favorable reception, much interest and enthusiasm being evinced by those attending the dinner. Before adjourning to the business offices of the Association, where an interesting exhibit of safety devices was on view, a few words were said by Mr. Henry R. Towne, president of Yale & Towne Manufacturing Company. Mr. Towne made referenee to one of the pictures shown during Mr. Hutton's talk, which portrayed a 'first aid to the injured' room in one of the steelworks, and said it much resembled a room in the plant of his own company. At this plant, 3000 workmen are employed, and during the year 1910, 14,000 minor injuries were treated in the small dispensary. A trained nurse was in constant attendance, and, when necessary, a physician was called in. Mr. Towne said that the total cost for the treatment of employees during the past year was only $1500. Consideration of the iron and steel industries will be followed by that of the railroads, and it is then expected to take up mining. Much interest has been aroused among the large employers of labor, and it is believed that the Association will have a most useful and successful future.

Floating Mines in London

In the early days of mining in the United States, mines were expected to pay for their own development. The capital invested was almost entirely that which came originally from the ground, but the amount needed was small. It was still possible to find veins that showed rich ore at the surface, and with only the most modest equipment, or none, mines could be opened and developed. Unfortunately this is rarely true at present. The big surface bonanzas are gone, and to succeed now it is necessary to prospect deep ground systematically, or to work on such a large scale as to make a profit from low-grade ore. Either course demands large capital investment, and where to obtain the money is the acute problem in many a district. It is not within the province of a technical publication to promote individual enterprises, no matter how worthy, and the *Mining and Scientific Press*, as well as those concerned in its management, remains aloof from all promotion. At the same time, it may be helpful to state briefly exactly what may be expected when a worthy property is suitably presented to those who have money to invest in mines.

London is now the greatest mining market. Great Britain receives a yearly return of $750,000,000 from investments in foreign lands, and of this sum, metal mining, exclusive of iron, contributes $150,000,000. Approximately one-half of this is the return on investments in gold mines; for the great gold mines of the world belong to the English. In Great Britain, as elsewhere, men who have made money in mines are usually willing to try again, and the English system of permanent companies managed by engineering firms, favors re-investment of the company surplus in a new mining enterprise. Many of these firms have established enviable reputations and are able to command large amounts of capital for any enterprise that can be shown to be profitable. Whether or not the ore exists and can be mined at a profit, determines whether or not the investment will be made, rather than the proposed scale of the enterprise. It is evident that only properties that 'will stand examination' can be handled under these conditions, but any such property can secure on fair terms the money that it needs. Just what those terms are may be illustrated by a few examples.

It must be remembered that English investors are not inclined to pay out a lot of cash unless some certain profits are in sight. If a property has large prospective as well as certain profits, the owner can get the full cash value of the certain profits, and the acquiring company will, in addition, find the cash necessary for the equipping of the property. Such properties are seldom obtainable, and the more common case is that of a property which has sufficient probable profits to warrant its full equipment but not enough to warrant a cash payment to the owners. In such cases the financier is usually willing to put his cash for equipment against the owner's mine. The interest retained by the owner would depend on the certain profits as well as the prospective profits. For example, take the case of a mine that has available 20,000 tons of $13 ore on which a saving of $11 can be made, the working cost being estimated at $6 per ton, and where the ore, both at ends of drifts and in its bottom, is of good grade. Such a property would warrant the erection of a plant with an initial capacity of 50 tons per day. Presuming that this would cost $50,000 to $60,000, then the owner would be given an interest of perhaps 45 per cent.

Or, taking the case of a mine that has 60,000 tons of $7.50 ore on which a saving of $6 can be made at a working cost of $4, again with good prospective profits, an equipment for handling 100 tons would be warranted. Such a plant would probably cost $100,000, and the owner would not receive more than a one-third interest, possibly one-fourth, in a company with the required working capital. In case of a property with several exposures of outcrop, over a considerable length, these exposures in width and length warranting the expectation of profitable exploitation, the vendor would be given a quarter interest in a company with sufficient working capital to prove the value of the property. In all cases the owners would have to submit as full reports as possible, and if these are not made by some one of known ability, then the owners would have to deposit some cash as a guarantee that the property was not misrepresented. The titles should be perfectly clear, preferably United States patent.

Another method of dealing with properties of merit is to lend sufficient money to the owners to place the mine in a productive stage. In this event there must be sufficient certain profit in sight to repay the lender the amount of his loan plus some remuneration. This, calculated as interest, appears high, but in the end the owner has a fully equipped property without parting with a large interest in it. The amount of the remuneration varies with the richness of the property. Under this plan the two cases cited above would work out in the following manner:

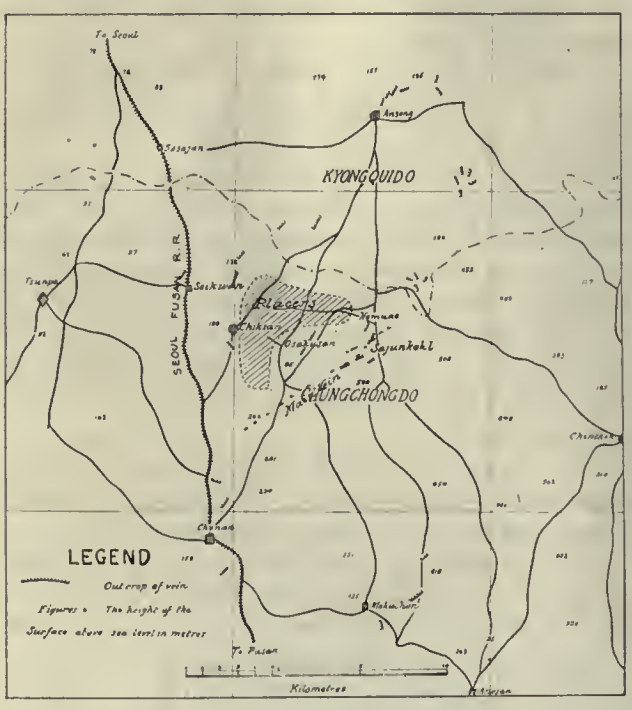
(1) Amount to be lent, $60,000; remuneration to be in three forms, including (*a*) interest on amount lent at 6 per cent per annum until loan repaid, (*b*) a percentage of the profits amounting to one-quarter of one per cent, for each $1000 lent, equal to 15 per cent if $60,000 be lent, and (*c*) a bonus of an interest in the property of 5 to 15 per cent. (2) Amount to be lent, $100,000; remuneration to be in three forms, (*a*) interest at 6 per cent per annum on amount lent until repaid, (*b*) a percentage of profits amounting to one-eighth of one per cent for each $1000 lent, equal to 12½ per cent if $100,000 be lent, and payable during not less than two years after production on a full scale has begun, and (*c*) a bonus of an interest in the property of not less than 10 per cent. There are many other ways in which mining properties can be financed, but the foregoing are examples from which anyone can make calculations as to what can be actually expected in London.

The Chicksan Mines, Korea

By Thomas T. Read

Korea is widely known as a mineral region of note, chiefly because of the conspicuous success attained by the Oriental Consolidated Mining Co., whose properties at Taracol, Chittabalbie, and Tabowie, 100 miles northeast of Pyengyang, have produced $9,500,000 in gold bullion and are still active. The copper mines of northern Korea were briefly described in the London letter of last week's issue. The Chicksan mines, 40 miles south of Seoul, are less well-known, as the exploration which has been in progress during the last few years has only recently reached a stage where an estimate of the value of the district could be formed. Recent results, however, have been of so encouraging a nature that their probable future importance makes a a description of the Chicksan mines of interest.

Map of Southern Korea.



Map of Chicksan Mining Concession.

The Korean Exploration Co., which is jointly owned by American and Japanese interests, obtained from the Korean government a concession to select mining lands, using Chicksan (see accompanying map) as a centre, and extending 13 miles east and west and 8½ miles north and south. Careful exploration work has been carried on throughout this area. The headquarters of the mine are at Homune, a small village in the prefecture of Chicksan, 40 miles to the south of Seoul. Seikwan station, on the Seoul-Fusan railway, is 9½ miles to the west, while Tsunpo harbor is 6 miles farther west. The mine is connected with the railway by a good road, so that transportation by bullock cart is easy and cheap, though not rapid.

Fig. 1. Stamp-Mill, Kurangkohl.

The deposits owned by the company are both veins and placers. Their relative positions and extent are seen by reference to the accompanying map. The territory covered by the concession consists of low rolling hills of granite and schist. The veins outcrop on the hills and the open valleys adjacent are filled with the placer deposits. More than seventy veins have been discovered throughout the concession area, large numbers of these having been previously worked by the natives according to their primitive methods. The largest vein has been traced for nearly five miles of its length and shows a notable gold content throughout, but only rich enough for profitable working

Fig. 2. Placer Workings.

at several points along its course. The ore in the three mines now working on this vein averages $14 to $20 per ton, rich streaks occasionally being found that run as much as $90 per ton. The present explorations indicate that it is safe to count on a very large tonnage of ore that will run $10 per ton or better. The richest ore is found in a vein at Homune, about a half-mile to the northwest of the main mine openings. This is very celebrated among the Koreans, having been the scene of extensive native workings that had to be discontinued on account of the water. The company began to explore this by means of an air-shaft, a pump-shaft, and a double-compartment main shaft. By the time these had reached a depth of 90 ft., 145 ft., and 230 ft., respectively, so much water was encountered that work was temporarily stopped until

Fig. 3. Sluicing.

more adequate pumping facilities could be installed, and it has not since been resumed, as efforts have been concentrated on exploring the main vein. Enough work has been done, however, to show that the vein is of good size and has an average gold content of $44 per ton. In numerous other places veins have been found, some of them possessing even richer ore, but no effort has been made to exploit them as yet, the management wisely considering that a greater profit will be obtained by working the lower grade ore of the main seam on a large scale.

The main vein is being worked at Sajunkohl, Kurangkohl, and Moonsokohl. At Sajunkohl there is an air-shaft and a main shaft, each about 150 ft. deep, and an adit which connects with a winze that extends to about 175 ft. in depth. The vein as exposed in these workings varies from 3 to 15 ft. in width, usually 4 to 8 ft., having an average gold content of $13 to $15. The ore from these openings goes to a 4-stamp Nissen mill, shown in Fig. 1, where it is amalgamated on plates, and the pulp then passes over tables. The concentrate thus obtained is dried and sacked for shipment to America. About 90% of the gold content is thus recovered. The tailing is stacked in a pile, so that it may be cyanided later. The ore is a hard white quartz, the amount of sulphides present not being very great. No experiments have yet been made as to whether it will be possible to cyanide the tailing from the plates without previous concentration, but it seems

Fig. 4. Native Workings.

quite probable that this may prove to be the case. In that event a high total recovery can be made very cheaply. The cost of shipment of the concentrate to America is rather high, but allows a good profit to be made on this method of disposing of it.

About five miles to the southwest, at Kurangkohl, on the prolongation of the same vein, a second

Fig. 5. Native Workings.

series of openings has been made. A vertical shaft has been sunk to a depth of 110 ft., and a short distance away an adit was driven with the expectation of intersecting the vein. Unfortunately, on intersecting the vein it was found that it had been completely stoped out by the natives to a depth of 60 ft. below the adit-level. A winze was therefore put down and a cross-drift is being driven to connect with the shaft at its 100-ft. level. The vein is wider here, averaging 10 ft., and in one place showing over 30 ft. The gold content is lower, being $6 per ton on the average, although rich streaks have

been found that averaged as high as $90 per ton. There is here a small mill, three Hendy 1000-lb. quadruple-discharge stamps with short plates, the pulp passing thence to a Pinder concentrator. The erection of the mill was not finished at the time of my visit, but the supply of ore from the exploration work at Kurangkohl and from the third opening on this seam at Moonsokohl, 1½ miles farther to the southwest, was already greater than the capacity of the mill.

A few hundred yards from the mine at Sajunkohl there is another opening on another seam parallel to the main seam and about 1000 ft. to the north of it. The vein has a fairly constant width of 4 ft., and the ore-shoot at the surface is 75 ft. in length. It has been followed to a depth of 300 ft., and at that depth has increased to 160 ft. in length, the ore averaging $14 to $16 per ton throughout. It therefore seems probable that a good small mine may be made on this vein, but the extensive working of the large main vein will undoubtedly prove the greatest source of revenue. During the exploration work not a little profit was derived from milling small lots of high-grade ore brought in by native tributers. The company makes only a comparatively low charge for milling, as the native work forms an effective supplement to exploration on the company's account. The total number of veins being worked by the tributers is very great, and not a few of these may eventually develop into valuable mines, but even if no further discoveries are made, those in process of development will undoubtedly prove of very considerable value.

A further large asset is the placer ground which occupies the broad valleys of the two small streams that cut across the main vein. These have been tested over an area of some 300 acres by means of 118 holes. The ground is 19 ft. deep on the average, and has an average content of 13.3c. per cubic yard, about twelve million cubic yards being available. The character of the ground can be seen on the eastern edge of the placer ground, near Seijaro, where the Japanese have been at work for four years. The ground here is 18 to 20 ft. deep. The upper 10 ft. of this, a rather loose soil, is removed by contractors, who load it into the cars of an industrial railway, constructed by the company, and dump it on worked-out ground. The next 6 ft., a bluish clay, is removed in a similar manner, but by daily wage. The gold is contained in a layer of sand 1½ to 3 ft. in thickness. This contains a few stones, but I saw very few that were larger than a man's fist, and there was one solitary boulder in all the workings at the time of my visit. The sand is gathered up in the Korean equivalent of a hod (see Fig. 3), holding 30 to 40 lb., carried up a staging similar to that in the background of Fig. 2, and dumped into the sluice, shown in Fig. 3. The cost of working by this method is about 10c. per cubic yard, and the recovery is about 12c., so the margin of profit is not great. The ground at this place averages 20c. per cubic yard, so there is room for improvement in the saving made. The native method of working is shown in Fig. 4 and 5. The cost of this is slightly less, but the recovery is poor. This ground ought to yield good results on dredging, as the overburden contains some gold, not enough to pay for sluicing it, but which would add to the dredging yield. It is also not at all improbable that the average gold content of the ground may prove to be greater than the results of the test-holes indicated, as the method followed in making the examination is likely to give low results. The character of the ground is such as to make dredging easy.

A further advantage that operators in this territory possess is the low cost of efficient labor. A contract was let for sinking and timbering a 4 by 4½-ft. shaft in easy ground at the rate of $2.70 per foot. The average cost per foot in hard ground is $5. A 16-ft. earth road cost $250 per mile to construct, although it involved making one deep cut and a good deal of filling in crossing the ricefields. About ¾ mile of foot-trail cost $9. The local labor is easily trained to the work, many of the men having worked as tributers. They are industrious, peaceable, and easily controlled; a typical group is seen in Fig. 6. They manifest a tendency to leave off work in order to hold feasts and celebrations of various kinds, but a system of fines quickly corrects this. The highest class of skilled labor, such as carpenters and blacksmiths, is usually Chinese and Japanese. These men naturally command much higher wages. Fig. 7 shows a group of natives at work putting down a test-hole.

The terms allowed the company by the Korean government were very favorable, the essential features being duty-free import and export of machinery and ores, exemption from all taxes, and the payment of a royalty of 25% of the net profits of the operation of the mines. When the Japanese annexed Korea this agreement was confirmed by the Japanese Ministry of Korea, and the company continues to operate under its terms. Possibly the fact that the original concession was obtained by a Japanese syndicate in 1900 may have influenced the viceregal government. Be that as it may, the regulations regarding the use of foreign capital in developing mineral deposits in Korea, which the Chosen government has promulgated, are very liberal and offer foreigners equal advantages with Japanese.

In regard to the other mines of Korea, little can be said at present. In many parts of the country the Korean government prohibited the carrying on of mining operations, and prospecting has been somewhat restricted by the reluctance of the natives to disturb graves, being even more superstitious than the Chinese in this regard. But the Japanese have no such reluctance, in the case of Korean graves, at least, and prospecting may now be expected to be prosecuted with vigor. The lack of facilities for communication and transportation was the greatest handicap to the development of mining, but the telegraph and telephone lines, railroads, and ordinary roads which are now under construction will soon remove this disability. Northern Korea offers an interesting field for exploration, but it is too soon as yet to venture an opinion as to the future possibilities of the area.

West Mexican Mining Camps

By A. L. Sheldon

Mining is now quiet aronnd Hermosillo, Sonora, there being more interest in lands. People are coming and going, examining land, and many sales have been made in the district. Mining men are turning their attention to land, owing to this activity, but this is only temporary. In Colorado, three or four years ago, many mining men entered into land and irrigation schemes. However, the tide has turned, and the outlook for mining in Colorado is said to be better than for years. Above Hermosillo, 20 miles east of Poze, the Las Tajos company has been developing the San Geronimo mine and has constructed a concentrating plant. The ore in the upper levels is an argentiferons galena of high grade. The company was making a good grade of concentrate, but the 20-hp. boiler used to pump water to the mill from the reservoir—a long distance—could not supply the mill and a 65-hp. boiler was installed. They built a dam about 40 ft. high, but it did not

Fig. 6. A Group of Koreans.

entirely fill during the last rainy season. George Powell of Idaho Springs is in charge.

J. M. Curtis is manager of the El Oro mine, about three miles this side of the San Geronimo. He is doing a little prospecting work, but has not yet discovered any well defined vein. The company has expended about $250,000, and has milled not more than 2000 tons of ore of $5 grade. They have sunk to over 400 ft. in depth.

The Sultana, east of Carbo, is shut down, and it is believed the mine is nearly worked out. The Cole-Ryan people took this mine only in order to obtain the Giroux at Ely. The Tecoloto company is putting in a small smelter on its copper property west of Carbo. The greatest activity in mining in Sonora during the past year has been in the Altar district, owing to the successful work of the new Quenner dry-placer machine on the clay-cement placer-beds. Practically the whole area has been located—more than 100 square miles. It is a very dry country. The Epes Randolph company spent over $500,000 building a mill and water plant, trying to treat their material by amalgamation, but it was found impossible, as the clay carried off the gold. The placer deposits have been worked in a small way for generations, the dry-washers doing the best work, but the Quenner invention has changed everything. It now looks as though Nature would have to give up the gold in this extensive deposit. The Quenner machine is practically a large barrel revolving slowly on a horizontal shaft. Chains are attached to the shaft inside, with hammers on the ends of the chains. The latter are arranged in lengths so as to give the material a centrifugal motion, which separates and discharges at one end all of the rock. The finely pulverized cemented material drops through a screen and is carried to one side, while the gold is separated in a dry blower that also makes a black-sand concentrate sometimes running as high as $1000 per ton. As the new mining law does not allow one to work his claim until title is received, there are as yet but few machines in operation, but these few are doing very satisfactory work. The machines are made in several sizes and handle large tonnages cheaply.

At Minas Prietas the Creston Colorado people are

Fig. 7. Koreans Drilling.

sinking a new working shaft in virgin ground, where a recent discovery of ore has been made. The old shafts and workings are in a dangerous condition, owing to the extraction of so much ore from this large vein, without sufficient filling of the stopes. The Mines Company of America controls this mine, the Dolores, near Madera, and El Rayo, near Santa Barbara, Chihuahua; also La Dura mines on the Yaqui river, above Corral, where the Yaqui river branch of the S. P. railroad connects with the main line in Sonora. The La Dura mines have been operating for years, and now having the railroad at the mines, the company will be able to handle its low-grade ore. George A. Schroter is consulting engineer and was recently at the mine outlining the work. La Junta mine, which is near Bacari, just south of the Quierago-Alamos district, was discovered within the last year. The owners shipped $65,000 worth of gold ore during the first six months. Now G. W. Smith at Savia is milling the low-grade ore, with satisfactory results. La Junta mine is owned by a number of Mexicans, who divide the ore pro rata at the mine. The mine is supposed to be on the Mother Lode, which extends from near Alamos to La Dura. Just south of La Junta, Wilson & McCarthy are developing their property on the same vein. They have good ore. Clementi Ibarri owns

the adjoining ground to the south, which gives fair results, from surface assays. All that section has been located for several miles. Where the vein is in the porphyry, or along the contact of granite and porphyry, there are good indications of opening mines. This mother lode, at the north end La Dura and at the south end Promontorio, is mostly silver. At Minas Nuevas, A. J. Yeager is cyaniding the old tailing on the Zambona mine, which is on the mother lode, and is turning out 12 to 15 bars per month, each worth $1000. He turns bullion in to the old Government mint office at Alamos. J. R. Hendra has been developing for several years the old San Domingo mine. He has large reserves of ore blocked out, and recently started his 10-stamp mill and concentrating plant, and is shipping a good grade of silver-gold-lead-copper concentrate, with some zinc. Courtenay De Kalb, manager for the Pacific Smelting & Mining Co., recently offered to contract for his product for 10 years. The Quintero, owned by a French company, about one-half mile south of San Domingo, on the same vein, but on contact of granite-porphyry, is now idle after paying dividends for years. At 1500-ft. depth the vein splits, and the one in the granite was followed with no results. The vein between the San Domingo and Quintero is in the granite, and so far as developed is of no value. The old Promontorio, in porphyry, and adjoining the Quintero on the south, after producing continuously for 100 years, is now idle. There are immense dumps which will be worked over again some day. I measured a tree 2 ft. in diameter on one of the dumps. The mine is only 800 ft. deep, and ought to be a good property today under proper management. Pierce Brothers at Alamos are doing some development on their property north of San Bernardo on the Chinipas road. They have some high-grade telluride ore. Seeley W. Mudd, of Los Angeles, gave up his option on Piedras Verdas, 15 miles north of Alamos, after doing some prospect work with the diamond-drill. At Chinipas, George Stevenson, manager of the Zapote mill and mine, is repairing the 10-mile ditch for water-power, overhauling the mill, putting in a cyanide plant, and intends to do away with the 18 miles of railroad to the mine, using a gravity tram. The company has recently acquired the Miguel Torres ground adjoining its property, in which the company had an interest. On Babehuahua creek, southeast of Alamos, Harry Rabb, an old San Juan man, is doing some work on the placers. During the past ten years that I have known these placers various companies have spent large amounts on them, but no one has made a dollar. The placer mines of Mexico are pretty thoroughly worked out. Near there, at Agua Caliente de Avila, there is a copper prospect called the Copper Iron King, a large gossan capping carrying gold and silver, and impregnated with copper. It has every appearance of making a copper mine with development. The mining industry around Choix is not very active. Since the Lluvia de Oro has got to work on its ore but few men are needed. D. C. MacKaller, formerly at the Dolores, is manager. He has a large force of Americans under him and is milling 90 tons of ore per day, making an annual production of $750,000. They have a 750-hp. hydro-electric plant at San Francisco on Fuerte river, 7 miles from the mine. The dam and plant appear well built, and will probably stand the assaults of the river, which has been known to rise 50 ft. in 24 hr. However, a rise of this amount will probably result only in a temporary shut-down during high water. They are putting in an electric furnace to treat the concentrate, which is now shipped to San Francisco. Diamond-drills are also being provided to prospect the undeveloped territory underground. The rock is so hard that they use the chert in the tube-mills instead of pebbles, with satisfactory results. This chert also carries gold. Under the present management the Lluvia de Oro bids fair to regain the good name which it had under the Underwood management. George A. Schroter is consulting engineer.

In San Nicolas Arroya, which empties into the Fuerte at San Francisco, F. R. Barry has in the limestone an immense mine of lead ore carrying gold and silver, the lead mineral being largely cerussite, although in places galena appears. The vein is an enormous one of over a mile in length, and several hundred feet in width, but the erosion has cut out a large part. Still there are on his '3rd of April' claim several million tons, practically in sight, as one can quarry it from the lower side of the perpendicular cliffs, giving 600-ft. backs for 1000 ft. in length and 200 to 500 ft. in width. The ore assays $2 to $32 gold, and 14 to 180 oz. silver per ton. No assays were made for lead, though the ore contains a good percentage. As this is only 12 to 14 miles up-river from where the K. C. M. & O. (Stillwell) railroad will cross the Fuerte, it bids fair to help solve the smelting problem (scarcity of lead) on the west coast. It appears quite probably that most of the placers on the Fuerte river below San Francisco (and there are few above) had their source from this deposit. The placers contain little iron, but for miles below this arroya they all carry what the natives call 'copalia'—a variety of cerussite.

About ten miles south of the Lluvia, at El Oro, Jack Shedden, an old Leadville man, is doing some development on a gold property. He has some Michigan people associated with him. Not far from El Oro, at Pina Alta, one of the numerous companies controlled by Ed. Tuffts, with his brother Harry in charge, is doing a little work and expects soon to erect a mill. The Choix Consolidated, of Los Angeles, having over 30 prospects in the Choix district, is continuing its policy of not working. The company now only pays taxes, but from time to time promises to put in a copper smelter. A subsidiary company, with Mr. Hasford in charge, is doing a little work on the Las Platanos near Choix. Some 7 or 8 years ago Juan Mendoza worked this property and shipped ₱214,000 worth of 18% copper ore. Afterward I spent several thousand dollars in development on the same and then abandoned it. At Yecorato, Jim Donovan is doing a little work on one of Robert Duff's properties

under a bond. Mr. Duff has a number of promising gold prospects in a section which has produced considerable placer gold. Mr. Lezuardo, representing some Milwaukee people, has recently returned from the States to operate his dredge on Yecorato river, just above the town of that name. At Riolito, 12 miles southeast of Fuerte, in the agricultural section, there are two or three promising gold prospects. Donaciano Armenta has recently been doing some work on his Alta mine. There is a small belt of soft metamorphosed shale which appears to have numerous small veins, at a 45° dip. The erosion has left this free gold on the surface above the veins. I have never seen in Mexico a section more thoroughly worked than this, for placer gold. The work is so old no one knows when it was done, and still placer gold is found. At San Jose de Gareia, the Jesus Maria Anexas property, formerly owned by the Anglo Exploration Co., but now owned by Mexicans, under the efficient management of M. A. Newman, is making a new record for itself with an annual production of about half a million. Mr. Newman has completely overhauled everything, putting in tube-mills and a cyanide plant. All the power has been changed to electric, using wood at ₱10 per 2000 kg. The mine pumps, hoist, stamps, Huntington, and tube-mills, mechanical stirrers in tanks, and lights in mine are all run by electric power. He is now putting in an additional 150-hp. boiler for power for another tube-mill, and cyanide-vats to treat 50,000 tons of old $12 tailing. These have to be moved over 500 ft. by a belt, elevated 50 ft., and re-ground. Owing to using the old mill and the topography of the ground, the cyanide-vats had to be placed over 500 ft. from the mill on the higher ground and the tailing dumped there. Electrification was the most economical way to solve the power problem; it would probably cost $300,000 for hydro-electric power from the Sinaloa river, 12 miles away, and at present there is no demand for the surplus which would be generated. Everything runs smoothly, treating about 70 tons daily. The Rosarita mine, about one mile above the Jesus Maria, after a continuously profitable production for 25 years, is shut down. It had been in litigation for several years with other Mexican owners of adjoining ground who live in Mexico City—personal friends of Porfirio Diaz. They were finally given a judgment against the San Jose owners for ₱800,000, who gave up the mine rather than pay it. There are still on the property several undeveloped veins in a lime-shale formation which make as good a showing on the surface as those which have been worked. Just over the hill east on the Chihuahua side is a promising free-gold prospect, the Pasadena, in the limestone. It is a hematite iron-quartz much oxidized. It looks good, but is undeveloped. It is reported that Eugene Tahys is expected to commence work on the Silverlito, which is between San Jose and Rosarita mines, but on the south side of the creek. At Patagon, Norman Tracy is sticking to it, determined to make a mine out of his property. He has milled some good ore. The breast of the lower tunnel is now in very soft ground. Though using false-sets and driving the lagging, he has difficulty in holding the ground. Dr. Thornhill and Mr. York, formerly superintendent on Jesus Maria mine, are developing a very promising property north of Mocorito. They have done several hundred feet of work which shows two feet of the vein and assays $100 gold with silver and copper present, the latter being in the form of sulphides.

At Calabacillas things are running along nicely under the able management of A. J. Underwood, who recently returned from the States. The last few months their production has been above the average. F. O. Pellham, the efficient millman, is taking a much-needed rest of a couple of months. Mr. Jessup is taking his place. J. Webb, mine superintendent, is also taking a vacation, but A. H. P. Wynne, the assayer, bullion-melter, and cyanide man, continues to occupy his position. He has been on the mine practically since it was discovered eleven years ago. The mine has produced about three million and is only 500 ft. deep. It is on a contact vein between andesite and rhyolite, the ore being in the latter. It is a remarkable free-gold ore. They save 95 to 97% of its value. The Seiglo Nuevo, about 20 miles south of Calabacillas, is a promising gold prospect, with a record of over $20,000 gold production in about a year. It has recently been examined by several, but so far no deal consummated. Above Tohyana, on Sinaloa river, near La Platano, a new discovery during the past few months gives promise of adding another golden star to Chihuahua's mines. A friend who examined it says that for 40 ft. in width the vein runs $30 to $50 gold and appears to be extensive; that the vein, in fact, has been traced several miles and shows mineralization. There have been numerous locations made on it, even some overlapping others, but as no work can be done until title is issued, it is entirely undeveloped. Over at Trigo the Zeigler brothers have purchased from Sam Jones the 80,000-ton dump of tailing made by the Anglo Exploration Co., and are preparing to treat it by re-grinding and cyanide. They intend to use an old Brückner roaster as a tube-mill. All through the mining districts with which I am familiar, practically all for the past two months have been busy remonumenting their claims, according to the new mining law. Especially is this true of the foreigners. They will all comply with it, but there is a disposition in places on the part of some native owners not to comply with it; it is proving to be quite expensive in many instances, owing to the topography of the ground, but if properly done it is permanent and a good thing for all. If they had been obliged to place upon each monument in figures the number of the title as well as the number of the monument—for instance, $\frac{4598}{3}$—it would facilitate matters very much, especially in congested districts.

Mineral-wool is glassy slag blown by compressed air into thousands of hair-like shreds. It is used as a non-conductor of heat, for fireproofing and similar purposes.

Pay-Streaks at Nome

By T. M. Gibson

*If nuggets exist anywhere in the third beach they will be found in the zone, marked by cannon-ball boulders, just below the beach plane proper. These boulders have done the tube-mill work in the surf, each being driven up and drawn back by the waves until it is worn out, or by some chance is drawn below the line of action of the breakers and finds a resting place in this row of boulders at the foot of the plane.

The beach plane rises about one foot in ten from the lower rim to near the middle, and then one foot in eight or less to the upper rim. The richest zone is invariably at the foot of this last slope. It is here that single pans could be picked up on the Portland, the Three Star, or May Fraction that would yield $500 or more. This rich zone was generally less than 25 ft. wide, and 90% of the gold was within 3 in. of the bedrock. There were places where one could pick up a dollar's worth of gold between his thumb and forefinger, and no single piece would weigh more than a tenth of a cent. More than $330,000 was taken from a spot in the May Fraction 100 ft. long and of an average width of 15 ft. Ninety per cent of this was in the bottom three inches, making a pay-streak worth over $21,000 per cubic yard. This rich zone on the Three Star Fraction was worth $2500 per linear foot of pay-streak, and parts of the Portland claim were worth $3000 per linear foot. These rich lenses were usually from 100 to 200 ft. long, and then would come a leaner zone and sometimes a blank. Of the two miles from the Portland claim to Discovery, Dry creek, about 3500 ft. was blank, 1200 ft. is still unworked, and the remaining 5860 ft. has averaged nearly $1700 per linear foot, and it is not yet exhausted, though the future output from drift-mining will not materially increase these figures. Most of the claims which carried these immensely rich lenses had in addition a much larger body of good pay-gravel. From the lower rim to the upper rim there would be a continuous body of gravel about 3 ft. thick that paid a handsome profit over costs of mining. It must not be understood that a so-called 'blank' is an area where the beach has been removed by subsequent erosion. The beach material is there, but the gold is lacking. This is a subject upon which there has been much speculation, and many theories advanced, some of which fit the facts of every case. The configuration of the shore-line undoubtedly had much to do with the richness or leanness of the deposit. In the case of the Mojave and O. K. claims, adjoining the east end of the Portland and the west end of the rich Four Corner Fraction, a low cliff or perpendicular wall of bedrock, rising abruptly along the shore, confined the shore-line, maintained a considerable depth of water, and effectually prevented the milling action of the surf which is so favored by a sloping shore. These claims lie in the most favored locality of the entire beach-line, yet they were 'blanks.' Again, a very low shore-line has an equally disastrous effect. The variations in the water-level due to the tides and to off-shore and on-shore winds, carries the surf-line over too great a surface area to leave a well defined line of concentration. This was exhibited to some extent in claim No. 4 Bourbon, and very notably between Cunningham and Hastings creeks. In this latter locality the beach-line is merely a low sand-bar which separated the open sea from a mile or more of lagoons and salt-water marshes lying between it and the foothills. This bar is the barrier eventually formed between Cape Nome and Army Peak, by the currents of the sea, and which cut off the shallow bay that had formerly reached inland to the foothills. The gold in this part of the beach is more finely divided than in that to the west of Nome river. It is spread over a wider area and is of such low tenor as to scarcely pay the expense of drift-mining. The old channels that drained the uplands and emptied directly at this old shore-line were an important factor, and probably the one of greatest importance, in determining local enrichments along the beach-line. The deltas of such old channels are easily recognized and several have been found during the progress of the work along the beach. The most important of these is the old channel of Anvil creek which poured its rich gold-bearing gravels into that part of the shore-line now covered by the famous Portland claim. I shall discuss this one at some length further on, as it played an important part in the enrichment of all the beaches down to the present one. Another old channel emptied in the vicinity of the east end of the Bessie claim and west end of the very rich May Fraction. This was a Dry creek channel and has subsequently been traced to the foot of the upland valley of Dry creek, a distance of approximately one mile. It seems to have had many meanders and to have shifted its bed frequently, leaving the gold-bearing gravel over an area of considerable width with rich concentrations in spots.

Another channel emptied a short distance east of Irene creek. This was a stream of considerable size and was probably the outlet of Osborne creek, which now flows westerly along the north flank of Army Peak and empties into Nome river. No effort has so far been made to follow this old channel toward its source, but the fact that it furnished gold for a rich beach deposit about its mouth, together with the well known gold-bearing character of Osborne creek gravels, and the strong probability that this was once the lower Osborne valley, make the area between this old delta and St. Michaels gulch, a southerly tributary of Osborne creek, a promising field in which to prospect. This covers a stretch of about three miles that is as yet unprospected. The only important deposits so far discovered west of Snake river lie at the mouth of an old channel which emptied into the beach a short distance east of Sunset creek, and this, no doubt, accounts for the local enrichment at that place. This

*Continued from page 424.

old channel is also yet unprospected, but will probably prove upon investigation to be a valuable deposit. These are the principal old channels that fed the third beach, but there are several of smaller size, each of which had a marked effect upon the enrichment of the beach-deposit about its mouth. Although generally rusty in appearance, the beach gravels are nowhere cemented (except by ice in the frozen belts), though there are a few small areas of bedrock where the slabby phyllites after having been shattered and loosened enough to allow gold and sediment to work down to a depth of two feet or more into the seams, were then cemented by iron oxide so that the gold adheres firmly to the broken bits of cemented material. This beach carries but little pyrite or other sulphides in the upper plane, but contains about 10% garnet sand and 1% magnetite and ilmenite with small quantities of limonite, hematite, and scheelite. These are distributed in the lower four or five feet of the deposit with an increasing percentage as bedrock is approached. The whole body of beach material is stratified into layers of varying degrees of coarseness, each layer being from an inch or less to a foot or more in thickness. In the lower plane or 'Slough-Over' the heavy minerals are not so well assorted into the bottom layers, and they occur more sparingly. Pyrite and arsenopyrite are usually present in the shattered surface of bedrock.

The distribution of permanent frost along this beach-line is peculiar, and no satisfactory explanation of its occurrence has yet been advanced. The entire deposit is frozen from surface to bedrock over approximately 75% of its length. The remaining 25%, with the exception of three or four narrow strips, is thawed only along the upper plane. On the seaward side of this plane both the 'Slough-Over' pay-streak and the overburden are permanently frozen. The frost wall rises quite abruptly from bedrock to surface even where the overburden is one hundred or more feet thick. This condition has been very advantageous to the work in the thawed areas, as it enabled the operators to sink shafts, make stations, and install pumps before having to cope with the water. Having everything in readiness a drift was driven to the thawed ground and the water allowed to flow down the slope to the pumps. The handling of the water in the thawed ground has never been a serious problem. The heaviest flow is in the neighborhood of No. 2. Saturday Creek, and the west end of the Bessie claim, where one hundred acres or more of thawed ground lie along the beach and to the northward. The flow here was approximately 500 gallons per minute in the Bessie workings. After a few weeks of continuous pumping in any given area, the flow begins to decrease, and at the end of three or four months is only about half what it was at first. This water is merely reservoired within frozen walls, with an overflow at the lowest surface point, and continued pumping would exhaust it down to mere seepage, the equivalent of the overflow. The thawed areas are of irregular shape, extending to the northward from a few hundred feet to a mile or more, but their south lines are coincident with the south rim of the upper beach plane; and though they may extend from 1200 to 3000 feet along this course, they do not deviate more than a few feet from this line. There are three notable exceptions to this rule, where in the beds of Wonder, Dry, and Newton creeks strips from 100 to 300 ft. wide are thawed considerable distances down-stream. Since the overflow from the thawed areas continues during the winter, it is probable that the water is derived from springs which have their source in the foothills and which reach the surface of bedrock at or near the base of the hills, with the temperature raised considerably above the freezing point and, consequently, are slowly thawing what was once a solidly frozen area. This may be the correct theory as to the origin of these thawed areas, but why they advance their southerly lines so evenly, or why several widely separated areas of different surficial extent should occupy the same relative position along their southerly boundaries is not so apparent.

Cross-Section, Beaches at Nome.

A matter of greater importance to the miner is the fact that the pay-streak in the thawed areas is not nearly so rich as it is in the frozen areas. This rule is without any exception, and it is so marked in several instances as to leave little room to doubt that it is something more than a mere coincidence. In the Discovery claim on Dry creek a strip of thawed ground about 250 ft. wide separated two frozen belts of pay-streak. Approaching from the west through the Ingleside and Tidal Wave claims, the pay-streak averaged about $2000 per linear foot on the upper plane. This average value continued into Discovery claim to the edge of the thawed ground and within the next twenty feet dropped to $500 or less per foot, and within 100 ft. dropped to less than $200, and did not improve until the frost was reached on the east side of the thawed strip. Here it was again worth about $1500 per

linear foot. In a like condition on the Bear Cub claim, the grab-samples dropped from 40 to 50 cents per pan in the frozen ground to 8 cents per pan in the thawed ground. In the Bessie claim the frozen ground was worth $2000 per linear foot and the thawed ground $300 or less. The Bessie thawed ground is on the east side of thawed strip about 1200 ft. long, and, although the greater part of this is, as yet, unworked, it has been extensively drilled and no rich ground encountered. Immediately to the west of this thawed area the Solo claim and westerly edge of No. 2 Saturday Creek were of the usual high grade found in the frozen ground. From a point about midway between Newton and Otter creeks, easterly for 3000 ft., is a continuous belt of thawed beach, and this stretch averaged less than $100 per linear foot, and no part of it exceeded $300 per linear foot; yet, adjoining this belt on the west, the Bon Voyage claim, in frozen ground, averaged about $700 per linear foot, and No. 9 Otter creek, adjoining on the east, about $400 per foot in 250 ft. of frozen ground, with the usual low-grade pay in its thawed ground. These facts, I think, leave no room to doubt the rule, but the reason for these differences in value between the frozen and thawed ground along this paystreak has not yet been found.

The Monroeville beach lies about three-fourths of a mile south of the third beach, and has been traced from a point near Little creek to Holyoke creek. It is approximately parallel with the third beach. This pay-streak, although having an east-west trend and lying upon true bedrock, sloping gently seaward, is yet so different from all the other beach-deposits as to have raised doubts in the minds of many miners as to whether it is a beach-deposit. While carrying much surf-worn material, the deposit is for the most part of very much coarser gravel and is without that definite stratification by which the other beaches are so readily recognized. Further than this, the gold is very much coarser than in the other beach pay-streaks, and is almost wholly in the shattered surface of bedrock. More than half the gold mined from the Union claim, which lies near the centre of the explored area of this pay-streak, is in nuggets, ranging in value from 25 cents to two or three dollars, with a few up to $30 and $40. Both east and west from this central portion, the average coarseness is diminished until at the extremities of the worked area it is little, if any, coarser than average beach gold. It differs from the other beaches, also, in having but little 'ruby sand' and no well defined layers of this material. There is a small quantity of 'black sand', but the most abundant heavy minerals are the sulphides, pyrite, and arsenopyrite. These latter occur in larger quantities than in any of the other beach deposits. This pay-streak is from 300 to 500 ft. wide, and its slope to seaward is only about 1%. About one foot of gravel lying on bedrock and from two to three feet of the shattered surface of bedrock are taken for the pay-streak. It is too low grade for profitable winter driving operations and is mined chiefly in the summer-time, when the material can be dumped into hoppers and sluiced as mined, thus saving the expense of rehandling from dumps. Its output to the present time has been about $400,000. There is still a large bedrock area unworked. This beach is 33 ft. above sea-level, and is overlain by from 50 to 55 ft. of muck, sand, and gravel, all of which is permanently frozen. It seems certain that this deposit owes its east-west distribution to surf agency, but it is probable that the shore-line stood at this level only a comparatively short time, and derived its gold chiefly from the rich gold-bearing gravels of the old channel of Anvil creek which had formerly made its way to the more southerly shore-lines through the area now covered by the Union mine, and probably had its mouth in this vicinity when the shore-line stood at this level.

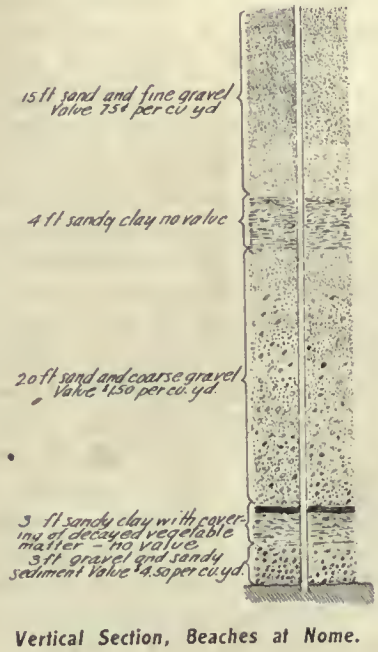
This old channel has undoubtedly been a very important factor in the enrichment of all the beaches in the zone lying southerly from the upland valley of Anvil creek. It was discovered by J. C. Brown in the fall of 1904, in his claim, No. 1 Below Discovery, on Little creek. Mr. Brown has often been given credit for the discovery of the famous third beach, but while his discovery of very rich pay was the cause of energetic prospecting in his immediate neighborhood, and this, soon after, led to the discovery by Johnson & Peterson, of the third beach, in the Portland claim, as a matter of fact, Brown's claim did not contain the third-beach pay-streak at all, but covered this old channel of Anvil creek which emptied into the sea a short distance to the south and east of his boundaries. This channel was well incised into the bedrock, and has subsequently been followed and mined in a northerly direction to its junction with the present bed of Anvil creek at Discovery claim, a distance of three-fourths of a mile. The rims are from 4 or 5 up to 10 or 12 ft. above the lowest part of the bed, and the pay-gravel not only entirely fills this trench, but overflows both to the east and west of the channel rims. The richest gravel is in the lowest part of the channel. In that part of Mr. Brown's claim facing the old seashore, the gravel bed has been worked to a width of 500 or 600 ft., though the channel proper is probably not more than 150 ft. in width. The total depth of the gravel is from 20 to 25 ft., and this is overlain by from 12 to 15 ft. of ice, bluish and black muck, and tundra vegetation. The entire deposit is permanently frozen.

The gravel within the channel rims is coarse creek-wash, consisting chiefly of quartz, schist, and limestone shingled by swift, southerly flowing currents. The overlying gravel is of cross-bedded delta character, the bedding usually standing at high angles. This material is of very similar character to the underlying channel gravel, but occasionally has rounded, surf-worn pebbles and sand interbedded with it. The best pay was on and near bedrock, but it was sometimes found following an inclined bed, and would be rich up to fifteen or more feet above bedrock. Mr. Brown mined and sluiced $40,000 in two weeks time, working three men, just at the close of the season of 1904, and by the end

of 1906 is said to have made himself a millionaire from the output of this claim. The gold was coarse and did not differ materially in physical character or fineness from that which was mined from the present bed of Anvil creek. Pieces worth from 10 cents to $2 were quite common, and many nuggets worth up to $30 and $40 were found. The bedrock is partly slaty, calcareous schist—or phyllite—and partly bluish crystalline limestone. The limestone lies to the east and northeast, making the southwest flank of Anvil mountain, and the schist to the west and southwest. The channel appears to have followed more or less closely along the contact, though sometimes entirely in the limestone and again entirely in the schist. As is the case with Anvil creek, some of the gold shows very little wear and the coarser pieces frequently have calcite and quartz, and sometimes scheelite crystals attached to them.

The accessory minerals which are most abundant are limonite, which is often found in nodules as large as a hen's egg, hematite, garnet, pyrite, scheelite, magnetite, and ilmenite, their relative abundance being in the order named. A pan of gravel taken from the bedrock, with boulders and coarse material excluded, will yield a half-pint measure full of these heavy minerals. The gravel is generally rusty in appearance, and occasionally a spot is more or less firmly cemented with iron oxide, though as a rule it is loose and free after it is thawed. Both in the limestone and the schists are many small mineralized veins and lenses, and these have probably contributed at least a part of the gold that made this area so rich, and by their reconcentration in the surf made the beach sand of the Portland claim, near bedrock, resemble a tray of coin at a bank teller's window. The fact that this ancient channel is intrenched into bedrock below the rims of the third beach offers indisputable evidence that it once emptied farther south when the seashore was lower than the third-beach level, and there is some reason to believe that it may have once emptied farther south and at a lower level than the present beach.

After exhaustive research and careful consideration of all the evidence by members of the Geological Survey, the conclusion has been reached that this portion of Seward Peninsula—that is, the area in the immediate vicinity of Nome—has, within comparatively recent times, geologically speaking, been uplifted, relatively to the sea, approximately 800 ft. In other words, what is now the 800-ft. contour on the hills adjacent to Nome was formerly at or near sea-level. The discovery three years ago of the submarine beach, which is 19 ft. below the present sea-level, is evidence that the uplift was greater by at least this amount, and recent prospecting with a Keystone churn-drill, offshore, about a mile west of the mouth of Snake river, has revealed what appears to be another beach or shoreline concentration at a depth of 45 ft. below sea-level. It is, therefore, evident that the uplift was greater than 800 ft., and we simply lose ourselves in speculation in attempting to fix a limit. It is possible, since Bering Sea is only 1200 to 1500 ft. in depth, that there was dry land connection with Asia, and the mighty mammoth, the remains of which are found buried in the frozen silts of the river valleys of both Alaska and Siberia, once roamed at his pleasure from the valleys of the Yukon, Koyukuk, and Colville to the valleys of the Anadir, Kolima, and Lena. The similarity of the flora also suggests that at some time in its geological history there may have been dry land connection between these countries. Whatever may have been the height to which these shores were elevated, it is certain that a subsidence followed and the sea again invaded the land. This subsidence was of an intermittent character, and various stops were made, each of sufficient duration to make a well-washed shore-line, and the tireless roll of the surf, dashing the rounded quartz pebbles and boulders up and down the gently inclined plane of the shore,



Vertical Section, Beaches at Nome.

accomplished an amount of trituration and concentration which makes man's efforts at milling operations appear puny indeed, in comparison.

Alfred H. Brooks, of the Geological Survey, who very early and with acute prophetic vision foresaw the probable presence of these ancient beaches in the coastal plain, seemed to labor under the impression that they were formed successively from the highest to the lowest or present beach, each representing a period of stability in the general uplift that took place in Quaternary time. He says, in his report of 1900, 'A Reconnaissance of the Cape Nome and Adjacent Goldfields of Seward Peninsula, Alaska', pages 80 and 81: "It has already been shown that the region has been gradually elevated during recent geological time. The coastal plain terraces, like the high benches already described, are made up of material that was deposited along the margin of the shore while the land stood at lower elevation relative to the sea than it does now. The successive benches mark a series of interruptions in the uplift, when the land stood at a constant elevation long enough to permit the accumulation of the material of which the terraces are

formed." And again, on page 90 of the same report, he says: "A question of interest is whether there may not be old beach placers in this region similar to those that are found in Oregon. It has been assumed that this part of the Seward Peninsula has, in comparatively recent times, been elevated to a height varying from 600 to 1400 feet. Attention has been drawn to benches which are believed to represent former shore-lines. It is a logical conclusion that during this period of uplift similar beach placers have been formed in the region, and a search for them should be a fruitful field of investigation. It has been suggested elsewhere that some of the escarpments in the coastal plain may mark former shore lines." In Bulletin No. 379, a report on progress of investigations in 1908, Philip S. Smith, of the Geological Survey, says, on pages 273 and 274: "About a dozen species of fossils collected from the submarine beach at this place (near Nome) by E. M. Kindle and the writer were submitted to W. H. Dall for determination. From their resemblance to fossils whose geologic positions have been determined, he stated that these forms mark, undoubtedly, the oldest horizon that has been found in the unconsolidated deposits of the Nome coastal plain. This coincides closely with the decision that had been reached by the writer on entirely independent grounds, namely, the relation of the gravels containing the fossils to the overlying deposits and the greater amount of decomposition that had affected the shells. No final statement can as yet be made regarding the precise geologic age of the fossils from the submarine beach, but there seems little room to question that they are at least as old as the Pliocene." Again on pages 277 and 278, he says: "From the present evidence it would seem that the earliest event recorded definitely, in the history of the region, is the formation of the 'outer submarine beach.' What the condition of the region was, prior to this incident, is not known, but it is probable that older coastal-plain deposits had been formed and were eroded by the waves to form this beach. After the outer beach had progressed to a certain stage, gradual depression with respect to the sea brought the shore-line at the level of the 'inner submarine beach.' The amount of this depression must have been about 14 ft. Still later, further subsidence of about 42 ft. brought sea-level to the elevation of the intermediate beach. The movement continued and the land sank with respect to the sea about 56 ft., so that the shore-line was on the level of the third beach. While each of the beaches was being formed by the sea, deposition was taking place on the sea floor, and sands and gravels brought down by the rivers and worn from the cliffs by the waves were covering the earlier beaches, thus producing a surface such as the sea floor of the present day might show, if it could be examined. After the shore-line had taken a position landward of the third beach, a change in the progressive depression of the land took place and uplift began. The result of the uplift was to cause more and more land to emerge from beneath the sea. The uplift seems to have gone on at first without any interruption, for there are no signs of long halts and the accompanying formation of beaches on the surface of the coastal plain. At length, however, when the shore-line was some distance to the south of the 'second beach' a period of relative stability ensued, and the sea gradually cut back into the coastal-plain gravels until a cliff, in places nearly 75 ft. high, towered above the beach. This feature can be more plainly seen in the vicinity of Rocker and Martin gulches, a little east of Nome. When this stage of cutting had been reached, an uplift of about 38 ft. brought the shore-line to a short distance seaward of its present position, and then in a period of stability the sea renewed its cutting on the shore and formed the low cliff which rises from the present beach." This is the more rational interpretation of the cycle of changes that have taken place in the geological history of the Nome coastal plain, and, if correct, will justify my statement that the old channel of Anvil creek probably once emptied farther south and at a lower level than the present beach. It was this old channel which brought the rich gold-bearing gravels southward from the Anvil hills, and their presence is evident in each successive shore-line from the third beach at Little creek to the present beach just west of the mouth of Snake river. It is on a line drawn between these points that all the beaches are richest. Moreover, between the shore-lines along this course, where the bedrock is of a slabby nature and makes good riffles for holding gold, many mines have been and are being worked.

While the bedrock floor of the coastal plain is slightly uneven in character, it is, broadly speaking, a gently-sloping plane from the foothills to the sea, along this line, and it is probable that this ancient stream as it made its way to the southward, following the receding shore-line, during the first uplift, played back and forth over a zone a half-mile or more in east and west extension, and thus left here and there the locally rich areas which mining operations have demonstrated to exist within this zone. It does not appear to have left a deeply incised channel south of the third beach, but this may be due in part to frequent changes of its course, after entering upon the open plain and in part to the cutting away of the channel rims by the waves, as the sea again invaded the land. There are, indeed, certain depressions having a north-south trend and low rims along the east side of Center creek for the last half-mile or so of its length, and even extending across Snake river to and beyond the submarine beach, where the bedrock has been carved away a few feet below the beach-level, and where a rim dipping to the eastward led Philip S. Smith to speculate on its probable cause. His conclusion was, that it was probably due to warping, but he admitted that his evidence was insufficient to form a definite conclusion. While these channel remnants have not been definitely connected with the northerly extension of the Anvil channel, they are best accounted for as a part of this old system. When the limit of the first elevation of the coastal

plain was finally reached, and subsidence began, this channel poured its rich gold-bearing gravels into each successive beach, during the time it was forming, and the grinding and sorting action of the waves milled and re-concentrated the material thus brought in. As the subsidence carried the shore-line to the landward of the third beach, the stream not only completely filled the rims of its old bed with gravel, but spread out to form a wide delta, 20 to 25 ft. thick, and being here near the upland valley which supplied the gold, made the rich placers worked by J. C. Brown and others, to which I have already referred. This old channel, no doubt, enriched the fourth beach to payable placers at the foot of the upland valley, but as subsequent erosion has carried away all traces of this beach in that vicinity, its gold has been scattered over the bed of the later stream as it once more followed a receding shore-line to the south.

BALATA

Balata is a variety of rubber which is used in the manufacture of belting and for the insulation of wires. The tapping of the balata trees is done with a cutlass, incisions being made not more than 1½ in. wide, about 10 in. apart, in a 'feather-stich' pattern up the trunks of the trees. The sap runs zigzag from cut to cut into a calabash at the base of the tree. The sap is collected from the calabashes into gourds and then it is taken to the camp, where it is poured into shallow trays that hold from 5 to 30 gal. The sap coagulates in these trays and the balata is taken off in sheets, dried, and despatched to town for transhipment. The laborers are paid by results, according to the amount of balata collected.

The following table shows the exports, in five-year periods, of balata from British Guiana since 1890.

Period.	Total for 5 years. Lb.	Average export per year. Lb.	Average value per year.
1890-1894	995,515	199,103	$73,400
1895-1899	1,682,265	336,453	100,600
1900-1909	2,386,655	477,331	162,750
1905-1909	3,278,683	655,737	353,350

Magnetic separation is based upon the fact that different mineral species possess different ratios of a physical characteristic called magnetic permeability; which means the ratio of their conductivity for magnetic lines of force compared to the conductivity of air. The determination of the exact permeability of minerals is exceedingly difficult, on account of the chemical differences in specimens from different localities; as well as the difficulty in securing sufficiently large specimens of the pure minerals. Investigators, however, have arrived at close approximations. It is found that magnetite is of sufficient permeability to ensure its easy separation from quartz, feldspar, apatite, pyrite, and other minerals, and that the permeability of pyrrhotite and ilmenite approaches the permeability of magnetite so closely that their separation from the latter is much more difficult.

Timber Treatment Plant at Rocker, Montana

Wood preservation, while important in its broad national aspect, is of direct personal importance to every user of timber which is exposed to decay or insect attack; for by lessening the cost of maintaining his fences, his mine timber, his telephone line, or his track, it means a direct saving in dollars and cents. The following is a description of a wood-preserving plant built by the Anaconda Copper Mining Co. in co-operation with the United States Department of Agriculture, Forest Service, at Rocker, near Butte, Montana.

The treating cylinder, 6 ft. diam. and 43 ft. long, is built to withstand a working pressure of 100 lb., and has a capacity of 350 cu. ft. or 6360 ft. board measure per run. It was planned to treat all the ties and bridge stringers for the Butte, Anaconda & Pacific railway, shaft-sets, and timber in the permanent openings of the company's mining properties at Butte and vicinity. Steam, electric power, etc., are furnished from the boiler and engine room of the old framing mill, where all 'stope' timber is framed, some 400 ft. distant. All the timber is shipped in by rail and unloaded in the storage yards, from which it is conveyed to the treating plant by means of small train cylinder cars run on 24-in. gauge tracks. After treatment the timber is piled on the loading platform ready for shipment. A tank for the butt treatment of poles is placed near the treating plant. Lodgepole pine poles given a butt treatment with creosote will last 18 to 22 years, as compared with 8 to 13 years for untreated cedar.

The following table shows approximately the relative cost of untreated cedar and treated lodgepole pine poles f.o.b. Butte. It is seen that in every case the treated lodgepole pine will cost less than the untreated cedar:

Length.	Top Diameter.	Cost: Untreated Cedar.	Cost: Treated Pine.
25	6	2.10	1.85
25	7	2.45	2.16
30	6	2.65	2.37
30	7	3.20	2.80
35	6	3.85	3.00
35	7	4.75	3.60

As an instance showing the relative saving by using treated timber, the following case is cited:

The cost of one complete set of untreated timber erected in a main drift of cross-cut is	$20.77
The cost of a similar treated set	28.02
Estimated length of life of the untreated timber	6 years
Estimated length of life of the treated timber	20 years

Figuring 5% compound interest, the annual charge for the untreated set would be $4.09, as compared to $2.38 for the treated, thereby an annual saving of $1.71 per set is obtained by using treated timber. However, in considering the practice of wood preservation the initial cost of the timber should not only be considered, but also the labor cost of replacing decayed material and the gradual increase in price of all kinds of lumber, poles, and ties.

Del Norte County Geology

By Oscar H. Hershey

Owners of mines in Del Norte county, California, will doubtless be interested in a geological map of that region. The map printed herewith is based on a rapid reconnaissance made in 1907, and, while not accurate in detail, shows the general distribution of the formations. The soft sandstones and silts of the late Tertiary formation underlying the 'Cresecnt City lowland' contain some thin lignite layers. The Franciscan sandstone and shale belt (perhaps including some Knoxville shale near the Oregon line) is not mineralized. Prospects are widely scattered in the great belt of serpentine and meta-gabbro that crosses the county from north to south. The Ora Anna is a gold-quartz vein in meta-gabbro. The Alta is the principal old mine of the Low Divide copper district. The country rock is serpentine. The Cleopatra is also a copper mine in serpentine. The Table Mountain is an old copper mine in serpentine. Many copper prospects are present in the belt near the Middle Fork of Smith river.

In the vicinity of Patricks creek there is a group of base gold-quartz veins in early Paleozoic igneous rock. The Monumental, working bodies of auriferous arsenopyrite impregnating altered basic rock, is the principal old mine in Del Norte county. Next in traversing the county from north to south is crossed an irregular belt of Galice dark gray and black slates and crushed sandstones, resting on a volcanic series and intruded by the serpentine-meta-gabbro series and by granitic rocks. The Weitchpec schists are mainly highly metamorphosed portions of the Galice formation. The Galice has been studied in Oregon by J. S. Diller of the U. S. Geological Survey, and shown to be of the same age as the Mariposa slates that follow the Mother Lode in the Sierra Nevada region. However, in Del Norte county the belt does not contain any important prospects so far as I know.

It is evident that the majority of prospects and mines in Del Norte county are in the serpentine and meta-gabbro areas, though the Paleozoic rocks of the Patricks creek district are also favorable. The Galice and Franciscan areas are practically barren.

Geological Map, Del Norte County, California.

Discussion

Readers of the MINING AND SCIENTIFIC PRESS are invited to use this department for the discussion of technical and other matters pertaining to mining and metallurgy. The Editor welcomes the expression of views contrary to his own, believing that careful criticism is more valuable than casual compliment. Insertion of any contribution is determined by its probable interest to the readers of this journal.

A B C of Empire Drilling

The Editor:

Sir—In your issue of February 25, I note a letter by Fred J. Siegel, referring to the use of the Empire hand-drill. His conclusion that not rotating the casing and not starting the pipe plumb were the causes of its not remaining vertical, however, are wrong. The casing was rotated continuously during the operations and the casings were always tested by levels to make sure they were exactly plumb. The reason, as stated before, was that the gravel was loosely packed, and when a boulder was struck slantingly, the shoe would work around the side, thus throwing the whole pipe out of plumb.

R. B. MCGINNIS.

Berkeley, California March 10.

Great Cobar Mine

The Editor:

Sir—I have had sent to me from Australia your paper of November 19, 1910. The part of the report you print to which I object is that a casual reader might assume that I was responsible for the plant that failed. Neither myself nor any of my officers had seen a plan of the furnace plant until some weeks after a considerable portion of it had arrived from America. During the years you say that the Great Cobar mine yielded handsome profits for the local owners I might inform you that I was the general manager, in fact was mine manager at Cobar and then general manager for all the Great Cobar Syndicate's properties for about five years before Great Cobar Ltd. appeared on the scene, and was then general manager for that company for two and a half years, and made for them £190,000 profit, the only profit the latter company has ever made.

G. H. BLAKEMORE.

Los Angeles, February 10.

Mining in the Ketchikan District, Alaska, in 1910

The Editor:

Sir—My attention has been called to an omission in the Press Bulletin which summarizes the mining industry of Alaska for the year 1910, issued by the United States Geological Survey, December 31, 1910. In this publication no reference was made to the fact that in September operations had been renewed at the Rush and Brown copper mine, located near Karta bay, Prince of Wales island. As the bulletin purported to enumerate all the properties in the Ketchikan district upon which any important work had been done during the year, the operations at the Rush and Brown mine should have been referred to. The only excuse that I can plead is that the Press Bulletin was prepared in considerable haste and that the omission was simply an oversight. There were probably other mining operations in Alaska of equal magnitude which did not receive mention, but in this case the omission was the less excusable because you had already recorded the fact of the renewal of operations at the Rush and Brown mine in your issue of October 29, 1910, page 588. It is my purpose to have the annual summary of the mining developments in Alaska, published by the U. S. Geological Survey, present a complete account of the conditions of the mining industry throughout the Territory. I shall be glad if mine operators and engineers will inform me of any omissions or errors which occur in these publications. The Press Bulletin issued about the first of January of each year is simply a preliminary statement to be amplified and in some cases, I regret to state, corrected by the more complete report published some months later.

ALFRED H. BROOKS.

Washington, D. C., March 4.

Tank Versus Vat

The Editor:

Sir—For a long time past I have noticed that you consistently speak of 'cyanide vats' in describing cyanide plants. Not remembering ever having heard the word 'vat' used in and about cyanide plants, except by one foreigner, who puzzled me for some time as to what he was referring, I went to some pains to look up the matter and found that on page 40 of 'A Guide to Technical Writing,' the distinction is made that a tank is a receptacle for holding a fluid, while a vat is a receptacle for carrying on any process, such as leaching for example. In other words, a tank is a tank if you put a liquid in it and leave it there, but if you carry on any operation in it, it is a vat. The dictionaries confirm this distinction, but all the same I want to hand in a minority report which I think the great majority of engineers will endorse. When I went to High School the teacher used to tell me in rhetoric class that "use is the law of language," and unless my ears have deceived me the men who are doing cyanide work do not talk about 'vats.' What difference does it make if technically it is a vat—a cyanide tank is not exactly like anything that existed before cyanide practice began, and if cyanide men had chosen to call it a papoose, who is there to say them nay?

EVE—That is a park.

ADAM—Why do you call it a park?

EVE—Because it looks like a park!—'Extracts from Adam's Diary.'

Not long ago the editor of *The Engineering and Mining Journal* tried to make us believe that a smelter ought to be called a smeltery, but no one ever stopped long enough even to laugh at him. It riles me, Mr. Editor, to write you what I consider an interesting and valuable description of my cyanide tanks and then have you put me down in print as using vats. They may use vats in a brewery and a dye works, but I call for a show of hands from the men who are doing cyanide work. Do we use vats or tanks?

KCN.

San Francisco, March 15.

Mistakes of the Prospector

The Editor:

Sir—Under the above heading I wish to present a series of facts that although minor in detail are far reaching in effect, and tend to wreak incalculable injury to mining in general, and especially to prospecting. We know, that is, we all should know, that capital can not and will not invest great amounts of money on surface indications unless they are exceptionally favorable. What is the average prospect but a surface indication, and how many prospectors are financially and physically able to sink deep shafts, drive drifts, and block out ore in order to demand a good price? Very few indeed, and these grow old in their endeavor, and do not realize that a much smaller sum would have been of more benefit to them in younger days, if judiciously invested, than a large one now. We have here a number of men who have passed the three-score mile-post and have worked their claims for a number of years. They had several opportunities to sell, but no, they have fixed prices, as high as the ladder which Jacob saw in his vision, and cash at that, and now they are like X. Beidler's dogs, waiting. These dogs, when they had driven a woodchuck to his hole, would squat on their haunches around the hole, awaiting his coming out. So finally the Government took a turn one day and bundled the whole tribe of Indians on the train. When it entered the Big Horn tunnel the dogs squatted on their haunches and waited its return, but it never came, and today—their bones are bleaching on the plains. The prospectors should consider that if anybody paid them their price, say one-quarter cash, and the actual price should be $60,000, the buyer would have to expend an equal sum, if not more, before he would realize a cent out of the venture.

Another matter of serious import is, misrepresentation and overestimation of values. A case happened here some time ago where a prospector went to Los Angeles and while there exhibited specimens of unusual value which he had pilfered from a neighboring property. Several people became interested and sent two men out to examine. They could not find a trace of the ore which had been exhibited, on the ground, but found out from where it came. Common sense should tell a man that such action is foolish, dishonest, that it is certain to be found out, and will not only hurt him but the whole district as well. Next comes the fellow with imagination, as, for instance, a certain man stated a year ago that he had exactly a second Witwatersrand, quartzites, schist, reef, and all (but the trouble is that the conglomerate is lacking, and a few other things too numerous to mention). Next he electrified the country by maintaining that he was on the North Star lode, which is about 35 miles distant, in Tertiary eruptives, while his claims are in pre-Cambrian schists. I presume the next thing we shall hear is that the lode has cut the Huronian and Laurentian and is rooting around in the barysphere, looking for a point of least resistance. People should treat such effusions for what they are worth, and this case with a covert sneer. In conclusion, I will state that the worst and most pernicious evil is the knocker, and he is found among all classes, from the hotel man who meets you at the door with a hearty smile upon his face, and as soon as your errand is stated and inquiries made, exclaims, "Ach Gott! it's nothing there!"—to the fellow who has been sent to look up some promising properties, and who initiates his entrance into the community by a grand old debauch, thus wasting the money trusting friends have furnished him, and then reports adversely, to cover up his shortcomings. Lastly comes the prospector who with envious eye looks upon his neighbor's progress, and the one who holds his claims by the easy method of pencil and paper, re-locating every 90 days.

Much more could be written of the shortcomings of the pioneers of mining, but I believe that I have stated the worst features, and hope the near future may bring better results. To suggest a remedy is unnecessary, for it is within the domain of common sense and its construction devolves on the one most interested.

H. C. Mueller.

Quartzsite, Arizona, February 17.

Weight and Volume of Ore

The Editor:

Sir—The method used by Charles P. Brooks for obtaining the specific gravity of ore was given in your issue of February 18, in an interesting article on the weight and volume of ore. His method consists of the obtaining of the volume of an unknown weight of ore by burying it in a box of wheat or grain, leveling the grain off even with the top of the box, then removing the ore and getting its volume by measuring the volume of the box from its top to the top of the grain. I have used practically the same method on a smaller scale, but substituted water for the grain. I had under consideration the specific gravity of galena ore with a quartzite gangue and containing blende and pyrite. The ore was hard and practically impervious.

I made a water-tight wooden box, whose inside dimensions were four by four by fourteen inches. This box was filled to a depth of about seven inches with water and the distance from the top of the box to the surface of the water measured and recorded. The rejects from the sample, weighing about eight pounds, were then placed in the box and thoroughly stirred with a spatula to work out all of the air. Then the box containing the water and ore was weighed, and the distance the water had risen in the box measured. The weight of a cubic foot of ore was then calculated by simple proportion. The weight per cubic foot of a number of samples containing different percentages of lead was obtained and a curve plotted showing the volume per ton corresponding to the various percentages of gangue-insoluble. The curve was so regular that the probable error in using it in obtaining the weight of any ore of a similar character was practically negligible.

A. E. Robinson.

Boise, Idaho, March 8.

Concentrates

Most of these are in reply to questions received by mail. Our readers are invited to ask questions and give information dealing with the practice of mining, milling, and smelting.

Cinnabar is known to occur at a number of places in Nevada, and some very rich quicksilver ore has recently been found there.

Potash is chiefly derived from the salt deposits at Stassfurt, Germany. The amount which can be produced and sold each year is regulated by the Government in order to maintain prices and prevent exhaustion of the supply.

The barrel-chlorination process was installed at the Mayflower mine in Amador county, California, in 1887, but was not a success, for the reason that the process at that time was not well understood. This process is now successfully employed at many places.

One of the foremost dredge miners of California has retired from the dredging industry and is engaged in planting fruit trees on the area of cobbles and sand created by his dredges in the pursuit of mining. The success of this undertaking should point the way to others.

The chloride and sulphide of gold are unknown in nature, though occasionally appearing in the reports of promoters on mines of which they have not the slightest knowledge. Any mine containing 'large veins rich in either the chloride or sulphide of gold' should be approached with suspicion.

Metals which do not readily oxidize on exposure to the air are gold and platinum, and to a less degree silver, aluminum, copper, lead, and zinc. Tin resists oxidation even better than the last three, though ordinary tin plate oxidizes rapidly, the central part being iron or steel with an outside coating of tin, in which it has been dipped.

Press dispatches announcing the discovery of rich ore in new districts are usually of greatest importance to those causing such news to be published. Once in a great while the facts are understated, through no fault on the part of the reporters, however. In most instances these reports are grossly exaggerated, no matter how rich the new discovery.

An original locator of a mining claim who loses it through failure to comply with the laws requiring annual labor or improvements, can recover nothing from one who re-locates the claim, either for work previously performed or improvements made. Even mining and milling machinery that may be on the property at the time of re-location can not be removed, as the former owner would be a trespasser and may not enter the property to remove the machinery placed there by him.

Guards for machinery that are well designed and neat are all too rare, and shafts and spindles, low pulleys and belts, intaking sides of gears, narrow clearances between fixed and moving parts, couplings, projecting screws, nuts and pins, and numerous similar risks on moving parts of machines as designed, are best handled for protection by the machine builder. In any case the safeguarding of these when within the reach of the operator is usually obligatory upon the employer and always desirable. If absent from machines when delivered the provision of such safegnards naturally falls within the field of the mechanical engineer of the plant.

Mining methods introduced in the mines of the Rand are interesting to mining engineers everywhere, but these methods in many cases are not generally applicable elsewhere. Rand methods, for instance, would in very few cases be available on the Mother Lode of California. On the other hand, Mother Lode methods are unnecessary on the Rand, owing to the wide difference in existing conditions. The conditions under which mining is carried on on the Rand may be said to be nearly ideal. The ground usually stands well, there is little water, and political conditions are such that the cheapest mine labor in the world is available. If conditions on the Rand were the same as in Colorado and California, the mines would mostly be idle.

Some mines are famous for the fine grade of the gold they produce, rather than for the amount. Some are famous for both. The Pike's Peak mine, in Cripple Creek district, is said to produce gold 999 fine. Mount Morgan, the famous mine of Queensland, Australia, turns out gold 997 fine, that is, from the upper portion of the orebody, the gold from the deeper part of the mine being lower in fineness. The placers of Juarez, Lower California, near San Diego, California, produce gold which sells for $20 per ounce, but unfortunately there is not much of it. The San Guiseppi mine near Sonora, California, produced nearly pure gold. Any light-colored gold is low grade, due to the presence of silver, and a reddish tinge indicates an alloy of the gold with copper.

Mining has not been generally recognized as a public utility, though there is one Utah decision that points in that direction. Mining enterprises can not exercise the right of eminent domain, and therefore mining adits can not be driven at will through the property of others for any purpose. The only way to overcome this is by organizing the company as a mining and transportation company, becoming a common carrier, and getting a charter which permits the company to engage in business of this sort. However, the company is then subject to the laws controlling railroads and other transportation companies, which may defeat the object in view. The Federal statutes governing the location of tunnel sites is plain. No tunnel claim may exceed 3000 ft. in length, and no vein location may be made on any vein discovered therein, not previously discovered on the surface, or elsewhere, that shall exceed 1500 ft. along the course of such vein.

Special Correspondence

LAKE SUPERIOR COPPER MINING

Experience in Re-Treatment of Copper Mill Tailing. — Michigan Copper, South Lake, Indiana, and Ojibway.

Probably $500,000 has been sunk in the Lake copper district during the past fifty years in unsuccessful attempts at re-treatment of tailing from the copper mills. In the early days only high-grade ore was milled, and the first operators depended mainly for their product upon mass and barrel-work, these being the heavy masses, often of many tons weight—masses of more than 500 tons having been yielded by the Minesota and Phoenix mines; while the barrel-work comprises chunks of native copper from a few pounds up to several hundred pounds in weight. The early mills were equipped with gravity stamps, and lost money on ore carrying 2%, or 40 lb. of copper per ton. Tailing losses necessarily were high in the early days, but have shown a gradual reduction. The old sands from the Osceola, Franklin, and Quincy mines are very extensive, while the Calumet & Hecla sand at the mills in Lake Linden, on Torch lake, amounts to more than 40,000 tons. The older sands are the richest. Extensive experiments at the Calumet & Hecla, conducted for nearly ten years past, have led to the building of a large re-grinding plant, and this is operating on a profitable basis, making a net recovery of about 5 lb. of copper per ton from tailing treated, at a cost of about 25c. per ton, giving copper in the form of unsmelted mineral at a cost of about 5c. per pound, allowing for smelting, freight, and incidental expenses. Copper from the re-grinding plant of the Calumet & Hecla is costing only about 6c. per pound, and the building of the Calumet & Hecla plant to treat its old tailing adds an asset worth millions of dollars to the company.

The Michigan Copper Mining Co. has ceased all exploratory work, owing to lack of funds. There remains a considerable tract of mineral land in the southern limits of the property unexplored and of unusual promise, lying as it does in the horizon of the several Adventure and Lake lodes. Tributers are at work in the Calico and Branch veins in the abandoned mine opened on these lodes, but are not taking out a great amount of copper. In the exploratory campaign just closed, 33 drill-holes were put down and the greater portion of the property was thoroughly drilled in an effort to find copper ground of commercial value. Several promising copper-bearing lodes were disclosed and these will be given proper attention when the funds necessary to carry on this work are forthcoming. The South Lake Mining Co. is doing work preliminary to drilling what will be designated as No. 12 drill-hole. This hole is expected to afford data regarding dip and strike of the several lodes disclosed in previous drilling, and will serve to determine the proper pitch and location of the inclined shaft which will be sunk to develop these deposits. The South Lake property apparently contains several lodes of great richness, but it is overlain by a heavy overburden of clay, sand, and gravel as thick as 260 ft. in places. The Indiana Mining Co. has temporarily ceased shaft-sinking until a head-frame can be erected over the shaft. The shaft has attained a depth of about 50 ft., and is therefore within 60 ft. of reaching the lode. The head-frame, which is in fact a part of the steel shaft-house that will eventually be erected at this point, will aid materially in sinking the concrete and steel drop-shaft, in that it will facilitate the handling of material in and out of the shaft. The Ojibway Mining Co., is developing copper ground of exceptional richness on the 1500-ft. level, tributary to No. 1 shaft. Driving in progress on the several levels above continues to disclose commercial ore at all points, and the showing in this shaft is highly encouraging. The shaft is sinking just below the fifteenth level. In the No. 2 shaft, sinking has been carried to below the seventeenth level. The drifts in ground tributary to this shaft do not reveal copper showings comparable with those in No. 1 shaft, and they leave much to be desired in this respect. The uppermost openings at this end disclose very lean ground, but this condition seemingly passes with depth, so that in the deeper laterals the showing is much improved. A material betterment is also evident as the No. 2 shaft drifts approach the No. 1 shaft. The general character of the ground in both shafts is better at depth than nearer the surface and the improvement apparently is widening as new depth is gained.

SOUTH AFRICA

Rand Geology.—Bore-Hole Prospecting.—New Rand, Limited.

Some very peculiar views regarding the geology of the Rand have been published lately. The local mining weekly surprises its readers by publishing such heterodox views as that the Rand banket reefs were of igneous origin. From the same quarter a peculiar geological map of a portion of the West Rand illustrated by even more peculiar cross-sections has made its appearance. The geology of this portion of the West Rand is certainly somewhat complicated, but the map and sections add to rather than diminish the confusion. It does not seem to be generally known that the area shown on the map as likely to constitute valuable mining ground has been repeatedly bored and proved useless, despite the promising aspect of certain surface indications; an occurrence which seems frequently to happen outside the charmed area of the Rand, extending, say, from Randfontein to Springs.

The search for a new Rand in the Orange Free State continues, but the Consolidated Gold Fields have become tired of spending money in this direction and have ceased prospecting operations for the present. Dr. Corstorphine, one of our leading geologists, will have learned by this how disappointing a task it is to look for the Main Reef series outside the Rand itself. His report to the Consolidated Gold Fields on the probability of finding the Main Reef series in the Orange Free State was very guarded in some of its terms, but on geological grounds was decidedly cheerful. Here again a little enquiry would have shown that this area has been well prospected in the past for the Main Reef series without success, although there were certain indications on geological grounds that lead one to believe that it ought to be there. It is dawning on some of our geologists that the Main Reef series is not such a constant series as might be supposed on geological grounds, for in new territory its place seems to have been taken by red shales, perhaps the Doornfontein red shales, but whatever they are they seem to occur very close to the Main Reef horizon. Several companies are interested in this Venterskroon, in addition to the Consolidated Gold Fields of South Africa, but none as yet has met with any striking success, a considerable area remaining totally unprospected. Some of the prospecting operations have been ill-advised, one firm even going so far as to put down a bore-hole in a practically vertical diabase deposit where the depth to the Witwatersrand beds must be enormous, and quite incapable of proving anything when reached.

Perhaps the most interesting task is that undertaken by the New Rand Limited, a company with £200,000 capital, under the guidance of A. R. Sawyer, which is also looking for the Main Reef series some forty miles farther to the east of Vereeniging. No less than thirteen bore-holes have been put down by this company, but always the same disappointing results follow—the ground is either faulted or unexpected intercalations of igneous rocks intervene, reducing the information obtained by every additional hole to much below that anticipated. As this kind of thing has happened to the last four bore-holes and every bore-hole penetrates seven hundred feet of useless coal strata, it is difficult to understand why the holes are not put much farther apart in order to gain additional information by proving the newer ground and avoiding useless boring. No. 13 bore-hole was equally disappointing, although in settled country, and there is every probability of No. 14 bore-hole doing the same, as where the formation is covered by coal measures it is difficult to select the best sites for these bore-holes.

BRAZIL

Diamond-Bearing Deposits.—Minas Geraes.—Bagagem.—Agua Suja.

The discovery of diamonds in Brazil dates back to the year 1729 when the first recorded diamond was found at Tejuco, now called Diamantina. For over 150 years Brazil held first rank as a diamond-producing country, but the opening up of the South African river-deposits and pipes ruined the Brazilian mines, and at the present time only a few mines are being worked where formerly there used to be a great number. Of the many States comprising the Republic of Brazil, Minas Geraes is the principal diamond producer, but it is from the State of Bahia that the carbonado or black diamonds for drilling are obtained. The western portion of Minas Geraes forms a triangle, and it is within this triangle that the Bagagem and Agua Suja diamond deposits now described are situated.

Bagagem, once the centre of an important diamond-mining industry, is situated on a river of the same name, and it was from the alluvial deposits of this river that large quantities of diamonds, including the well known 'Star of the South' and 'Dresden' diamonds, were obtained. Agua Suja is a village on a small tributary of the Bagagem, and its diamond-bearing beds differ considerably from the other sources of the diamond in Brazil, as they represent, with the exception of the Boa Vista mine, near Diamantina, the only spot in Brazil where diamonds have been found in what appears to be a locally formed deposit. The Bagagem alluvial deposits which contain the diamonds consist of recent gravels as well as ancient terraces, the former consisting of loose pebbles and large boulders of granite, gneiss, and schist. The river terraces are composed of the same rocks cemented together in a ferruginous matrix, and rise to an altitude of about 100 feet above the present stream. Both deposits have been worked, the recent gravel being the richer of the two. Along the valley, however, barren alluvial deposits occur, and this would seem to indicate that the patches of rich gravel in the Bagagem have not been derived from one general source, such as the deposition of a great bed extending over a vast area, but from isolated areas in which the diamonds occur in place. The non-occurrence of diamonds in the Rio Santo Fe and other river valleys must be accounted for by the rivers not having intersected diamond-bearing areas.

The following is the history and description of the Agua Suja diamond-bearing beds. In the year 1868 a miner named Sebastian discovered a diamond in the red earth near the banks of the Agua Suja. This led to a rush and in a short space of time, many hundreds of diggers were at work. Though the red earth yielded a fair amount of diamonds, the soft boulder bed upon which it rested was found to contain diamonds in greater number, and the number of diggers increased to several thousands, with the result that the workings were opened up for a distance of about a mile, where the beds were found to terminate at both ends against the schist formation. The African diamond discoveries then occurred, interfering with the output, and later on the deposit was taken in hand by a French company that is the present owner. It is clear, on close examination, that the soft conglomerate bed locally known as 'Taua' is the diamond bearer, and may be taken to represent the true home of the diamond in Brazil. Among the varieties of rock composing this soft conglomerate the following are the most numerous: pyroxenite or 'Pedra Verde', 80%; augite porphyrite, 5%; granites, schists, etc., 5%; sandstone, 5%, and other varieties of rock, 5%. The cementing matter consists chiefly of a soft red clay with numerous small, highly rounded pebbles of augite-porphyrite, probably constituting one-fourth of the entire bed, and it is in this cementing matter that the diamonds occur, together with the minerals associated with them, which are garnets similar in every way to those found at Kimberley, ilmenite, olivine, magnetite, yellow and red jasper, topaz, ruby, tourmaline, and rutile.

It would appear that all the rivers in Brazil in which diamonds are found in the alluvial grounds derive their precious content from similar conglomerates to those described. In fact, the Brazilian diamonds originate from beds of the Agua Suja type; and, in further corroboration of this view, there is the fact that the diamonds in Brazil vary in quality in the different workings just as much as they do in the different South African pipes. Buyers can distinguish the diamonds in Brazil and can tell the particular field from which they have been derived, while the boring carbons all come from one small and distinct area. In a contribution to the *American Journal of Science* on 'The Genesis of the Diamond', Orville A. Derby, director of the Geological Survey of Brazil, describes the Agua Suja deposits as follows: "In only one Brazilian mine, so far as known, are basic eruptions a characteristic feature, and in this the association seems to be accidental rather than genetic. This is the Agua Suja mine in the Brazilian district."

It must be noted that the diamond-bearing bed is a thoroughly decomposed breccia in which both matrix and included pebbles are transformed into clay. The origin of the boulders can, however, be recognized as well as the rock to which they originally belonged. The granite and schists upon which the diamond-bearing bed rests are also recognizable as well as the masses of the sedimentary and later eruptive series. Fragments of opal constitute a peculiar feature when this mine is compared with others in the same region or other diamond mines of Brazil. Still more peculiar and characteristic is the great abundance of magnetite and magnetite rock which Mr. Hussack has succeeded in tracing to a special magnetite-perofskite type found near Catalas in the State of Goyaz. The elements pyroxene, perofskite, and magnetite suggest a type of basic eruptions such as has actually been met in the Jacupirangu district of the State of Sao Paula in genetic relations with various nepheline-bearing rocks, the whole constituting a typical volcanic series. The Agua Suja occurrence thus offers a certain number of analogies to those of the Kimberley district of South Africa which are entirely lacking in other Brazilian localities as far as they are known, even at Bagagem, which is the same river basin. Baur says: "A new diamantiferous deposit has been discovered at Agua Suja, about 12 miles south of Bagagem. The diamonds are here associated with blocks of rock identical with that which occurs *in situ* not far away, together with much magnetite, and also ilmenite, decomposed perofskite, pyrope, and rutile. Some of the minerals, more especially the perofskite and pyrope, have not hitherto been found associated with the diamond in any other Brazilian locality. This association of minerals recalls the mineral constituents of the 'blue ground' of Kimberley in South Africa."

It will therefore be seen that there are in Brazil diamond-bearing deposits similar to those so extensively worked in South Africa, but so far as proved it is similarity in content rather than in mode of occurrence, because nowhere, so far as we are aware, have any true diamond pipes been discovered. It is therefore probable that instead of being obtained from pipes, the diamonds found in these alluvial deposits in the river basin may have been obtained from diamond-producing vein-deposits or dikes in the immediate neighborhood. The pebbles of which these alluvial deposits are composed are not only semi-angular, but can be distinctly traced to their source in local rocks, and have not been transported from any considerable distance. If the diamonds had been derived from a great alluvial conglomerate, as some authorities believe, they would not vary in character; but it has been already shown that the diamonds vary in appearance so much that buyers can distinguish the stones produced from the different fields. This fact would seem to indicate that the stones came from local deposits similar to the Agua Suja, and not from any great alluvial conglomerate deposits; while the fact that some portions of the same river valleys are quite destitute of diamonds also goes a long way to establish the view that their source of origin is local and not general.

BUTTE, MONTANA

East Butte Copper Co. Makes Improvements. — Interest in Radersburg.—The Raven M. Co. — International in Competition With A. S. & R. Company.

The East Butte Copper Mining Co. has commenced a number of improvements. A number of dams will be constructed to hold the tailing which will be re-worked. A new dust-chamber is in course of erection, and a new smokestack 15 ft. in diameter on the inside and 150 ft. in height will be built. This work will be completed in about three months. The company is operating two furnaces, and plans are being prepared for the erection of a third, while a mechanical ore-feeding device is also to be introduced. When the improvements outlined are completed the company will increase its output, and can place copper on the market at as low cost as any, according to R. H. Goss, the president, who also says that the grade of ore being hoisted averages 7% copper.

Reports of the finding of rich gold ore at Radersburg have brought a number of Eastern capitalists into the district. Within the past two weeks a number of claims have changed hands at a considerable advance on old prices. The Keating Gold Mining Co. has one of the best properties. The value of ore shipped from the Keating to the East Butte smelter is $35 to $40 per ton, while some returns have run up to $75 and $96 per ton. The property is now being opened on the 600-ft. level. The Black Friday, owned principally by Cincinnati, Duluth, and Boston people, will soon reach a depth of 700 ft. Some excellent ore is being found. The Butte & Radersburg, situated about one mile south of the Black Friday, is on the same lode. Sinking there has reached a depth of 160 ft., from which level a drift will be run 100 ft. north and south on the lode. About two feet of good ore has been opened at the bottom of the shaft. If reports are to be believed, the treasury of the Raven Copper Mining Co. is about depleted, and, so far as known, there is not enough in sight to warrant the stockholders in paying another assessment, which the directors are said to have ordered. Counting an exchange of the old stock at 25c. per share, an assessment of 25c. and another of 10c., 60c. per share has already been contributed by the stockholders, which leaves 40c. still due to bring the cost up to $1, which is the par value. Those in authority ought to furnish some information to the stockholders as to the condition of affairs. The Anaconda Copper Mining Co. has purchased from the North Butte company the Emily and Millview claims, which are the western extension of the Berlin claim, and which run along the north boundaries of the Elm Orlu and Poser, of the W. A. Clark holdings, and the Butte & Superior claims, while to the south of them is the Badger State. This purchase is in line with the policy of the Anaconda company announced some time ago, to secure all valuable properties offered at a reasonable price. The price paid for this property has not been announced. The Butte-Alex Scott is shipping an average of two cars of ore per day to the smelter, and good returns are received. Extensive development is being done on the 1400, 1500, and 1600-ft. levels, and a large tonnage of ore is being blocked out. The Little Annie, a property situated in the Walkerville district, and owned by the Alex Scott company, is again to be operated after having been idle three years. Men have been put to work erecting a new head-frame, putting a hoist in position, and preparing for electrical equipment. The old inclined shaft is to be abandoned and a new one sunk; this work will be commenced at once. During the time the mine was operated a few years ago the ore taken out averaged from 7 to 9% copper.

The new Washoe Sampling Works, being erected by the Anaconda company to take the place of the building destroyed by fire several months ago, are nearing completion, and according to present calculations will be ready to receive ore in about two months. People who had thought a treaty of peace had been signed between the Guggenheims and the Amalgamated Copper Co., have changed their opinions, owing to the announcement that an extension is to be constructed at the plant of the International S. & R. Co., at Tooele, Utah, for the purpose of treating lead ores. The Guggenheims have had a practical monopoly of the lead industry. The International company's plant at Tooele is understood to be controlled by the Amalgamated interests, and this latest move is believed to be an intimation to the Guggenheim people that they have had a monopoly long enough. The fact that the International has secured enough ore to justify the erection of the addition is taken to indicate that the Guggenheims have lost or will lose a considerable amount of the lead ore they have been treating.

ST. PETERSBURG, RUSSIA

Iridosmium.—Increased Silver Production. — High Price of Platinum. —Precious Stones.

Pending final returns of the year's mining in Russia, a few statements are available respecting one or two very interesting departments of the industry. It is known that iridosmium is associated with platinum. One feature of the sale of crude platinum to the foreign syndicate has always been that although the ore was sold on the merits of its platinum content—usually 83 per cent metal—the more valuable although, of course, less abundant associated metals, osmium and iridium, were entirely lost to the vendors. The refiners, in the process of refining the ore, obtained these very valuable metals, say from two to three per cent of the weight, for nothing. Iridosmium is produced in the Urals on the Miassk Mining Estate, in Western Ekaterinburg Mining Circuit, in the Kyshtim Mining Works Estate, and in the Northern Ekaterinburg Circuit. Unfortunately, during the last few years, this metal has not been produced so freely as before. It is obtained from platinum ore or mixtures of osmium and platinum. According to statements just issued, 14.9 oz. of iridosmium were obtained from the Urals, Miassk circuit, 37.23 oz. from the Western Ekaterinburg district, making a total of 52.13 oz., or 31 zolotniks less than in 1909.* To show the falling off, it will be interesting to read the returns for the last ten years, as follows: 1901, 19 funts, 17 zolotniks; 1902, 11f.; 1903, 11f.; 1904, 11f., 86z.; 1905, 8f., 14z.; 1906, 3f., 39z.; 1907, 5f., 24z.; 1908, 4f., 13z.; 1909, 4f., 29z.; and 1910, 3f., 93z. This makes a grand total for the ten years of 1080 oz. So far as is known up to the present iridosmium is not found anywhere in Russia except in the Urals. For a long time it was considered unfit to be worked, as it required an exceedingly high temperature to melt it, nothing lower than 1600° C. Iridium sheets and wire are now made of it, as well as thermo-couples capable of measuring temperatures up to 1600° C.

It is somewhat different with silver, as instead of being a diminishing quantity, the returns show that its production is increasing with great rapidity. Particularly is this so in the Urals, where for a long time silver production had been practically negligible. Without going back to so early a period as when silver was first found in the country, we may say that its production had practically ceased by the year 1894. Subsequently the metallurgists began to recover silver from the gold ore at the Kyshtim works and also at the Blagodat mines, and for the last ten years silver has been an item of growing importance in the country, as much as 452 poods being the result of the year's working in 1909, including the Blagodat mines' 367 poods and the Kyshtim works' 85 poods. In the year 1910, the quantity of silver recovered from Kyshtim was 66 poods and from Blagodat 350 poods. Besides the foregoing, other districts have contributed a share, but not such a striking one, to the total production, as follows: Altai (Tomsk), 66 poods; Nerchinsk (Transbaikal Province), 4 poods; Karalinsk (Semi-Palatinsk Province), 5 poods. Thus, as can be seen,

*1 pood = 526.65 Troy oz.
1 funt = 13⅔ Troy oz.
1 zolotnik = 0.137 Troy oz.

the Urals, according to information up to date, constitute the Russian natural silver ground.

The platinum production in 1910 was greatly stimulated by the abnormally high prices reached in the course of the year. The effect of these prices was to cause the miners to work at high pressure; although such did not occur all over the field, which is represented generally in the following districts: Cherdin, Perm, Southern Verchotur, Northern Verchotur, Southern Ekaterinburg, Northern Ekaterinburg. The leading district is Southern Verchotur, the production of which in platinum last year amounted to 210 poods, 26 funts, 24 zolotniks, 78 dolis. The next district in importance was Perm, the production of which was 87p., 19f., 2z., 78d.; the other producing districts being in the order of their importance, Southern Verchotur, Cherdin, and Southern and Northern Ekaterinburg. The total of the production was 334p., 23f., 41z., 41d., which compared with the total of the preceding year marks an increase of 22p.. 2f. Now this is not a correct statement. It is no doubt a correct statement of the platinum produced and duly reported to the Government, but this metal is so easy to smuggle that a very considerable percentage of the production is taken out of the country without being reported at all. How much this amounts to, it would be impossible to estimate. Figures of experts differ, but it would make an astonishing addition to the total reported above. 1910 was not a record year. It was beaten easily by 1901 with 388 poods; 1902 with 374 poods; 1903 with 366 poods; and 1906 with 352 poods. It seems that an exceptionally fine area, the Urals, is not producing platinum as it used to do. Only one conclusion can be read out of this, namely, that the sands are being washed out and new deposits are not being discovered equal to the old ones that have been exhausted; or there is the bare possibility, although it has not even been suggested by experts, that a larger proportion is being smuggled away. It is generally acknowledged that, failing some fresh discovery, it is going to be hard work to get back to the old level of production in the Urals as far as platinum is concerned.

One of the minor mineral industries of the Urals is very seldom mentioned, perhaps more seldom now than in preceding years because it does not appeal to the imagination like platinum and has passed almost entirely under the control of foreigners, namely, the searching for and polishing of precious stones. These may be said to consist principally of garnets and emeralds. For many years this furnished occupation for numerous peasant families in the Urals who had to struggle on in ignorance of the proper methods of dressing the stones for the market. It has long been known that these stones found their way mostly to Paris and London, where they were ground. But an English company has settled down on the ground, and, possessing as it does the most important mines of the field, is able to attract practically all of the precious-stone business of the Urals that is worth having. It is complained that this company simply collects the stones and exports them in their rough state to be polished in London, thereby depriving the natives of the occupation to which they had been accustomed for many years. An agitation is being raised similar to that which has brought to the front the now almost certain Government monopoly of the platinum industry. It is held by local industrialists that official steps must be taken to save what remains of the precious-stone industry from the absolute domination of the English (Isumrud-Emerald) company. Of course, garnets are very plentiful, and some other precious stones have been found in the Urals, notably diamonds, but these have only been found in limited quantities, and can not be said to have interested the outside world at all.

DEATH VALLEY REGION

Notes on the Formation and Mining Prospects of the Funeral Range.

That portion of the west slope of the Funeral range extending northwest from the Keane Wonder mine toward Boundary canyon, will soon come into the greater prominence it seems to deserve. It is a region of the ancient schists and limestones, capped in the higher parts of the range by quartzite. The schists and limestones, especially the former, are in the most contorted condition imaginable, the distortion being due to a series of intrusive dikes and sills of eruptive rock. The most prominent of this series is perhaps a grano-diorite. A true diorite of a darker color is less frequent. A typical granite can be seen, as well as an eruptive gneiss of a schistose character. A quartz-monzonite and a monzonite-porphyry occur. The two most promising localities, and where actual extraction of ore is in progress, are in and near Smith's canyon, and the Keane springs. The former is the first gulch northwest of that in which the Keane Wonder mine and mill are situated. The latter is three miles farther northwest. Both canyons practically head at the summit of the range. Keane springs are about three-fourths of a mile west of the crest. In the same gulch, about 1½ miles from its mouth, on the east edge of Death Valley, are a number of springs which supply water for the small Clapp mill. A short distance below the camp at these springs a small stream of water passes over falls about 100 ft. in height and sinks into the gravel. A wagon can be driven to the foot of the falls. Smith's canyon is where C. Kyle Smith was killed some two years ago, in dispute over a mining claim, by John Cyty, who was acquitted and has returned and is now working the disputed ground. He has just purchased the Harding mill of three Nissen stamps at Leland, California, and is transporting the equipment to his millsite at the mouth of the canyon. There is a spring of water there, and the mill is to be erected and put in operation soon. He claims to have two feet of good ore. North of Clapp canyon, in a most rugged section, is the Hartford-Montana property, where Arthur Burns is working under a lease, and is extracting good milling ore which he packs over a rough trail to the Clapp mill. On the south side of Clapp canyon, at the edge of the valley, where the vein can be easily reached by wagon, are the seven claims owned by Frank J. Grace and Frank O. Sharrock. They have a vein that follows closely the bedding between two varieties of schist, that on the foot-wall side being of a brighter and more greenish tint than on the other. At varying distances from the foot-wall, and never quite touch-

Upper End of Death Valley.

ing it, so far as noticed, may be seen small outcrops of a dark diorite of greenish tinge. The vein has been traced for the length of three claims. For a distance of some 450 ft. are several openings, all showing free-milling gold ore. This vein averages three feet in width, and contains heavily iron-stained quartz. At one opening is a small amount of copper carbonate and sulphide. It is a promising prospect, and is under option now at a price understood to be $50,000, the first payment being due May 1. Not far away are other prospects of considerable promise belonging to F. J. Grace, J. M. Callahan, W. W. Wilson, and others.

TORONTO, CANADA

Construction Work. — Shortage of Power. — King Edward Mine. — Diamonds in British Columbia.

The winter roads to Porcupine which were threatened with an early break-up owing to mild weather, have become firm again with the prevalent cold snap, and greater energy is being shown by the mining companies in forwarding freight. Great quantities of machinery are going in, and the leading mines will shortly be well equipped. A total of 73 stamps will be in operation during the coming season. The Hollinger will have 30 stamps, the Dome 40, the Vipond 1, and the Preston East Dome 2. All these are already on the ground or on the way. The Bewick-Moreing syndicate has been very active in erecting machinery at its two camps, one in North Tisdale and the other near Pearl Lake. It has put in five large boilers, with compressors and hoisting machinery. All this activity is reflected on the stock exchange. There have been numerous new flotations, some of which probably will never advance beyond the prospectus stage, but the latest count shows 10 listed companies, the shares of which are being freely dealt in, headed by the Hollinger, which bids fair to be the Nipissing of the Porcupine boom. While this stock has made considerable advances, the others are much less buoyant. Prominent among recent flotations is the West Dome Mines, Ltd., capitalized at $3,000,000, which has taken over the Foster property, adjoining the Dome, lately acquired by F. Augustus Heinze, who becomes president of the company. The shares are $5 each, and the underwriting of 100,000 at $2.50 gives the company $250,000 for development. A plant comprising a six-drill compressor, three large boilers, and hoist has been ordered for immediate delivery. The Vipond has taken over the Airth claim adjoining it on the east. At the Hollinger, 1370 ft. of driving has been done on the 100-ft. level, the vein for the entire distance running from 5 to 8 ft. in width. On the 200-ft. level the vein is exposed for a width of 10 ft. in a drift from a winze. The Tisdale has installed its compressor-plant, and the No. 2 shaft is down 85 ft. The Pearl Lake has let a contract to sink three 100-ft. shafts. A vein has been discovered on the 48-ft. level of the Crown Chartered which is believed to be the Vipond free-gold vein. A 30-hp. boiler and steam hoist have been ordered. At the North Thompson, adjoining the Hollinger, a vein has been stripped for over 200 ft., and shows visible gold. A shaft is down 42 ft. on the northeast corner, from which a cross-cut is being run in high-grade ore. Among recent prominent visitors to the camp were G. von Polenz of Berlin, representing German capitalists, and William B. Ridgely, former comptroller of the currency of the United States.

Cobalt is still handicapped by the shortage of power, but relief may shortly be afforded by the organization of a merger of the power companies of the district which are being taken over by the recently incorporated Northern Ontario Power & Light Co., capitalized at $7,500,000. It is understood that mining interests are well represented in the new organization. The Crown Reserve will build a 40-stamp mill in case the proposed concentrator for the Kerr Lake district is not built. There are 50,000 tons of low-grade ore on the dump and in the stopes ready for the mill, and this is accumulating at the rate of 60 tons per day. The Nipissing and La Rose have declared their regular dividends. The Treasurer's report of the latter company shows $1,079,000 on hand, but the directors adhere to the conservative policy of small dividends and large cash reserves. Milton T. Culbert, manager of the O'Brien mine, died on March 14 in the hospital at Toronto, where he had gone for treatment for appendicitis. He had been ailing for about three weeks and was only 30 years of age. Floyd Weed, formerly of Colorado, has been appointed manager of the Bailey. The annual statement of the Beaver showed earnings of $106,856, and ore at smelters, in transit, and on hand to the value of $143,403. The net income was $131,170. The King Edward property is to be abandoned, as all efforts to find silver ore at depth have proved fruitless. The Temiskaming is making arrangements to erect 10 additional stamps, increasing the capacity of its mill by one-third.

R. W. Brock, director of the Canadian Geological Survey, announces that diamonds have been discovered in British Columbia. They were found in peridotite on Olivine mountain near Tulameen river. They are quite small—none larger than a pinhead—but a series of tests showed that they were certainly diamonds of good quality. Owing to their small size and irregular distribution, the discovery is regarded as of scientific rather than commercial importance. The finding of diamonds in Canada has frequently been reported, but this is the first definite official announcement of such a discovery.

SEATTLE, WASHINGTON

Alaskan Oilfields.—Amalgamated Development Co.— Character of Oil.

The next important oil developments on the Pacific Coast promise to be in Alaska. Five or six years ago there was a good deal of excitement over the oilfields in the vicinity of Katalla, to the eastward of the mouth of the Copper river, but petroleum in commercial quantities was never found. The reason now assigned for the fact that shipments were never made is that the most promising wells were deliberately choked by contending interests that were each seeking to gain sole possession. During last year, new interests quietly bought what is known as the old English property, where most of the early wells were drilled, and these new owners plan to make the first shipment of Alaska oil about May 1, or soon after. Steel tankage to contain 37,000 barrels of oil is on its way from San Francisco to the North, and this is to be followed by nine miles of 4-in. steel pipe to convey the oil to the harbor at Controller bay. A line of 2-in. pipe is partly laid, but this was found to be inadequate to handle anything like the flow of the four wells on the property. A refinery of limited capacity is being constructed near Katalla to refine petroleum for the Alaska market. The new owners find a most satisfactory yield of oil. One well on a measured test yielded 720 barrels per day, while the other three brought the total up to 2100 barrels. This measurement of the wells was taken in December, in the presence of two officials of the Interior Department. The largest tank, of 30,000 barrels capacity, will be placed in position at the harbor. Its capacity will about fill an ordinary tank-steamer. A tank of 5000 barrels and one of 2000 barrels will be placed near the wells.

The Alaska oil locations were made before Mr. Roosevelt, as president, withdrew all the coal and oil lands of the district from entry. Titles have not been called into question by the Department. The oil territory is a belt about 25 miles long and 6 or 8 miles wide, along the coast to the north and west of Controller bay. Numerous seepages occur, some yielding two or three barrels per day. The Indians told the traders of the oil fifteen years ago, and in a year or so the best locations were made. A number of Americans formed the Alaska Development Co., which leased its holding to a Canadian concern, called the Pacific Oil & Coal Co., backed by McKenzie & Mann, now building the Canadian Northern railway across upper Canada. In turn this company leased to an operating concern known as the Pacific Mines Co., Ltd., which was to pay a big royalty as soon as oil was developed in "commercial

quantities." The three-cornered arrangement brought about the friction. The new owner is the Amalgamated Development Co. Dr. Burls, a London oil expert, in conjunction with his partner, Sir Boverton Redwood, made a report designating the spots at which oil was most likely to be found. Oil in varying quantities was found on each of the four locations that he first marked. Then the strife between the different interests began, and the wells were declared to be valueless for commercial purposes. The Alaska petroleum is not expected to compete with the California product, as the California oil has an asphaltum base and is chiefly valuable for crude fuel-oil, while the northern oil has a paraffin base, and should be refined. It is two-thirds benzine and kerosene products. The following analysis of the oil from a Katalla slough well is from the report of G. C. Martin, on the geological and mineral resources of the Controller Bay region, issued by the United States Geological Survey:

Katalla, Alaska.

Distillation.	Per cent.
Below 150° C., naphtha	38.5
150 to 285° C., illuminating petroleum	31.0
Above 285° C., lubricating petroleum	21.5
Residue, coke, and loss	9.0

Almost all the United States is supplied with gasoline from the Pennsylvania, Ohio, and other Eastern wells, although there is some of this more volatile product from wells in Colorado, and a little from California. Gasoline-producing petroleum is not too plentiful, and the market is ready to receive a supply from new territory.

NEW YORK

Interest and Activity in Porcupine Stocks. — The Hollinger. — The Dome and Other Mines. — Comment on Copper Mines. — The Amalgamated.—Alvarado M. & M. Company.

The one feature of overshadowing interest in New York mining circles this week was the sudden activity in Porcupine stocks and properties. There has been, during all of the winter, much desultory talk concerning Porcupine, but there has been no real sign of any widespread market activity. Now all this is changed, and without tangible reason for it. Inquiries about properties, orders for the purchase of stocks, subscriptions to syndicates are pouring in from all quarters. Printing-presses are suddenly busy turning out maps, prospectuses, and literature concerning Porcupine. Options are being bought and sold, and it has come almost overnight, so far as New York is concerned. A week since there was not a Porcupine issue quoted on the New York Curb; now there are a dozen, headed by the Hollinger, all actively traded in, and the list bids fair to have daily additions. The leader of the list of newcomers in the market is the Hollinger, which has shipped, so far, some $78,000 worth of ore, and will be in readiness to start regular production with a 30-ton mill by June 1. The company is capitalized at $3,000,000, in shares of $5 par value. These are selling at about $9, giving the property a valuation of $5,400,000. L. H. Timmins, one of the group that controls the company, said in a recent interview: "Porcupine, to my mind, will be a greater gold camp than was South Africa in the past. Porcupine ores are the easiest in the world to treat." The Hollinger will begin producing, handling about 150 tons of ore daily, which is expected to average about $50, and from which an 85% recovery is expected. The Dome property, controlled by the International Nickel interests, and by officials of the United States Steel Corporation, is to have a 40-stamp mill in operation in August, but this company has decided to treat the tailing, which will bring the average of its ores down to something like $10. One of the important deals of the week was the taking over of an option upon a 120-acre tract by interests connected with the Proprietary Mines Company of America. The ground is known as the North Dome and has an extraordinary surface showing. The deal was made by P. Kirkegaard, formerly general manager for the Deloro smelter at Deloro, Quebec, who bought the ground last fall. The price to be paid is said to be more than $100,000. Part of the Davison property is said to have been under option at $160,000, and to have been turned over during the past week at just twice this figure. Unquestionably, the figures given out will stand a heavy discount, but there is absolutely no question that the Eastern markets have suddenly awakened to the fact that a new gold camp is to be exploited, and that the public, which has been bored to extinction by all the devices put out to attract attention, is beginning to take an active interest.

The copper situation remains for the greater part unchanged. Copper-mining shares have lost place as market leaders. The starting of the mills at the Ray Consolidated and the Miami is looked upon apparently as a calamity rather than an achievement. The two companies are eventually to add 140,000,000 lb. of copper to the annual production of the country. Ray Consolidated is to turn out 100,000,000 lb. at an estimated cost of 8½ to 9c. per lb., while Miami is counting upon a production of 40,000,000 lb., to cost not more than 9c. Ray Consolidated belongs to the Guggenheim string of coppers, and will add its output to that handled by the Guggenheims as selling agents. Miami ore and concentrate will be sent to the Greene-Cananea smelter, and the product will be sold by the Amalgamated Copper Co. as successor to the United Metals Selling Co. The Amalgamated has sent out notices to the shareholders in the United Metals Selling Co. that it has purchased a controlling interest in the United Metals Selling Co. at $246 per share, and that it stands ready to purchase any and all other outstanding stock at the same price if offered any time before June 1 next. There has been some sharp criticism of the Amalgamated's action in issuing $12,500,000 of notes to take over the United Metals, suspicious noses having detected the odor of an 'inside' deal, whereby the Amalgamated company paid $12,500,000 for the privilege of handling its own copper. As a matter of fact, Amalgamated gets all of the long-time contracts which were held by the United, as well as $7,000,000 in cash and bills receivable, and 40,000 shares of International Smelting & Refining; these items alone make up enough in the way of book value to cover the price paid without leaving very much in the way of commissions to be taken down by any 'insiders.' There will be some important changes in the handling of copper metal, now that the United Metals is to be eliminated. When the late Henry H. Rogers became a factor in United Metals, he made his son-in-law, Urban H. Broughton, general manager, while Leonard Lewisohn secured the position of European sales agent for his son-in-law, Sir Charles S. Henry. It is more than likely that the foreign business will be placed in the hands of Henry R. Merton & Co., of London, who control the lead business abroad, and who are now very important factors in the European copper market. The present correspondent of the firm in this country is the American Metal Company.

The Alvarado Mining & Milling Co. is making a bond issue of $1,000,000. This company is in control of the Palmilla mine at Parral, Chihuahua, Mexico, originally operated by Pedro Alvarado.

General Mining News

ALASKA

COPPER RIVER

It is stated at Seattle that the Guggenheim-Morgan syndicate is to withdraw from all mining interests in Alaska, except as to the Bonanza copper mines at Kennicott. Its efforts, aside from the operation of this mine, will be directed to transportation, both steamship and railroad.

JUNEAU DISTRICT

The report of the Alaska United Gold M. Co. for the month ended February 15, 1911, is as follows: Ready Bullion 100-stamp mill operated 30 days, 13 hr., 38 min., having crushed 19,132 tons of ore, and saved 380 tons of concentrate. Estimated gross value of free gold recovered, $21,533; gross value of concentrate, $16,515; total, $38,048. Total realizable value of product, $35,553; operating expenses, $30,069, leaving a net profit of $5484. Construction expenses, $2007; yield per ton of ore milled, $1.99. The 700 Ft. Claim mill of 100 stamps operated 30 days, 17 hr., 4 min., having crushed 16,062 tons of ore and saved 280 tons of concentrate. Gross value of free gold, $21,540; concentrate, $16,172; total, $37,712. Total realizable value of product, $35,817; operating expenses, $24,702; net profit, $11,114. Construction expenses, $1590; yield per ton of ore milled, $2.34. Development work performed, 783 ft. on Ready Bullion, and 257 ft. on 700 Ft. Claim. Stock of ore broken, 2799 tons in Ready Bullion, and 10,876 tons in 700 Ft. Claim.

PRINCE WILLIAM SOUND

An area of about 7000 acres has been located on the Valdez flats as placer claims by those who believe this ground is sufficiently auriferous to make it profitable for dredging. It is stated that some of these claims are to be tested by a California dredging company. Much of the same area was staked ten years ago with the same object in view, but the field was not tested. The Amalgamated Development Co., according to statements accredited to Charles O'Connor, has a partly developed oilfield at Katalla, situated on Controller bay. It is claimed the company has put down six wells, three of which are yielding 1200 bbl. of petroleum per 24 hours. A dock is being built on Controller bay for the company's use, and a shipment of 20,000 bbl. of oil is to be made.

ARIZONA

COCHISE COUNTY

The Commonwealth M. Co., controlled by A. Y. Smith and associates, has built a cyanide plant for treating a tailing dump at the Commonwealth mine. The plant, which has the capacity of 100 tons per day, is equipped for the all-slime process of cyaniding, and is ready to be operated. The property is situated at Pearce.

GILA COUNTY

One 500-ton section of the concentrator of the Miami Copper Co. has been in operation since March 15, and the other three sections are expected to be operating some time this month. The design of the plant provides for two more sections, the foundations for which are built, but the equipment is not in position. The new mill was designed and constructed under the direct supervision of H. Kenyon Burch, the company's mechanical engineer, acting under the authority of B. Britton Gotzberger, general manager, and J. Parke Channing, consulting engineer. Concrete and steel were used to a great extent in building the plant. The foundation and floors are of concrete, containing about 15,000 cu. yd. of structure; and the mill building, sampling plant, and circular ore-bins are of steel. Practically the only way in which wood was used was in making the launders. The coarse-crushing plant consists of two No. 7½ gyratory crushers, and two sets of 54 by 24-in. rolls, the ore in passing from the crushers to the rolls being sized by four 10 by 4-ft. manganese-steel trommels. The ore, reduced to 2-in. size, is passed to the sampling plant by a 300-ft. belt conveyor, thence to four cylindrical steel bins, each 30 ft. diam. by 30 ft. high, set 24 ft. above the ground on concrete foundations. Equipment for automatic weighing is provided, the ore passing by gravity from each bin to the mill section opposite it. At the head of each section is a set of rolls by which the ore is ground to about ⅛-in. mesh. This is followed by classification over 22-mesh screens, the oversize being pulverized in Chilean mills having 30-mesh screens; the latter product unites with the screen undersize and this material is classified, the coarse passing to sand tables, and the fine to slime tables. The steam-electric power plant is housed in a steel building, 240 by 70 ft. in size, the steam being generated by four 600-hp. water-tube boilers, using oil as fuel. Included in this plant are three Nordberg engines, each direct-connected to a 1000-kw. electric generator; and two Nordberg air-compressors. The mill machinery is operated by electric motors distributed throughout the plant.

YAVAPAI COUNTY

Electric power has entirely supplanted steam power at the Humboldt smelter and at the Bluebell mine, both being operated by the Consolidated Arizona Smelting Co. The two properties use 1040 horse-power.

CALIFORNA

AMADOR COUNTY

The monthly dividend paid by the Bunker Hill Con. M. Co., on March 15, amounted to $10,000. The clean-ups at the mill during February were over $19,000. As the mill capacity has been increased, the output probably will be greater from now on. The property is in Amador. An electric hoist is being put in position at the Hardenburgh mine. The Amador Queen mine, which has been idle twenty years, is now an active property. It has a 1000-ft. shaft, but little lateral development. Its location is in Hunt's gulch. The Zeila mill of 40 stamps is not operating at quite full capacity. There seems an abundance of ore, but there are some obstacles in the way of getting it to the mill fast enough.

ELDORADO COUNTY

The Hope M. Co., operator of the Landecker gravel mine at Placerville, has 16 men at work in the mine and mill, and the force is to be increased. One air-drill is employed prospecting, and three drills are in use opening and blocking out the gravel in the channel. In this locality work is progressing at the Rising Hope, and Carpenter-Kumfa gravel mines; and the Bendfeldt, recently bonded to two Goldfield miners, is to be in operation by April 1.

INYO COUNTY

(Special Correspondence.)—J. E. Clark, a representative of the Bamberger and other interests of Utah, is opening a high-grade gypsum deposit near the old 'China ranch,' about four miles from Tecopa. He has brought in three carloads of machinery and lumber from Schurz and Rhyolite, Nevada, including hoists, crushers, gasoline engines, and other things necessary for operating. He has a contract with selling agents in Los Angeles for a daily extraction of 100 tons for use in plaster and cement. He is expecting to make other contracts for its sale as a fertilizer or neutralizer of alkaline salts in southern California soils. The T. & T. R. Co. will build a spur to the mine, and the product will be crushed on the ground, but shipped raw. A recent visit to the Skidoo mines, controlled by E. A. Montgomery, brings to mind again what mining men of nerve will do to win gold from mother earth. The claims embraced in the company's holdings are at a long distance from a railway. The ore could not be shipped, and water was not available near at hand for milling. After preliminary development, water was brought to mine and millsite through a pipe-line 24 miles in length, heading at large springs on the north slope of Telescope peak, at an elevation of between 8000 and 9000 ft. The elevation at the mill is between 5000 and 6000 ft. The 10-in. pipe is strong and expensive. The cost of getting some of it into position was enormous. The bill for wagon haulage

alone from the railway at Johannesburg to nearest road at the pipe-line was $75,000. The pipe-line cost nearly $300,000. Pressure is reduced at two or three points, so that when the water is delivered to the Pelton wheel at the mill its pressure is about 300 lb. per square inch. This water-wheel, with the assistance of one or two gasoline engines, runs the machinery at the mill and mine. The crushing machinery of the mill comprises two jaw-crushers of the Blake type, two 5-stamp batteries of 1050-lb. stamps, built by Hendy, and one 5-stamp battery of about 1300-lb. stamps, built by the Union Iron Works. The latter 5-stamp battery was bought and erected by lessees about a year later than the installation of the former two, and was afterward sold to the Skidoo Mines Co. The ore is mainly free milling, but in some places streaks of galena, copper, and iron pyrite occur. Below the apron-plates are three Deister tables. These collect during the month a limited tonnage of sulphide concentrate, worth about $450 per ton. Tailing goes direct to the dewatering and percolation tanks. The earlier tailing, in the tailing ponds, is from time to time elevated and run through the extra cyanide tanks. The ore is collected on the tunnel levels, and trammed in trains of mine cars by mule-power direct to ore-bins in the upper part of the mill. About $550,000 was expended on this property before any return was had. This amount came from the sale of 400,000 shares of treasury stock to Mr. Montgomery at $1 per share, and a further loan by him of $150,000. The first unit of the mill has been in operation about three years and the whole mill for nearly two years, though there have been many stoppages from breakage of pipe and other causes. There has been a total production to date of over $500,000. The loan of $150,000 has been repaid, and there have been two dividends of $50,000 each in addition, with probably over $100,000 now in the treasury. The ore mills from $11 to $16 per ton, with higher-grade streaks. The veins are strong and persistent on both strike and dip, with grade of ore holding up well on the lower levels. A large amount of ore is partly exposed, and the mine has undoubtedly a long life.

Skidoo, March 25.

NEVADA COUNTY

The Kate Hardy mine has passed to J. W. Morrell of San Francisco, and W. M. Beggs of San Jose, at a price said to be $80,000, in accordance with the terms of a bond given two years ago by Tyler Dudley. If the mine is not sold again within the next few weeks it is probable that Morrell and Beggs will operate it, and put in a number of improvements, including a 10-stamp mill. Ore of the value of $20,000 was mined during two months last year, but the mine has not been operated steadily. The Red Lodge mine, now in possession of an Idaho company, and situated near Washington, is being developed by two adits, by one of which great depth will be attained. The lower adit was started close to the South Yuba river, and was only recently commenced. It is reported that the Ironclad Gold M. & M. Co., having the Ironclad mine at Rough and Ready, is to re-open the property within the next two or three months. The holdings comprise 70 acres, situated close to Grass Valley; the equipment consists of a mill, power-plant, hoisting engine, and pumps.

SIERRA COUNTY

The Dragon Fly gravel mine is being operated by Squire & Simmons, who put in a power-plant whereby pumps are brought into use to keep the workings free of water, thus enabling them to take out the gravel to bedrock. The property is situated on the middle fork, near Engle ranch.

TRINITY COUNTY

(Special Correspondence.)—A gold-bearing lode, ranging 3 to 4 ft. wide, has been cut at a depth of 60 ft. in the Venica mine, near Lewiston. The ore assays from $15 to $20 per ton, and is partly free milling. The property is under a long-term lease to Collins, Paulsen & Collins, of Lewiston, and they have decided to install a gasoline hoist. During February the Headlight mine produced bullion valued at $18,200. It is expected that the March yield will be considerably in excess of this. The Headlight is situated near Carrville, and is owned by the Trinity Gold M. & R. Co. The final payment of $45,000 on the property was made a few weeks ago. The property comprises a hill of ore, about 400 acres of the overburden having been stripped off by hydraulicking. The ore runs about $3 to $4.50 per ton. It is understood that mining costs in February averaged 60c. per ton, and milling costs $1.10. It is expected to materially lower mining expenses shortly, as the advent of warm weather will permit the mining of the great deposit by the glory-hole method. The company is composed largely of Los Angeles people. David Goodale is manager. Developments at the No. 4 adit of the Bonanza King mine, near Trinity Center, have been progressing during the winter. The power-plant has been rebuilt, and the mill placed in condition to operate. It is planned to commence production at an early date. The Bonanza King was formerly the greatest producer of high-grade ore in the county, and originally was the property of the Treadwell brothers of Alaska. It is understood that a fair reserve of medium-grade ore has been developed. Several properties in the Lewiston district are preparing for a busy season.

Weaverville, March 24.

TUOLUMNE COUNTY

(Special Correspondence.)—Within a few days the Pennsylvania shaft of the Carlotta mine will have been unwatered and sinking commenced. It will be sunk 200 ft. deeper, as will also be the Carlotta shaft, and both will be connected by a level. The property was lately bonded to John Oleson, of San Francisco. A. B. Dodd, of San Francisco, and S. J. Silva, of Oakland, have purchased the Contention mine, in the Knight's Creek district, the consideration being $40,000, one-fourth of which sum must be paid before the extraction of ore is begun. The property has been developed to a considerable extent, and the outlook is good. It is being equipped with a 10-stamp mill. Development is to be begun at the Fleming mine by Walter Smith and associates, who have purchased some machinery for the property. Rich ore has been uncovered at a depth of 80 ft. in the old Tarantula mine, near the Rawhide, which has been bonded to George Stayton. A deep shaft was sunk on the property by former operators, but it does not follow the vein, and no cross-cutting was ever done. It is stated that the Jumper mine, at Stent, has been sold, and that R. S. Rainsford, for many years in charge of the Argonaut mine, in Amador county, has been made general manager, while Neil Cochrane has been retained as superintendent. The North Fork Mining Co. has sold a 2-stamp mill to the owners of the Gianelli mine, who will erect it on their property near Arastraville. It is reported that a London company will re-open and operate the Golden Gate mine, situated one mile southwest of Sonora, which has been idle for about fifteen years.

Tuolumne, March 20.

(Special Correspondence.)—The unwatering of the Spring Gulch mine is again in progress, after an interruption of several weeks caused by an accident, in which the skip was lost. At the Somerset, in close proximity to the Spring Gulch, rich ore is being taken out. Both properties are bonded to W. B. McCubbin and George Ash. The face of the adit, being driven at the Mt. Eden mine, south of Tuolumne, by W. D. Deming and George Wilds, shows 3 ft. of quartz that will give good returns in gold, and the owners are encouraged by the results of their work. A steam-hoist is being put in position at the property of the Springfield T. & D. Co., preparatory to sinking the incline shaft to the gold-bearing deposits, thus making possible the extraction of gravel at a cost much less than the present. The Jumper mine, near Stent, which was recently sold, was purchased by the Golden Rule Mines Co., of Maine. This company also bought the Golden mine, an adjoining property, from J. A. Smith. It is said to be the intention to sink the Jumper shaft several

hundred feet deeper. The Keltz mine is to be operated again by H. H. McIntyre and associates, of New York. The Kanaka mine, owned by Mrs. Agnes D. Parr, of London, is to be operated again. Some necessary repair work will be started at once. L. E. Parr, who will have charge of the mine, has arrived at the property. It is expected that operations will be resumed at the Rising Sun mine, at Arastraville, with J. E. Conde as superintendent. The property is owned by D. A. Porter and others, of San Jose, but is to be operated by Mr. Fancher and associates, of the same city, to whom it was bonded some time ago.

Tuolumne, March 26.

COLORADO

GILPIN COUNTY

The Gunnel mine, near Central City, is now thoroughly drained through a connection recently made with the Newhouse tunnel. A 200-ft. raise was driven from the tunnel to a blind level which had been driven from the base of a winze, the latter having started on the 1100-ft. level of the Gunnel. The drill-hole by which the connection was made let the water through with great force, and, while the miners were thoroughly wet, they escaped without injury. When the connection is enlarged to the size of the raise, the mine workings will be well ventilated. The distance from the portal of the tunnel at Idaho Springs to the Gunnel raise is 21,968 feet.

LAKE COUNTY (LEADVILLE)

The *Carbonate Chronicle*, Leadville, states that the Dinero and Sugar Loaf tunnels, which have been driven into Sugar Loaf mountain, have opened a fissure vein a mile in length, of an average width of 5 ft., the ore in which assays $50 per ton, and that these developments have proved the vein to a depth of 500 ft. The Siwatch cross-cut, now in 2700 ft., is soon expected to tap another great fissure of that part of the district. Thus it is seen that Sugar Loaf region is being developed by three important adits. The fissure veins of this mountain contain copper ore, and the making of great copper mines is anticipated.

The operators of the Wolftone and Castle View, on Carbonate hill, have connected the workings of the two properties to facilitate the extraction of zinc-carbonate ore from the latter. J. C. Hersey is shipping low-grade zinc ore from the dumps of the R. A. M. mine to the Western Chemical Works at Denver. An additional furnace has been brought into use at the Arkansas Valley plant of the A. S. & R. Co., making 5 of its 7 furnaces in operation. This is considered an indication of an increase of Leadville's production of silver-lead ores. Ores are also received at this plant from other counties, especially from Summit, Chaffee, and Pitkin.

PUEBLO COUNTY

The A. S. & R. Co. has all of its 7 furnaces in blast at its zinc-smelting plant, situated at Blende, near Pueblo. The zinciferous ores smelted are received mostly from Leadville, Silverton, Rico, Ouray, and from Chaffee and Clear Creek counties. A force of 400 men is employed at the plant.

TELLER COUNTY (CRIPPLE CREEK)

Lessees on the 400-ft. level of the Gold Dollar mine have opened a shoot of ore not previously known, and are breaking ore of a width of 10 ft. and which is said to assay 2 to 3 oz. gold per ton. The ore consists of calaverite in quartz. J. Carr has a lease on the Lonaconing mine of the El Paso Con., and expects to sink the 350-ft. shaft 200 ft. deeper. He is overhauling the hoisting and compressor plant. The Roosevelt drainage tunnel is discharging 10,000 gal. of water per minute. On this enterprise $550,000 was spent, but it is expected to result in lowering the former water-level to a depth of 400 ft., and render accessible a vast area of mineralized country, and relieve the operators of the expense of pumping. In anticipation of a much larger tonnage of mill ore being produced, several old plants are being overhauled to make them ready for the treatment of ore.

IDAHO

LEMHI COUNTY

The property of the Ima Con. M. Co., near Salmon, has passed under a 7-years lease to C. H. Huffy and J. Nolan. One condition of the lease is that the lessees are to build a 10-ton concentrating mill, and have it ready to operate by next September, and to increase its capacity annually thereafter. A. C. Fralik of Boise is at his mining property, near Shoup, which is to be further developed and equipped this season. Considerable tonnage of ore is blocked out, and it is probable that a mill will be erected next summer. The ore consists of gold quartz, which is suited to amalgamation and cyanidation.

OWYHEE COUNTY

The Banner M. Co., which has a group of mineral claims situated on Florida mountain, adjoining the Trade Dollar mines, at Silver City, has a large extent of developed workings, and a Nissen 4-stamp mill, having spent $160,000 on development and equipment, the latter including a transformer-house for electric power. It is reported that the ore blocked out is sufficient to keep the 30-ton mill operating a year. The ore is rich in gold, and is largely free milling. Peter Steele, one of the stockholders, and a practical mining man, has had charge of the property from the first.

SHOSHONE COUNTY

(Special Correspondence.)—B. M. Francis, in charge of the Rex mine, near Wallace, is shipping eight cars of ore per month, and expects to treble this output in a short time. Two more shifts of miners will be put on as soon as the mill is ready to run to its full capacity. It is now being used only to treat the ore taken out of the raise in the 500-ft. level. When completed the mill will have the capacity of 300 tons daily. The shaft is now down to a depth of 900 ft., and work is in progress on the east and west drifts of the 700-ft. level, and in the raise from the 500-ft. level. Sixty-five men are at work at the mine, and 22 in the mill.

Wallace, March 25.

NEVADA

EUREKA COUNTY

The Cortez district is close to the western border of this county, and Mt. Tenabo is a conspicuous landmark of that region. Its situation is about 35 miles south of Beowawe. Several mining properties in this district were highly productive in silver and lead from 1865 to 1890. One of these, the Garrison, is credited with having yielded an output worth $9,000,000. The group contains 33 patented claims, and there are 15 miles of workings. There are said to be good reserves of low-grade ore exposed in the mine at present. The Cortez Metal Recovery Co., which in 1908 erected a cyanide plant to treat certain oxidized silver-bearing tailing on the dumps of the Garrison, has operated with success. The Rossi mine, situated on the southwest slope of Mt. Tenabo, was likewise a big producer in early days, and has developed bodies of silver-lead ore in contact veins. It has been acquired by a company organized by T. C. Parker, of Battle Mountain, and financed at Des Moines, Iowa, and the mine is to be re-opened. A few miles away is the new property of the Tenabo M. & S. Co., controlled by Salt Lake people, who are preparing for further development. It is said there is now exposed about 8000 tons of ore that samples $13 per ton, and close to 17,000 tons assaying $3.50 to $4 per ton.

The Buckhorn mine, owned by George Wingfield, and being developed under direction of F. J. Siebert, is said to have a large tonnage of profitable ore blocked out between the 300-ft. level and the surface. It is stated that $350,000 has been spent in development and equipment. The property is not far from the Cortez district.

HUMBOLDT COUNTY

(Special Correspondence.)—The Edmonds-Schloss lessees on the Mayflower mine, at National, report some of the

richest ore ever found in the camp. The vein is 2 ft. wide, with 4 in. of talc and white quartz, the latter yielding ore of remarkable richness. The entire 2-ft. vein is said to carry milling ore of high grade. The find was made in a 105-ft. winze, 320 ft. from the portal of the adit. The approximate vertical depth at which the vein was opened is 335 ft. It is planned to sink the winze 20 ft. deeper and run drifts both ways on the lode. Joseph Schloss, one of the lessees, is from San Francisco. The National Mines Co. has declared its third dividend for the present year, making a total disbursement of profits of 35% on the capital stock for the first three months of 1911. The last dividend is at the rate of 10%, amounting to $80,000. This makes a total of $495,000 paid in dividends since last July. The production of the company and that of lessees on its estate for 1910 was approximately $1,750,000. The company is capitalized at 1,000,000 shares, but only 760,000 shares have been issued. The Cole-Bullis lease on Nineteen-Ten ground, now owned by the parent company, is proving one of the richest blocks of ground in the Barret Springs district. The vein is 3 ft. wide and most of the ore is of shipping grade. Some of it assays $200 per ton. At present seven tons is being extracted daily, most of this being incidental to development. Stoping will commence shortly. Shipments are being made to sampling works of the Western Ore Purchasing Co. at Hazen. J. M. Blood is superintendent. The Bi-Metallic reports the discovery of a new vein of rich ore. This property is about to make its first shipment to Hazen.

Winnemucca, March 23.

LYON COUNTY

The mines at Silver City are producing, many of them being worked by lessees. The McTigue mill has started up, and the three cyanide plants are being put in condition for the season's work. The Nevada Mining, Reduction & Power Co. has three shifts of miners at work on the Hayward mine, and is tramming the ore to its mill at Dayton.

The Mason Valley Mines Co., which is erecting a smelting plant at Wabuska, under direction of Jules Lebarthe, intends that its initial plant shall consist of two blast-furnaces for copper smelting, each 44 in. by 25 ft.; two stands of converters, a sampling mill having the capacity of 100 tons of ore per hour, and it is probable that one reverberatory-furnace will be built. Recently four electric locomotives were ordered for use in moving charge and slag cars. Transformers are being built, and the transmission line from the Truckee river to Wabuska is being established. This plant is to be operated partly on ore from the Mason Valley mine, and partly on ore from the mines of the Nevada-Douglas company. It is estimated that the former mine has exposed 1,074,635 tons of ore averaging 3.95%, 92,000 tons running 2.38%, and 100,000 tons assaying about 1.9% copper.

MINERAL COUNTY

The Rawhide Queen Mines Co., which has a 10-stamp mill, with concentrating-tables, at Rawhide, has purchased from the Pacific Tank & Pipe Co., San Francisco, complete equipment for a cyanide annex to the plant, consisting of two Trent agitating-tanks, two Dorr thickeners, an Aikens classifier, an Oliver continuous filter, tanks, zinc-boxes, and piping. It is learned that in the stamp-batteries cyanide solution will be used, that the sulphide will be recovered on the tables, and the tailing is to be cyanided. E. W. King is at the head of this company, as well as the Rawhide Coalition Co., the mill superintendent being H. S. Chapman. J. H. Barrett is one of the directors. The annex is to be ready June 1.

UTAH

BEAVER COUNTY

(Special Correspondence.)—During this month the Moscow has shipped three cars of ore, and two more are ready for shipment. February shipments amounted to two cars. These shipments netted about $1000 per car. Practically all of it was taken from a 150-ft. winze that was sunk below the 400-ft. level. The management is considering sinking a new shaft so as to catch the vein at a point about 1000 ft. on the dip, and much nearer the ore on the 550-ft. than the present shaft. On the Horseshoe Fraction a vein carrying 66% lead and 20 oz. silver per ton has been opened.

Milford, March 25.

JUAB COUNTY

(Special Correspondence.)—The item of interest in Tintic district has been the development on the Victoria. The orebody has been penetrated 40 ft. without reaching the opposite wall. The ore which is being sacked samples from $1200 to $1500 per ton. About 100 sacks have been filled, and it is hoped to make up one carload of ore of this grade. Directors of the Colorado have posted a dividend of 6c. per share, amounting to $60,000, making a total to date of $2,390,000. Grand Central is confining most of its work to developing, and a statement was recently made that 200 tons are being developed for every ton shipped. The cave recently opened in the Beck Tunnel is being explored, and it seems to be of greater extent than was first estimated. There is ore in a part of it. Shipments for the past two weeks have been slightly above the average, having been 175 and 170 cars, respectively. Iron Blossom and Centennial Eureka each shipped 46 cars last week, and the week before Iron Blossom shipped 46 and Centennial Eureka 42. Despite the increase in tonnage, Iron Blossom, much to the disappointment of the stockholders, passed the dividend that it was expected to declare this month.

Eureka, March 27.

SALT LAKE COUNTY

(Special Correspondence.)—John MacDonald, formerly of Utah Copper and later of Ray Con., is now in charge of mine operations at the Montana-Bingham. Mr. MacDonald developed the underground workings of the Utah Copper and, previous to that, of the Golden Gate. The Silver Shield has opened a 4-ft. vein of good ore in the winze on the main level. This makes two parts of the mine from which ore is being shipped, 150 tons having gone out within a week.

The Majestic Copper Mining & Smelting Co. has brought suit against the Miners' Smelting Co. and F. Augustus Heinze, to recover $20,000 alleged to be due as rental on the Majestic smelter at Milford since January 1, and interest from that date. The case brings to light an interesting deal. Mr. Heinze organized the latter smelting company and then obtained control of practically all of the stock. He also bought 150,000 shares in the Silver King Coalition and with the influence thus secured obtained a contract from the latter company for the smelting of its ores. The contract specified that Mr. Heinze must own or control a smelter in Utah, so the Majestic was leased for that purpose. The Silver King contract was sublet to the A. S. & R. Co. at a good profit, and the Majestic smelter was never started up. The owners now claim that the Miners' Smelting Co. has defaulted in its payment due in accordance with the terms of the lease.

Salt Lake, March 27.

SUMMIT COUNTY

(Special Correspondence.)—The extent of the recent discovery in the Silver King Con. has not yet been proved. The ore has been penetrated toward the walls in several different places, but each time it spreads into the bedding planes, so that there seems to be justification for the report when the find was made that it is one of the greatest in the history of Park City. Shipments for the past week were 1850 tons, with Silver King Coalition leading.

Park City, March 27.

TOOELE COUNTY

(Special Correspondence.)—The West Dip company, at Mercur, has shut down for an indefinite period. This company has been operating the Daisy Combination and has been treating about 65 tons daily in the mill, using the cyanide process.

Mercur, March 25.

(Special Correspondence.)—The Dry Canon district, north

of Ophir, is waiting for good weather which will put the roads in condition so that shipping may be resumed. Shipping was suspended the last of December, since which time the ore has been accumulating awaiting the time when the roads should become passable.

Ophir, March 24.

WASHINGTON

FERRY COUNTY

(Special Correspondence.)—J. W. Lloyd, manager of the Knob Hill, has also taken charge of the Trade Dollar, San Poil, and North San Poil, for the San Poil Consolidated Co., which has a bond and lease on each of those mines. The San Poil and the North San Poil are both producing a good grade of ore. On the 200-ft. level of the Trade Dollar a raise is being carried up from a point northeast of the shaft, and the ore being stoped samples about $20 per ton. About 150 tons has been broken and is ready to ship. The machinery on the mine is inadequate for hoisting the ore and waste required of it. The company intends increasing the force, and contemplates installing an air-compressor and an electric hoist. The compressor is to be at the San Poil mine, and air will be piped to the Trade Dollar for power-drills. Electric power will be drawn from the auxiliary plant of the North Washington Power & Reduction Co. The ore now broken will be shipped to the smelter before the new machinery is installed, and, for that purpose, a trestle will be built from the Trade Dollar dump, 100 ft. across the gulch, to a spur of the railroad.

The ore-shipments from the Surprise mine during February aggregated 36 carloads, averaging a net value of about $2000 per car. It is expected that the March output will be considerably larger. The third section of the North Washington Power & Reduction Co.'s mill is under roof, and the framework of the sampler will soon be under cover. A tramway will connect the sampling works with the main sections of the mill. It will be sustained by heavy pedestals, sites for which have been blasted out of solid rock. The first carload of machinery for the mill has been delivered, and the balance has been shipped.

Republic, March 24.

MEXICO

CHIHUAHUA

(Special Correspondence.)—The Veta Colorado Mining & Smelting Co., operating near Parral, is about to commence operations, and, to meet the demands of the new mill, has installed a number of electric generators and motors. The electrical equipment for the mines was first provided and comprised a 200-kw. generator with exciter, switchboard, and transformers; also two 75 and one 50-hp. motors for hoisting, as well as six pump motors, including two of 150 hp. each for operating station pumps, and one of 40 hp. This first generator is operated by a Hamilton-Corliss tandem compound engine. Subsequently, three additional 380-kw. generators were installed, with a corresponding number of exciters, switchboard, and lightning-protection apparatus. This additional generator capacity was necessary to supply power for the 40 or more motors distributed throughout the new mill and cyanide plant. This, in connection with the former electric equipment purchased for the mine, makes in all over 50 motors, having a combined capacity of between 1500 and 2000 hp. All of the electric apparatus was supplied by the Westinghouse Electric & Manufacturing Co. of Pittsburg, represented in Mexico by the Cia. Ingeniera, Importadora y Contratista S. A. With all of the machinery installed and in operation, this plant will be one of the largest and most modern among electrically operated mines and mills generating their own electrical power. A complete lighting system has also been installed. The Compania Industrial Mexicana of Chihuahua contracted with the Veta Colorado people for much of its mill machinery and construction work. Bernard MacDonald is general manager for the Veta Colorado M. & S. Company.

Parral, March 20.

GOLDFIELD CONSOLIDATED

In his report for February, J. F. Thorn, general superintendent, gives the following figures.

During the month of February, 1911, the total production was 23,675 tons, containing $973,730.78, or an average of $41.13 per ton, of which the whole was milled, with an average extraction of $38.59 per ton, or 93.84%. The total net profit was $719,325.04, or $30.38 per ton.

Development Work: 4220 feet of development work was performed during the month of February.

Operating Costs: The total cost of mining, development, transportation, milling, office, and general expense was $8.31 per ton, distributed as follows:

Mining:		
Development	$1.34	
Stoping	2.20	
		$3.54
Transportation		0.08
Milling		2.47
Marketing		0.48
General expense		0.42
Bullion tax		0.53
Construction		0.79
Total cost of operation		$8.31

Some work is being done on the old Reilly shoot, near the south end of the Combination No. 1 claim, which promises to open quite a tonnage of $15 to $20 ore. No new discoveries of any importance have been made in the Mohawk mine, but quite an area has been added to the new orebodies mentioned in last month's report. In the Red Top, Clermont, and Grizzly Bear mines there have been no new discoveries. In the Laguna some very good ore has been found on the No. 2 south level, and the indications are that this portion of the mine will produce quite a large tonnage of $15 to $20 ore. While no new orebodies of any great importance have been discovered during the past month, the known orebodies have been extended to a considerable extent, and the mines as a whole are looking exceptionally well. The production for the month of March will be approximately $900,000, or a net profit of about $700,000. During the month practically three days were lost on account of a break in the power-line somewhere in the White mountains.

AMERICAN MINING CONGRESS

The directors of the American Mining Congress, the permanent headquarters of which are in Denver, have selected Chicago as the meeting place for the 1911 session, which will be the fourteenth annual meeting of this body. The exact date has not yet been selected, but it will probably be some time in October. The official call for the convention will be issued shortly, authorizing the appointment of delegates to the meeting. It is probable that this will be the last session to which outside delegates will be appointed, as the directors have for some time been working out plans for the abolition of the delegate system, and permitting only members of the American Mining Congress to participate in the proceedings. The Mining Congress is agitating the adoption of workmen's compensation laws by the various coal-mining States with the object of providing a fund, by a small tax on coal production, to furnish indemnity for the victims of mine disasters and a pension for aged mine-workers. Recently a committee of the Mining Congress drafted a bill for a law of this character which is now being submitted to the legislatures of many mining States for their consideration. The Mining Congress is also working for more efficient inspection and regulation of coal and metal mines with a view to decreasing the loss of life in mine disasters; the standardization of electric practice in mines, the general revision of the mineral-land laws, and other matters. These and other problems will be discussed at the Chicago meeting.

Personal

Professional men are invited to send news of their engagements and travels. Such news is interesting to friends.

GELASIO CAETANI is at Rome.

ALBERT BURCH is at Goldfield.

MARK B. KERR was in San Francisco.

H. S. CHAPMAN was in San Francisco recently.

P. L. EBERHARDT, of Wallace, Idaho, is in San Francisco.

EDGAR A. COLLINS will leave in April for London and South Africa.

JOHN B. FARISH, of Denver, was at the St. Francis hotel, San Francisco.

P. A. WICKHAM was in San Francisco, and has gone to Alamos, Mexico.

A. J. MCCONE, of Reno, was at the St. Francis, San Francisco, last week.

CARL O. LINDBERG, of Spurr & Cox, Inc., visited San Francisco this week.

L. J. MAYREIS has returned to Collahuasi, Chile, from a visit to the United States.

FRANK KLEPETKO has been examining the Ferrobamba copper property in Peru.

DOUGLAS WATERMAN, manager for the Gigantic M. Co., in Salvador, is in San Francisco.

H. F. REID is lecturing at the University of California on 'The Mechanics of Earthquakes.'

JAMES E. CHAPMAN is engineer for the Guanajuato Con. M. & M. Co., Guanajuato, Mexico.

CHAS. E. BASCOM, of the Broderick & Bascom Rope Co., St. Louis, Mo., was in San Francisco.

C. M. FASSETT, of Spokane, who has returned from the Orient, was in San Francisco last week.

VICTOR G. HILLS is consulting engineer and manager for the Scheelite Mines, Ltd., in Halifax county, Nova Scotia.

C. B. NAREMORE has resigned from the U. S. Geological Survey to accept a position with the Associated Oil Company.

W. H. WEED is at Arispe, Sonora, but will go shortly to Cumpas to examine the properties of the Transvaal Copper Company.

ROBERT GORDON, mine superintendent and engineer for the Montezuma Mines of Costa Rica, Central America, has returned to the mines.

F. H. HILLMAN, who made an enviable record as manager for the Standard Oil Co. in Illinois, has been transferred to California, and has established headquarters at Bakersfield.

W. C. MADGE, formerly metallurgical engineer for the Yampa Smelting Co., sailed March 22 on the *Lusitania* for London, where he will design a smelter for an English company operating in Russia.

S. E. BRETHERTON has returned to San Francisco from Shasta county, where he was looking after the development work for the Bully Cave company, near Winthrop, and the Afterthought company, at Ingot.

T. E. DICKEL, recently foreman of the cyanide plant at Minas del Tajo, Rosario, Sinaloa, Mexico, is to take a similar position with the North Washington Power & Reduction Co., at Republic, Washington.

C. W. PURINGTON was at Chita, Siberia, lately for the Russo-Asiatic Bank. Mr. Purington has resigned as manager for the Orsk Goldfields Ltd., though he remains connected with that company in a consulting capacity.

C. H. MUNRO will sail from San Francisco on the *Korea*, April 18, to spend the summer at the Koichan Mines, of which he is now general manager for the Orsk Goldfields Ltd. Mr. Munro will be accompanied by W. H. LANAGAN, who will be assistant manager, vice D'ARCY WEATHERBE, resigned.

Obituary

THOMAS RICKARD, who died at his home at Berkeley, California, March 25, following heart failure and a fall from his bedroom window, was a mining engineer well known and well liked throughout the West. He was a son of Reuben Rickard, one of the pioneer mining engineers of California and Nevada, and a nephew of Thomas Rickard of London. Edgar Rickard was his brother and T. A. Rickard his cousin. Thomas Rickard was born in France in 1869 and graduated from the University of California in 1887. He lived in Nevada, practising his profession for a year after leaving college, and then returned to San Francisco, where he took an interest in the firm of Parke, Lacey & Company, sellers of mining machinery. In 1901 he joined J. O. Harron and Alex McCone in buying out the older firm, the name being changed to Harron, Rickard & McCone. He was vice-president of this concern at the time of his death. Mr. Rickard was a man of wide interests, but found time to be active in public affairs, having served as mayor of Berkeley, as member of the Chamber of Commerce, and as trustee of the California Institute for the Deaf and Blind. He was prominent in lodge and club circles. He was a man everybody liked, and in a quiet, unobtrusive way he did his part in helping the many with whom he came in contact.

Market Reports

LOCAL METAL PRICES.

San Francisco, March 30.

Antimony	12—12¾c	Quicksilver (flask)	52½
Electrolytic Copper	14—15¼c	Tin	45—46½c
Pig Lead	4.75—5.70c	Spelter	7—7¾c

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

METAL PRICES.

By wire from New York.

Average daily prices in cents per pound.

Date.	Electrolytic Copper.	Lead.	Spelter.	Silver, per oz.
Mar. 23	12.13	4.41	5.54	52⅝
" 24	12.08	4.41	5.51	52⅝
" 25	12.08	4.41	5.51	52½
" 26	Sunday.		No market.	
" 27	12.08	4.43	5.50	52¾
" 28	12.08	4.43	5.50	52¾
" 29	12 08	4.43	5.50	52¾

ANGLO-AMERICAN SHARES.

Cabled from London.

	Mar. 23. £ s. d.	Mar. 29. £ s. d.
Camp Bird	1 13 10½	1 11 10½
El Oro	1 5 0	1 4 9
Esperanza	1 14 4½	1 14 4½
Dolores	1 5 0	1 5 0
Oroville Dredging	0 7 0	0 5 9
Mexico Mines	7 10 0	7 13 9
Tomboy	0 15 0	0 15 0

(By courtesy of W. P. Bonbright & Co., 24 Broad St., N. Y.)

MINING STOCK QUOTATIONS—NEW YORK.

(By wire from Catlin & Powell Co., New York.)

	Closing prices, Mar. 29.		Closing prices, Mar. 29.
Amalgamated Copper	$ 64	Miami Copper	$ 19¼
Arizona-Cananea	3	Mines Co. of America	5
A. S. & R. Co.	76⅝	Montgomery-Shoshone	1/16
Braden Copper	3¾	Nevada Con	18½
B. C. Copper Co.	8	Nevada Utah	1
Butte Coalition	17⅞	Nipissing	11
Chino	22¼	Ohio Copper	1⅝
Davis Daly	1⅛	Ray Central	1¾
Dolores	5⅛	Ray Con	17⅛
First National	2¼	South Utah	⅞
Giroux	6⅜	Superior & Pittsburg	14
Greene-Cananea	6⅛	Tenn. Copper	38
Guanajuato Con	⅛	Trinity	4⅛
Inspiration	7⅝	Tuolumne Copper	4⅞
Kerr Lake	6⅜	United Copper	4⅛
La Rose	4⅛	Utah Copper	44⅞
Mason Valley	8⅞	Yukon Gold	3⅞

COPPER SHARES—BOSTON.

	Closing prices, Mar. 30.		Closing prices Mar. 30
Adventure	$ 5	Mohawk	$ 36
Allouez	32	North Butte	28¼
Atlantic	4	Old Dominion	37
Calumet & Arizona	50¾	Osceola	106
Calumet & Hecla	490	Parrot	11½
Centennial	12	Santa Fe	1
Copper Range	62½	Shannon	10⅛
Daly West	4¾	Superior & Pittsburg	14⅜
Franklin	9	Tamarack	38
Granby	32½	Trinity	4
Greene Cananea, ctf	6⅞	Utah Con	13
Isle-Royale	13¾	Victoria	1⅝
La Salle	4	Winona	7¼
Mass Copper	6	Wolverine	110

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

SOUTHERN NEVADA STOCKS.

San Francisco, March 30.

Atlanta	$ 11	Mayflower	$ 5
Belmont	5.95	Midway	17
Booth	9	Montana Tonopah	78
Columbia Mtn	2	Nevada Hills	2 97
Combination Fraction	11	Pittsburg Silver Peak	75
Fairview Eagle	40	Rawhide Coalition	3
Florence	1 90	Round Mountain	51
Goldfield Con	6.35	Sandstorm Kendall	9
Gold Kewenas	6	Silver Pick	4
Great Bend	1	St. Ives	16
Jim Butler	25	Tonopah Extension	1.10
Jumbo Extension	44	Tonopah of Nevada	8.00
MacNamara	13	West End	51

(By courtesy of San Francisco Stock Exchange.)

CURRENT PRICES FOR CHEMICALS

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

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

	Min.	Max.
Acid, sulphuric, com'l, 66°, drums, 100 lb	$0.80	$1.00
Acid, sulphuric, com'l, 66°, carboy, 100 lb	1.00	1.50
Acid, sulphuric, C.P., 9-lb. bottle, bbl., lb	0.13	0.18
Acid, sulphuric, C.P., bulk, carboy, lb	0.09½	0.12
Acid, muriatic, com'l, carboy, 100 lb	1.60	2.00
Acid, muriatic, C.P., 6-lb. bottle, bbl., lb	0.15	0.20
Acid, muriatic, C.P., bulk, carboy, lb	0.10½	0.15
Acid, nitric, com'l, carboy, 100 lb	5.25	6.50
Acid, nitric, C.P., 7-lb. bottle, bbl., lb	0.16	0.22
Acid, nitric, C.P., bulk, carboy, lb	0.12½	0.15
Argols, ground, bbl., lb	0.20	0.25
Borax, cryst. and conc., bags, 100 lb	2.75	3.85
Borax, powdered, bbl., 100 lb	3.00	4.00
Borax glass, gd., 30 mesh, cases, 100 lb., tin lined	10.00	13.00
Bone ash, 60 to 80 mesh, bbl., 100 lb	4.50	5.50
Bromine, 1-lb. bottle, lb	0.55	0.65
Candles, adamantine, 12 oz., 40 sets to case	3.50	4.15
Candles, adamantine, 14 oz., 40 sets to case	4.00	4.55
Candles, Stearic, 12 oz., 40 sets to case	4.95	5.50
Candles, Stearic, 14 oz., 40 sets to case	4.65	5.20
Clay, domestic fire, sack, 100 lb	1.50	2.00
Cyanide, 98 to 100%, 100-lb. case, lb	0.20¾	0.24¾
Cyanide, 98 to 100%, 200-lb. case, lb	0.20	0.24
Cyanide, 127-129%, 100 lb. case, lb	0.27½	0.28½
Cyanide, 127-129%, 200-lb. case, lb	0.26¾	0.27½
Lead acetate, brown, broken casks, 100 lb	8.75	9.00
Lead acetate, white, broken casks, 100 lb	10.00	10.25
Lead acetate, white, crystals, 100 lb	11.75	12.25
Lead, C.P., test., gran., 100 lb	13.00	15.00
Lead, C.P., sheet, 100 lb	15.00	18.00
Litharge, C.P., silver free, 100 lb	10.50	13.00
Litharge, com'l, 100 lb	7.50	9.00
Manganese ox., blk., dom. in bags, ton	20.00	25.00
Manganese ox., blk., Caucasian, in casks, ton. (85% MNO_2—¾% Fe)	45.00	50.00
Nitre, double ref'd, small cryst., bbl., 100 lb	7.00	8.00
Nitre, double ref'd, granular, bbl., 100 lb	6.50	7.50
Nitre, double ref'd, powdered, bbl., 100 lb	7.25	18.00
Potassium bicarbonate, cryst., 100 lb	12.00	15.00
Potassium carbonate, calcined, 100 lb	15.00	18.00
Potassium permanganate, drum, lb	0.11	0.12½
Silica, powdered, bags, lb	0.03	0.05
Soda, carbonate (ash), bbl., 100 lb	1.50	1.75
Soda, bicarbonate, bbl., 100 lb	2.00	2.50
Soda, caustic, ground, 98%, bbl., 100 lb	3.15	3.50
Soda, caustic, solid, 98%, bbl., 100 lb	2.65	2.85
Zinc shavings, 800 fine, bbl., 100 lb	10.50	11.50
Zinc sheet, No. 9—18 by 84, drum, 100 lb	9.50	10.50

CURRENT PRICES FOR ORES AND MINERALS

(Corrected monthly by Atkins, Kroll & Co.)

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

	Min.	Max.
Antimony ore, 50%, per ton	*$20.00	$25.00
Arsenic, white, refined, per lb	0.02¼	0.02¾
Arsenic, red, refined, per lb	0.06¾	0.07¼
Asbestos, according to length and quality of fibre, per ton	100.00	350.00
Asbestos, lower grades, per ton	10.00	100.00
Asphaltum, refined, per ton	15.00	20.00
Barium carbonate, precipitated, per ton	42.50	45.00
Barium chloride, commercial, per ton	42.50	47.50
Barium sulphate (barytes), prepared, ton	20.00	30.00
Bismuth ore, 10% upward, per ton	*75.00	upward
Chrome ore, according to quality, per ton	10.00	12.50
China clay, per ton	15.00	20.00
Cobalt metal, refined, f.o.b. London, per lb	2.50	
Coke, foundry, per 2240 lb	15.00	17.50
Diamonds:		
Borts, according to size and quality, per carat	2.00	15.00
Carbons, according to size and quality, per carat	75.00	100.00
Feldspar, per ton	5.00	25.00
Firebrick:		
Bauxite, per M	175.00	
Magnesite, per M	190.00	
Silica, per M	47.50	
Flint pebbles for tube-mills, per 2240 lb	15.00	25.00
Fluorspar, per ton	10.00	15.00
Fullers earth, according to quality, per ton	20.00	30.00
Gilsonite, per ton	35.00	40.00
Graphite:		
Amorphous, per lb	0.01	0.02½
Crystalline, per lb	0.04	0.13
Gypsum, per ton	7.50	10.00
Infusorial earth, per ton	10.00	15.00
Magnesite, crude, per ton	7.50	10.00
Magnesite, dead calcined, per ton	22.50	27.50
Magnesite, brick (see firebrick).		
Manganese ore, oxide, crude, per ton	10.00	25.00
Manganese, prepared, according to quality, per ton	40.00	120.00
Mica, according to size and quality, per lb	0.05	0.30
Molybdenite, 95% MoS_2, per ton	500.00	600.00
Monazite sand (5% thoria), per ton	150.00	200.00
Nickel metal, refined, per lb	0.45	0.60
Ochre, extra strength, levigated, per 100 lb.	2.25	3.25
Platinum, native, crude, per oz	25.00	30.00
Scheelite (see tungsten ore).		
Sulphur, crude, per ton	15.00	25.00
Talc, prepared, according to quality, per ton.	20.00	50.00
Tin ore, 60%, per ton	450.00	475.00
Tungsten ore, 65%, per ton	520.00	550.00
Vanadium ore, 15%, per ton	200.00	250.00
Wolframite (see tungsten ore).		
Zinc ore, 50% up, per ton	*15.00	20.00

JOPLIN LEAD AND ZINC PRICES

The highest price paid for zinc sulphide ore in Joplin district during the week ended March 18 was $45 per ton, the base price ranging from $37 to $42 per ton of 60% zinc. Zinc silicate ore sold on a base of $20 to $24 per ton for that running 40% zinc. The average price of sulphide ore was $39.60; zinc silicate, $22.30, and all grades, $38.36. The highest price for lead ore was $56 per ton; the average of all grades, $54.38. Most of the ore shipped for the week was from the stock purchased the week before. The metal shipments for the week ended March 18 were 11,914,740 lb. zinc, 2,119,370 lb. lead; for the 11 weeks ended that date, 109,768,040 lb. zinc, 19,179,290 lb. lead.

THE NOVA SCOTIA STEEL & COAL CO. has increased its dividend from 5 to 6%. Its profits for 1910 were $1,140,504, as against 907,949 for 1909, the increase being partly due to the re-financing of the company, whereby the interest on its bonds was reduced from 8 to 5½%. The company has $493,787 cash in hand. The value of current assets is $2,351,326, an increase of about $348,000, while current liabilities have decreased from $999,109 to $555,039. The position of the company in regard to current assets is therefore nearly $800,000 better than last year.

MINING AND SCIENTIFIC PRESS

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EDITORIAL

CONTRADICTING rumors occasionally industriously circulated, we announce that the *Mining and Scientific Press* is not for sale; neither is there any intention of removing its headquarters. Over a half century ago, with the whole field free from competition, the founders of this paper chose San Francisco as the place of publication, and they chose wisely. The city is now, as always, a great mining centre with close ties to the whole Western mining region and with a growing influence in the countries that border the Pacific, the greatest field remaining to be developed. We give the mining news of this territory, and serve the mining men of the world. Having survived earthquake and fire, good times and bad, for fifty-one years, we feel that we have a right to this as our home.

THE AMERICAN-JAPANESE commercial treaty has been formally ratified and most cordial relations between the two governments prevail.

ANOTHER notable Swiss tunnel was completed on the last day of March when, after five and one-half years work and the expenditure of twenty million dollars, the Loetschberg tunnel on the route from Milan to Berne was completed for the nine miles of its length. For speed of tunnel-driving the palm goes easily to American engineers, but for ingenious methods of coping with unusual difficulties the Swiss tunnels will long remain famous.

MRS. ELLEN H. RICHARDS, who died at Boston last week, was a notable example of the eminence to which a woman may attain in scientific work. As a member of the teaching staff of the Massachusetts Institute of Technology for over thirty years, as a member and officer of various learned societies, and in varied public services, no less than in the gentler duties of the home, her achievement was great, and her passing leaves profound regret in many hearts.

APPROPRIATIONS by the State for experimental work in metallurgy are urged by the *Herald-Democrat* of Leadville, Colorado, which points to the immense quantities of low-grade ore that would be made available if processes could be improved. That smelting of precious metal-bearing ores has reached as high a state of perfection as can be expected has recently been stated by so good an authority as Mr. Franklin R. Guiterman, but it is doubtless true that in the broad field of research connected with ore-dressing and hydro-metallurgy, there is room for helpful work in the laboratories at the State Universities and the School of Mines.

CONCENTRATES, one of the long-established departments of this paper, is evidently widely read and appreciated. A number of the country newspapers publish a column each week taken from this department, carefully crediting it to the *Mining and Scientific Press*. Others are not so scrupulous. A contemporary technical publication that makes a great parade of virtue used nearly a dozen items from this department in one recent issue, without a line of credit.

THE MASSACHUSETTS INSTITUTE of Technology celebrates its fiftieth anniversary in Boston this week, and will mark the event by a 'Congress of Technology' at which the sober pursuit of science will be varied by lighter diversions. The list of speakers for the technical session is long and one that includes the names of men who have been significant factors in the progress of the last half-century. A year the senior of the Institute, we extend to her our congratulations upon her fiftieth year of successful work, our admiration for what she has accomplished, and our sympathy with the ideals she is striving to realize.

RAILWAYS in the United States have adopted a policy of frank publicity, and it will, we believe, be greatly to their advantage. The recently established 'Bureau of Railway Economics' publishes monthly bulletins showing revenues and expenses in different geographical regions. This bulletin is sent free to the press with the statement that "while of course you are at liberty to make use of the information, it should be understood that this offer is made entirely without request or suggestion that the bulletin be made the basis of published comment." That breathes the right spirit. With increasing control of railways through commissions, there is the greatest possible need that the public be given exact facts promptly. Complete understanding usually leads to complete agreement.

PROTEST has been made to us by a Slavonian miner against the phrasing of our correspondent's account of the labor troubles at the Homestake. He writes a manly and dignified letter protesting that the Slavic people in America are misjudged and indicating clearly that he, at least, has studied American history to advantage, and has acquired much of the American point of view. It is easy to overlook the good qualities of those whose language and customs differ from our own. A few decades ago the Irish immigrants suffered from the same prejudice that the Slavs have now to meet. Today the Irish are more vigorously American than many who come from earlier stock. When, following the troubles of 1848, many Germans came to the United States, even university graduates were judged uncouth, and set to digging ditches. We trust that the Slavs may prove their worth as successfully as the Irish and Germans have. In the meantime, it may comfort our friend to learn that we know at least one engineer who pays premium wages for Slavonian labor.

WHAT has become of the plans for a new building at Washington to house the United States Geological Survey and related Bureaus? The conditions under which the geologists write their reports may be illustrated by the fact that in one room, eight by fifteen feet in area, with two windows, five persons work. Under the circumstances, we are not particularly enthusiastic over the twenty-two pages of the Sundry Civil Bill on which are listed appropriations for post-offices from Aurora, Nebraska, to Ypsilanti, Michigan.

CONSERVATION in its legal aspects has given rise to much controversy. At the first White House conference Mr. William J. Bryan applied the phrase 'twilight zone' to that borderland between State and National authority within which land-grabbing corporations were assumed to find the greatest scope for future activity. There has been a general belief that the shadows lay deep over this territory and that it was big with strife and evil. We are glad to present a more cheerful picture in the admirable summary of the limits of State and National authority as regards conservation, in the form of an address delivered by Mr. Curtis H. Lindley at the dinner given by the Commonwealth Club of San Francisco to Mr. Theodore Roosevelt. To say that it is the best statement of the situation yet given the public is but to echo the opinion of the thoughtful students of conservation who heard or have read the address. Its brevity leaves no room for anything but the analysis itself; arguments for or against are not given. It is impartial and authoritative, and an excellent illustration of the public service that a great lawyer can render by making clear to laymen the fundamental legal principles applicable to a public question of wide moment.

Alaska and the Public Lands

Alaska and its problems have been much discussed in the last few years, though not all that has been said is either true or helpful. The discussion has, however, served to focus attention, and to that extent has prepared the way for better conditions. Alaska has suffered from having no authorized spokesmen, and multiplicity of counsel has confused the issues. We present elsewhere the report of the Alaska Committee of the American Mining Congress, prepared, after nearly two years work, by men familiar with the country and having an interest in its future. Amid all the confusing and frequently belligerent briefs that have been filed, this one impresses us as particularly sound and judicial. It will well repay careful study. We are in substantial agreement with the conclusions and recommendations of this committee. That Alaska needs better administration rather than more law, that the coal lands should be opened, that existing titles and claims should be promptly adjudicated, that a land court is desirable, that a leasing system is applicable, and that both laws and regulations should encourage rather than discourage the prospectors, we have repeatedly urged.

It is all too easy to ask and even to secure new laws; and it is much too difficult to secure effective administration of law anywhere in the United States. If that be so where population is dense and customs are established, it is but natural that in the Far North, a land of wide extent, of scant population, and of many transients, poor administration should be common. Added to the inherent difficulties of the situation, is the circumstance that Washington has kept tight hold of too many things. It has been too often true that a permit or paper had to go to Washington for approval before an improvement could be undertaken; which at times meant a season's delay. Local officers of all ranks should be given wide authority and then rewarded or punished as they used or abused it. In Government service, shirking responsibility and passing decisions up to a higher official is common. It makes life easy for the subordinate, but hard on the ranking officers and on the public. A few mistakes might well be borne in the interest of prompt transaction of business. Appeal on reasonable grounds or in matters of magnitude should, of course, always be open.

That the coal lands are the key to the future and that the solution of the problem of their disposition is Alaska's most pressing need, will be generally conceded. Fuel is at the basis of civilization, and Alaska undoubtedly contains a great reserve of high-grade coal available to dwellers on the Pacific Coast. At present the abundance of California oil relieves the situation, but in the end reliance must be placed upon Alaska's resources of coal, and perhaps petroleum. Even now there is a market for a certain amount of coal, estimated by Mr. A. H. Brooks at approximately a million tons per year. With great fields easily available, locomotives in Alaska burn imported coal. It is not so important to place the blame for this as to find the remedy, and for that the people look hopefully to Mr. Walter L. Fisher, the new Secretary of the Interior. He has the confidence of the public and will doubtless find a way to speedily adjudicate the numerous conflicting claims and allow the opening of such lands as are really subject to patent. Looking farther afield, we note with interest that the committee found but little objection to the application to coal lands of a leasing system, provided that it was made equally applicable to public coal lands in the Western States and Territories, and that the revenue be used locally. Both of these contentions we believe sound; at least to the degree that the bulk of the income, after paying expenses of administration, should be devoted to local needs. In some cases the amount available would be more than could be used to good advantage, as in certain parts of California where the portion of the tax on railroads collected by the State but returned to the counties, is enough not only to do away with any local taxation, but to support county governments of unusual extravagance. The plan adopted in connection with the Reclamation Service has merits. Under existing law every cent derived from the sale of public lands must be spent in the public-land States. A large part, fifty-one per cent, must be spent on reclamation projects within the State or Territory where it originates. The remaining part may be temporarily diverted to some other public-land State where the amount available is smaller or the need greater, though it remains as a credit subject to ultimate repayment for use where it originated. When the law passed, Oklahoma, for example, had small need for irrigation, but a large fund, since the public land there sold promptly. Wyoming had large needs and but small funds. Part of Oklahoma's surplus could therefore be diverted temporarily to Wyoming to advantage.

The most significant point, however, should not be overlooked, that money derived from sale of Western lands is spent in the West and not in the East. Those who have attempted to make capital out of a supposed desire of Eastern conservationists to profit from the West, have too frequently overlooked this point. The same principle has been applied by the Forest Service when a part of the income from sale of timber is directly paid to local governments; the remainder is used for building trails, fighting fire, and for other similar purposes to the benefit directly of the States and Territories in which the National Forests are situated. This same principle should be recognized in any leasing system applied to the coal lands of Alaska and the West, or indeed to any of the public lands. If this be done, and if the system be framed so as to give proper encouragement to the prospector, we see no reason why it may not be advantageously applied to both oil and coal lands. Local officials must have the authority necessary for prompt transaction of business, the bulk of the revenue must be available for local needs so long as they are acute, and the legitimate prospector must be recognized and rewarded, or any system of leasing will be unpopular in the West as well as in Alaska.

Since the foregoing was written, the United States Circuit Court at Seattle has handed down a decision in the Alaskan coal land cases now on trial, which appears to sanction some of the methods which have been employed in securing large areas of the coal-bearing lands belonging to the public domain. Until full details of the decision have been received generalization upon it is worse than useless, but it is to be hoped that further confusion and legal entanglement has not been added to the already too great mass of it. The execution of laws should be just, simple, and direct. An injury will be done to our commonwealth if the coal lands of Alaska are allowed to pass into the control of big corporations without some adequate return being made. But it must not be overlooked that if the methods employed in preventing their passage under such control are so involved and unwieldy that as a net result the development of the lands is unduly hampered and delayed, injury will also accrue. Recently there has been much talk of 'efficiency' in the administration of railroads. It ought not to be too much to hope that the infection will spread and that the execution of laws may be conducted more with regard to the attaining of substantial justice and less with regard to legal intricacies.

National and State Authority in Conservation

By Curtis H. Lindley

*Whether there is a doubtful zone between National and State authority in conservation may only be determined by considering the State's relationship to the National Government in regard to the public domain within its borders; the areas over which State laws are dominant; the powers of the Federal Government acting within these areas—first as a sovereignty exercising governmental functions, and second as a landed proprietor, owning and controlling the disposition of the land which constitutes the basis of its conservation policies. In submitting what follows, I may explain that the generalizations may in some minor phases be subject here and there to exceptions, owing to difference in environment. I am dealing with the situation as I understand it to exist in the State of California.

With reference to other States, while the differentiation may be slight, there is no time to explain, elaborate, or note exceptions. The heart of the subject may best be reached by a process of elimination. We may state the following as postulates—principles which, I understand, have been established by the highest judicial tribunals, both State and National.

1. In the beginning the Federal Government owned none of the Western lands; nor did it ever own nor has it since acquired any 'public land' in the larger sense within the present boundaries of the thirteen original States or those carved out of them. Tennessee and Texas also fall into this category.

2. The first cession of territory to the Government came from the original States, and vested in the United States, roughly speaking, the area extending westward to the Mississippi. The terms of cession created a public domain which was to be the theatre of future States, and was to be held by the National Government in trust for all the people. Each State carved out of this territory entered into a compact that it should never interfere with the primary right of disposal of the soil, or subject the land to taxation so long as the title remained in the Federal Government. The Constitution of the United States, as ratified by the States, contains the following brief clause with reference to the public lands: "The Congress shall have power to dispose of and make all needful rules and regulations respecting the territory or other property belonging to the United States, and nothing in this Constitution shall be so construed as to prejudice any claims of the United States or of any particular State." Subsequent additions to the public domain were acquired through treaties of cession and purchase, and States subsequently created out of the added areas were admitted into the Union under like compacts and under the aegis of the Constitution.

3. The States, as such, acquired no right of property in this domain by virtue of their sovereignty except lands underlying tidal waters and navigable streams, such rights being subordinated to the public right of navigation, which is under the control of the National Government. Whatever other property the States acquired on admission or subsequently, came through donations by the National Government for educational and other purposes, such as sixteenth and thirty-sixth sections in each township for schools and lands granted for agricultural colleges, universities, and like purposes. In the exercise of what may be termed its agrarian policies, the National Government has sold into private ownership lands to actual settlers and other purchasers, and has donated large areas to aid in the construction of railroads, wagon-roads, and other internal improvements. The residuum, until recently a rapidly disappearing quantity, is the 'Public Domain', subject to national conservation.

4. Within the States, the Federal Government is to be considered in a dual aspect. (1) Landed proprietor, holding the public domain in trust for all the people; and (2) a sovereign exercising such powers and governmental functions as were granted to it by the States upon subjects defined in the Constitution; such, for example, as the right to regulate commerce between the States, the control of navigation, and others not necessary to enumerate.

5. Under the Constitution and compacts between the States, the Congress of the United States has the absolute control over the public domain. It determines all questions of policy with regard to its disposition. It may reserve it from sale; donate it; lease it; and prescribe such terms as it may see fit for privileges granted on or over it, the same as any other land-owner. With this policy the State has no concern, and can not interfere.

6. With the exception of such small areas as are occupied by the National Government for purely governmental purposes, such as post-offices, customs offices, etc., as to which the State has in express terms surrendered its sovereignty and ceded it to the National Government, the State exercises what may be loosely called the 'police power' within its entire boundaries. All ordinary State laws passed in the exercise of its political jurisdiction are operative over the public domain, provided such laws do not contravene the compact between the State and the National Government—that is, do not interfere with the primary disposal of the soil, and do not impinge on the constitutional power of Congress to deal with the lands as it sees fit.

7. For purposes of this analysis, we must consider the State solely in its sovereign capacity and not as a land-owner. In California, at least, by a process of rapid elimination, the State has ceased to be a land-owner. Such landed property as it may still own, and which has escaped the pernicious activity and piratical vigilance of 'land sharks' and speculators, is purely negligible.

8. National conservation, as we understand it, is

*Address at dinner given to Mr. Theodore Roosevelt by the Commonwealth Club, San Francisco, March 27, 1911.

a policy of primarily placing the remnant of the public domain, other than that portion of it which is purely agricultural in character, in a state of reservation, and subsequently dealing with it or its natural resources in such a manner as will economically yield the best results to all the people. Its principal aim is to obtain a maximum economic production at a minimum of waste: to prevent individuals or aggregations of individuals from securing monopolies: and to exact some equivalent for the privileges granted. It may be asserted, and is claimed with some degree of plausibility, that in assuming to prevent intrastate monopolies, the Federal Government is exercising a State function. But as I understand it, this is simply the result of a policy, and flows incidentally from the right to dictate terms upon which privileges on the public domain are granted: a right with which the States can not interfere. Where a right exists, the motive with which it is exercised, in a legal sense, is of no moment. As before noted, in the initiation and administration of measures designed to carry these policies into effect, the State has no voice, and so long as the Federal Government carries out these measures without infringing on the rights of private property, which it had previously sold, there is no one to complain. If it becomes necessary to utilize, injure, or destroy private property for the use of the Federal Government in the carrying out of its policies of national conservation, the Government must condemn the land under State laws, the same as any public utility corporation would be compelled to do.

9. These generalizations are subject to an important consideration which involves that department of conservation which deals with the use of water in the running streams; that is, the reclamation of desert lands, Federal irrigation projects, and the development, transmission, and use of hydroelectric power. As to this field of activity, the State assumes a position of importance. So far as re-forestation of denuded public lands, the management of forests, the sale and disposal of timber, and the terms under which rights temporary or permanent may be acquired in public lands containing coal, oil, phosphates, or other minerals which may be included in the conservation policies, are concerned, the State has no function whatever to perform.

10. Running water is not, in the usual sense, subject to ownership. Rights are essentially usufructuary. As to the use of water flowing over the public domain, the Federal Government, at an early period of the development of the West, adopted the policy of sanctioning the appropriation of water for beneficial purposes and its diversion from the natural channels for mining, irrigating, and other industries. The policy had its inception first in recognition of local rules and customs, subsequently crystallizing into positive congressional enactments. So that it has come to pass that while the National Government through its ownership of the land has the right to use water passing over it for the benefit of the lands riparian to the stream, which right is purely relative in connection with private owners on the same stream, and has the right to insist, like any other proprietor of lands, that the State shall not deprive it of such rights, or interfere with the navigability of the streams, yet if it desires increased privileges in connection with its conservation policies, it must acquire the appropriative right, the same as an ordinary individual. In other words, the National Government is committed to the policy that as to rights to be acquired in running water, other than those inherent in the ownership of the land itself, the State laws, rules, and regulations are controlling. In this regard, the Federal Government occupies the same status as an individual, or private corporation.

11. Federal control over the potentialities in running water arises, not out of its ownership of the water, but out of its ownership of the land either over which it flows or over which it must be conducted. Taking for illustrative purposes, the hydroelectric feature of the conservation policies, while the right to use the water must be acquired under State laws, there can be no diversion or use of it on or over Government land without the consent of the United States. In this way, the Government is in a position to dictate the terms and conditions under which privileges and easements over the public domain shall be granted, and to exact something in the nature of a royalty for these privileges. The State has no concern with this; has no right to inhibit, or control it. If it be asserted that this attitude of the Government is inimical to the State's interest: that it retards development and paralyzes industries (and such assertions are made), the State can not complain. The Government is simply dealing with its own property in its own way under the authority granted by the Constitution and compact with the States. If there is to be a change in policy, it must come through appeals to Congress.

12. This brief analysis would seem to sanction the deduction that with regard to national conservation there is no 'twilight zone' in which National and State sovereignty overlap, or interlock. These two sovereignties revolve in concentric orbits without serious danger of collision or damage.

13. If I were called upon to suggest the possible duty of the State, I should say that it would lie in the direction of sympathetic co-operation, adjusting its water legislation and policy so as to coördinate with the Federal Government. Theoretically at least, it is the function of the State and not the general government, to prevent all monopolies which do not enter into interstate commerce. But as many streams are interstate, and electricity is an article of commerce which may be transmitted from one State into another, State control over the industry could not be universally effectual. State co-operation with the National Government in other lines has been brought about; for example, in the construction of a débris dam to restrain the detritus from flowing from the watershed of the torrential streams of California to the valleys below, a shattered hope of the hydraulic miner that this would enable him to resume the interdicted industry; also in dredging the Sacramento and San Joaquin rivers to improve navigation. Just what may be the attitude of the State as to sympa-

thetic co-operation in national conservation measures will depend on the Legislature, which, under our representative form of government, is supposed to express, for the time being, at least, the will of the people of the State.

14. It is quite apparent that the State is, like the general government, in control of one of the essential factors in the hydro-electric industry, which factors should be united in a common purpose. This situation in no sense involves a conflict in the exercise of sovereign powers. Each sphere of control is defined and recognized by both State and Nation. The State may emulate the example of the Government and impose conditions under which water may be appropriated and used commercially, for power purposes. And there looms up the probability of being compelled to satisfy two sovereigns instead of one, which suggests in turn, the possibility of burdensome and deterrent conditions. It would seem that in this direction there is room for discussion as to plans of coördination. These plans must be carefully worked out by those familiar with the complexities of the situation. Mere unenlightened opportunism, however well meant, will not accomplish very satisfactory results.

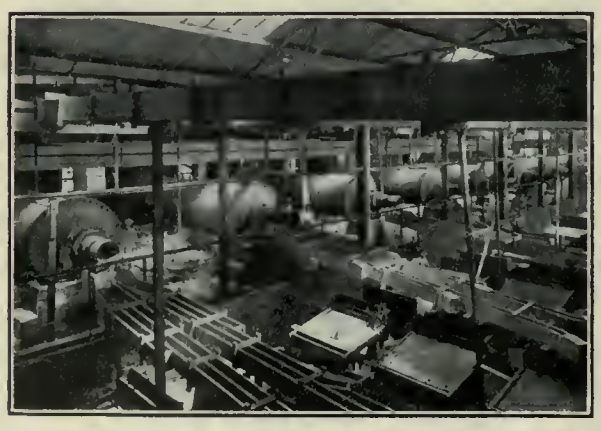
In other times and in other nations, the national domain has been the plaything of tyrants. In the American Commonwealth, it has fed the appetite of greed; has been preyed upon by the pillaging landgrabber and annexed by the fraudulent land pirate. That there still remains enough upon which to focalize a national sentiment, and around which to build a national hope, is due solely to those men who had the great foresight to take the initiative, and the magnificent courage to deliver the message. Among these patriotic citizens the name of him, who like Abou ben Adhem, leads all the rest, is that of the distinguished guest of the evening.

The New Randfontein Mill

A recent occurrence of note is the starting of 300 stamps in the huge mill recently erected on the Randfontein property, which claims to be the biggest reduction plant under one roof in the world. The mill has 600 stamps, supplemented by 16 tube-mills, and the necessary sand and slime plants. Taken altogether, it is an imposing structure. There are already 400 stamps on the Randfontein property, so that the new mill will bring the number of stamps available up to a thousand. It will be readily understood that to keep all these stamps supplied the ten mines in operation on the property will be fully employed, and to bring the ore reserve up to the mark some effort will be required. At present the ore reserve represents two years milling, which according to modern Rand practice is below ordinary local requirements. When all the stamps get fully at work at Randfontein, it is confidently expected that the property will be not only the premier producer of Transvaal, but also of the world.

Randfontein Central Mill.

Crusher House With Conveyor-Belts From Bin to Crusher.

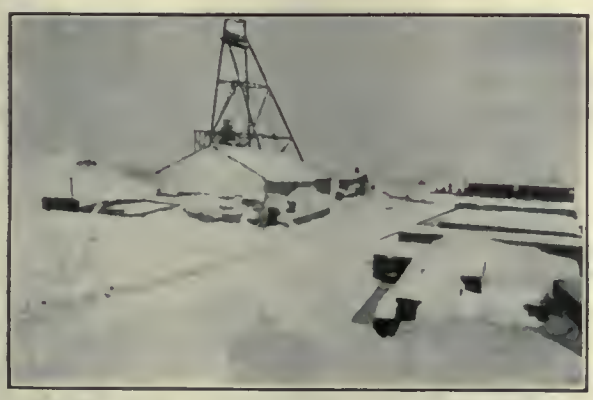


Tube-Mills. Randfontein Central.

Gold-Recovery House. Rondfontein Central.

Construction Work at Nevada Hills Mine

The Nevada Hills Mining Co., operating at Fairview, Nevada, is sinking a new shaft, erecting surface equipment, and building a 20-stamp mill and cyanidation plant. The 3-compartment shaft is being sunk between the original Nevada Hills vein on one side, and the Eagle and other existing veins on the other side. Both vein-systems are to be tapped by levels from the 600-ft. station of the new shaft. At the surface has been erected a 77-ft. steel head-frame, in close proximity to which a 150-hp. electric hoist is being placed. In each of the two hoisting compartments a 2-ton skip is to be operated, by which the material to be hoisted will be dumped into a 2-compartment bin at the top of the mill—one compartment for ore and the other for waste. Ore is to be drawn from the bin to a Hercules Blake crusher, 20 by 12 in.; the crushed ore is then to be elevated to the top of the mill, descending thence by gravity through automatic weighing machines to the sampling plant, and finally discharging into the 600-ton steel bin above the stamp-batteries. The milling processes comprise crushing in four 5-stamp batteries, of 1250-lb. stamps, table-concentration, and pulverizing in tube-mill; this is followed by cyanidation in connection with continuous agitation, decantation, and filtration, the final solution to be delivered to the zinc-dust precipitating-plant within the refinery building. The process is continuous throughout, and the cyanidation plant is to have some new features not used in general practice. The mill buildings are steel, the foundations being of reinforced concrete; the buildings are being covered with asbestos-lined corrugated iron, making them fireproof. The mill machinery, mine hoist, air-compressor, and shop machinery are to be operated by electricity, for which transformer houses are being built. The mill, which will have the capacity to treat 125 tons of ore per day, is provided with a steam-heating system, and is expected to be in operation by about June 10. The mill and mine plant were designed by J. B. Fleming, who is directing the construction work. W. H. Webber, who had charge of the property for the former company, is general manager for the present company, of which George Wingfield is president.



Head-Frame and Storehouse at New Shaft, Nevada Hills Mine.

Millsite and Mill Construction, Nevada Hills Mine.

Head-Frame Foundation, Nevada Hills Mine.

Stamp Foundations and Ore-Bins, Nevada Hills Mine.

Low-grade gold mines are worked successfully in many parts of the world. Some of the Victorian mines in Australia have recently issued reports that are worthy of notice. The New Moon Co., Bendigo, treated 13,800 tons of quartz, assaying 4 dwt. 10 gr. per ton, for the six months, and a reduction in working costs to 15s. 1¼d. per ton, as compared with 16s. 3d. per ton for the previous term, enabled the company to pay dividends amounting to £2400. The Birthday Tunnel Co., Berringa, has been conspicuous for economical management for some years, and after a period of misfortune is just making headway again. The 24,398 tons of quartz crushed during the past six months yielded 2846 oz. of gold—an average of 2 dwt. 8 gr.—and was so handled that the company was able to reduce the bank overdraft.

Alaska and Its Needs

The Alaskan Committee of the American Mining Congress, consisting of Henry R. Harriman, John L. Steele, and Maurice D. Leehey, has presented a vigorous report, of which an abstract is printed below. The report is of especial interest at this time in view of the announced determination of the new Secretary of Interior to pay especial attention to Alaska.

Your Committee has sought to emphasize the fact, which they now report to this Congress, that Alaska is now suffering, and for the last two years has acutely suffered, not so much from a lack of adequate mining laws on the books, as from an uninformed, though well meaning, long-distance attempt to administer these laws. While the representatives of our Government have been, for the most part, intelligent and able men, they have been so restricted in authority and hampered by red tape and cumbersome regulations, that for the past two years, with a few notable exceptions (and these

Map of Alaska.

largely of the placer industry), the extensive, and largely intensive, development of Alaskan resources has been at least at a standstill. Alaska can be put in a most healthful and enviable position if she can be given a helpful administration of existing laws, in the spirit in which they were enacted. Such a policy once adopted toward Alaska, would necessarily bring with it the prompt and intelligent amending of laws which are susceptible of amendment, and the enactment of new legislation, as it may be required. The men in charge of the administration of the law should be granted needful authority to locally administer the laws which now exist, with full knowledge of the spirit and intent of that law, and questions which would not deserve serious attention of a town council, should not be referred to Washington to pursue a tedious course through various bureaus of the department, before appropriate action can be taken.

If the Federal Government and people at large desire to see Alaska develop, and her important resources made tributary to the National and commercial needs of the States, then let them pattern somewhat after the policy of the Dominion Government, which is making such marvelous strides by a policy of encouragement to settlers and prospectors, granting the local officials full authority to deal promptly and fearlessly with local conditions that arise. Let these officials understand that every proper act will be promptly approved, successful administration rewarded by promotion, and every blunder by prompt dismissal. Let our prospectors understand that our Government, like that of Canada, desires to see her resources developed along lines that will secure the greatest good for the greatest number of persons, and let capital be safeguarded, but duly warned that monopoly and commercial oppression in any form will not be tolerated, and Alaska will promptly respond by pouring her treasures into the lap of the American people.

While this Committee has been studying somewhat closely, and would have been glad to have presented to this Congress, if desired, a more technical analysis of existing laws, it is our firm belief that the vital question in Alaska at the present time is not a matter of technical construction and amendment of existing statutes, but one of high administrative policy to be adopted at this critical point in her history. This, then, is our report to the American Mining Congress: **Alaska's present need is a new administrative policy rather than additional legislation.** Let this statement be received in no sense as a reflection. Alaskans are not inclined to quarrel with the past. Their faces are set toward the future. We believe that the time has now come, with the fund of information which now for the first time is available to the Federal Government, when such a policy can be correctly announciated. A vigorous, intelligent, and helpful administration of existing laws, will early solve the present problems of the coalfields, the railroads, the forest reserves, and the fisheries of Alaska, and will indicate from time to time further legislative steps. It will be better for Alaska to be given a helpful and intelligent application of inadequate or even inappropriate laws, than to continue in the present condition.

Both the President, Mr. Taft, and Mr. Roosevelt have endorsed the general proposal of a leasing system for coal lands. We recognize the popular demand at this time for some such system, and are not opposed to its adoption, if it can be made uniformly applicable to unappropriated coal lands throughout the United States as well as Alaska. There are now in Alaska, unappropriated and reserved by executive order, 1000 out of 1200 square miles of known coal area, as distinguished from large districts which have not been visited by the prospector, and that there are within the United States, exclusive of Alaska, according to the report of the President, 95,515,000 acres of coal lands now withdrawn by executive order. A general leasing plan, therefore, if brought to a successful solution, would be applicable to 80% and we believe fully 90% of the known coal lands in Alaska.

The belief seems to have gained ground that Alaskans have objected to a leasing plan for the reason

that they do not wish to subject the coal to a fixed royalty, or tax, per ton. This is not in any sense the case. Not only have the Alaskans no objections to the imposition of a reasonable tax per ton upon coal exported, but they have gone so far as to publicly suggest such a fixed revenue, on condition, however, that the proceeds be applied to the construction of needful roads in the mining districts, the building of school houses and other expenditures in Alaska. We have found a well-rooted objection to taxing the products of Alaska for the benefit of the States, and it would seem that this objection is well grounded in the principles of true conservation in the opening up of a new country.

For two years this Committee has conducted hearings and personal investigations, and has been made intimately conversant with a large majority of pending coal entries in Alaska. The claimants have spent in the aggregate fully a million and a half dollars and years of effort in prospecting and developing the coal resources of Alaska. They are for the most part men of moderate means, and they are entitled to be given the patents which the law of the location promised. There should be reasonable restrictions, of course, but the present claimants should be given such title as will enable them to raise the necessary development funds by selling bonds based upon their title. Of the million and a half dollars which we estimate has been so raised and expended by these men, and their friends and associates in the States who have backed their efforts, we do not include a single dollar coming from any source which could in any way be criticized or made a subject of suspicion or innuendo.

In ascertaining the sentiment of Alaskans on the proposed leasing system, the Committee has been surprised to find that those interests which have in the past been freely charged with a desire to monopolize the coal lands of Alaska, are today fostering, and in some cases advocating, the adoption of a leasing system. This Committee is in no way opposed to any of the interests operating in Alaska. We believe that the investment of large capital should be encouraged. It is, however, a fact, that for the last fifteen or sixteen months the leasing plan has been openly favored by certain of these interests. Human nature and the desires of 'big business' are sometimes selfish, and we sound a note of warning lest, taking advantage of a present popular clamor for the leasing system, and with less expense to themselves, by ignoring the rights of the discoverers, a monopoly of production of the Alaska coalfields may not be more readily brought about under a leasing system than by a rigid enforcement of the anti-monopoly clause of the Act approved May 28, 1908. We submit, that to force at least a large number of Alaska coal claimants to accept leases to the lands to which the law entitles them to receive patent, will absolutely confiscate their holdings. And further, if they, the men of Alaska, be eliminated, your Committee is firmly convinced that the result will be to give the control of the Alaska coalfields to the transportation companies and their proteges, and that such companies, now existing, and yet to be formed, without being obliged to recompense or reimburse the men who have discovered and opened up these fields, will be able to effect a monopoly of production of the Alaska coalfields, more sweeping and ironclad than would be possible under a rigid but helpful enforcement of the Act of May 28, 1908.

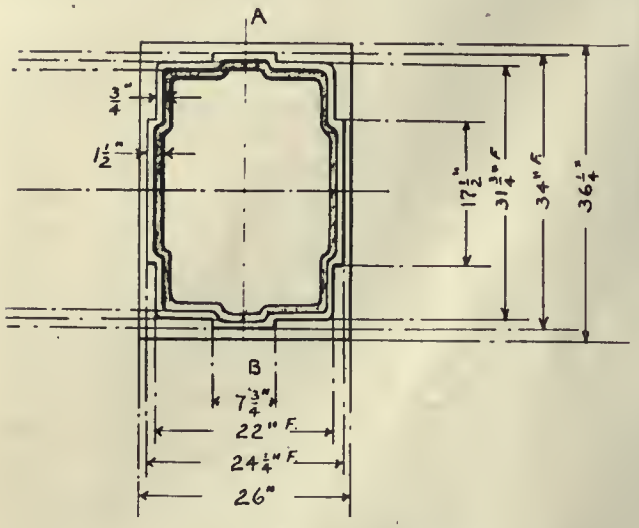
We find that Alaskans generally are endorsing the recommendation of the President and of the Secretary of the Interior for the creation of a Land Court. They have come to recognize this as the proper method for the determination of contests to which the Government is a party. The officers of the General Land Office should no longer be forced to act in the treble rôle of detective, prosecutor, and judge. We submit that the claimants to Alaska coal lands and mineral lands are entitled to have their rights determined as speedily as possible, and by an impartial tribunal. The proposed Land Court could promptly distinguish between valid and fraudulent entries, and do justice to the claimants, and at the same time provide a fuel supply for Alaska, the Pacific Coast, and the American Navy.

A percentage of the Government Agents who have been called upon to make important reports upon Alaskan matters have actually visited, in Alaska, the subject-matter of their reports. We write it down as an axiom that wherever an agent of the Government has actually visited in Alaska, the subject of his investigations, be it coal, fisheries, or otherwise, has met on the ground the men whose business he was inspecting, and has informed himself as to the actual facts and conditions surrounding the case, that his report has been broad and liberal in its character, and helpful in its results. On the other hand, the reports which have handicapped and injured Alaskans, and which are largely responsible for current misinformation on Alaskan subjects, have been written in the 'wilds' of Seattle, and amplified by men who have braved the hardships of Washington, D. C.

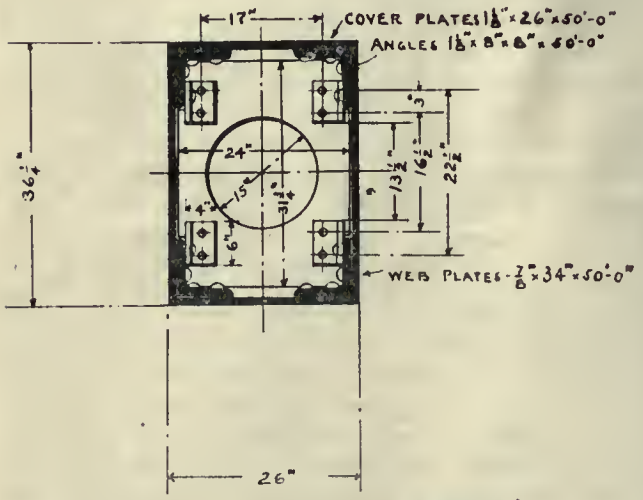
Recommendations.—(1) The new policy, and the helpful and intelligent enforcement and amplification of present laws, including the law intended, as its title states, 'To encourage the development of coal deposits in Alaska.' To aid in this, we believe in the creation of a Land Court, as proposed. We believe that such a tribunal can determine these questions uninfluenced by popular clamor, and its decisions will be readily adopted by the people at large. (2) We feel that the most urgent demand of Alaska is for the opening of her coal properties. While, unquestionably, transportation throughout Alaska is the greatest present necessity for the mining industry, coal must be provided before we have the transportation facilities. (3) No policy for the development of Alaska will be well founded or can long endure which does not recognize as an essential principle the rights of the discoverer and of the pioneer; that while Alaska invites, and must make attractive, the investment of large capital, she must at the same time make an equal appeal to and equally safeguard and encourage the pioneer and prospector.

El Oro Steel Spud

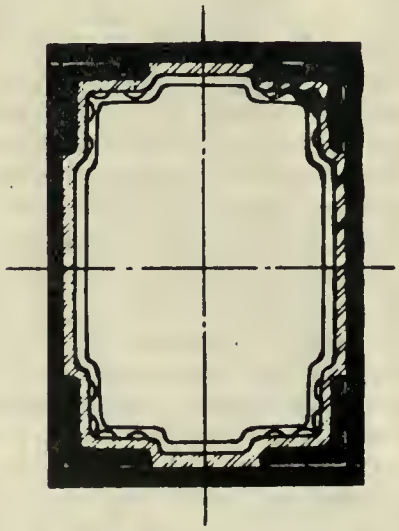
The problem of making a spud that will stand the heavy strains incident to dredging in hard ground is one that is extremely diffieult to solve. The first spuds were sticks of wood. These long since proved inadequate, and are now only used on the smaller boats or for stepping ahead. Spuds built up of structural steel have been in use in California for some years. As the size of the boats



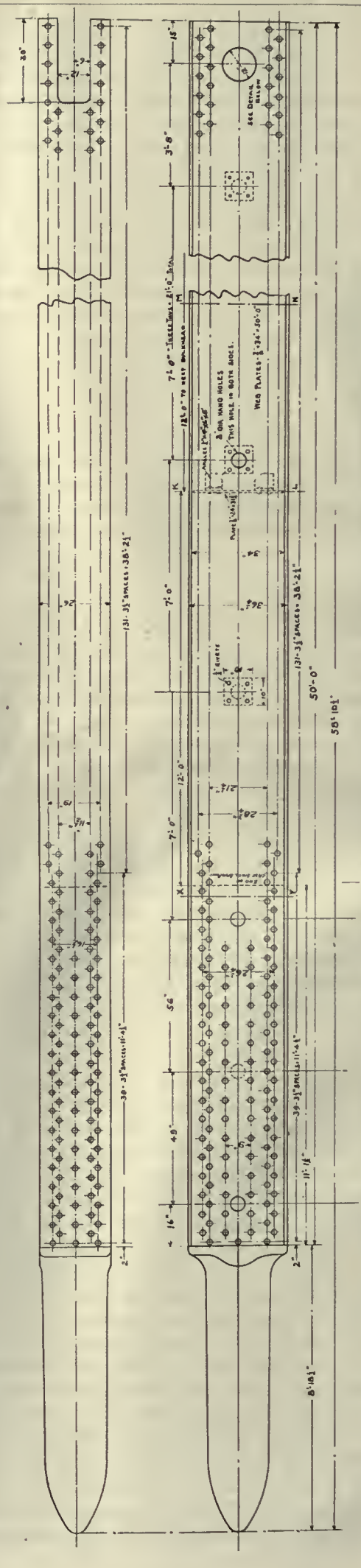
Full End View of Point Casting.



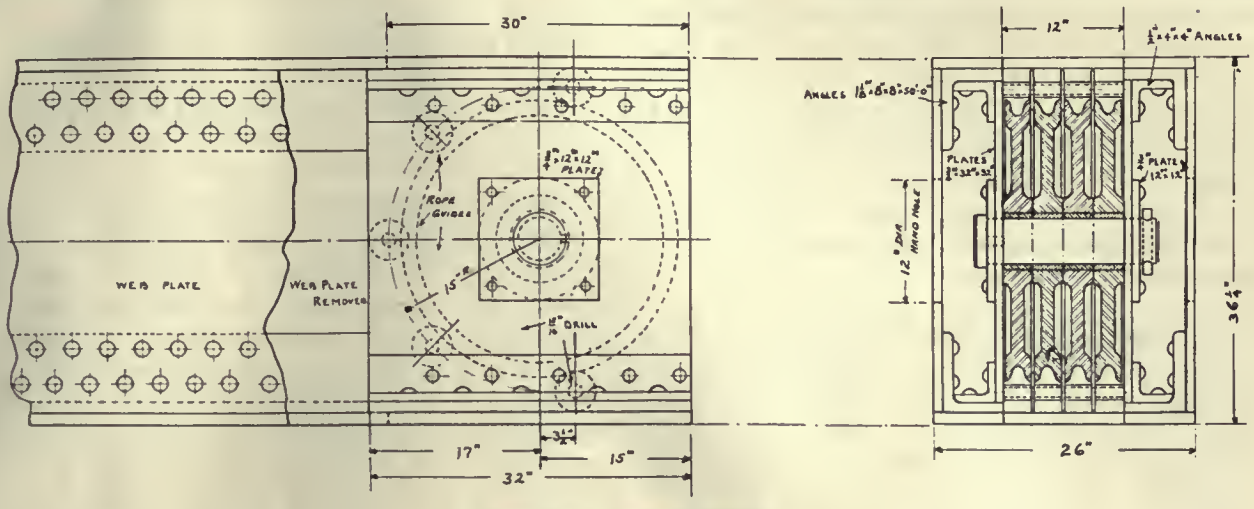
Section K-L, Showing Detail of Bulkhead.



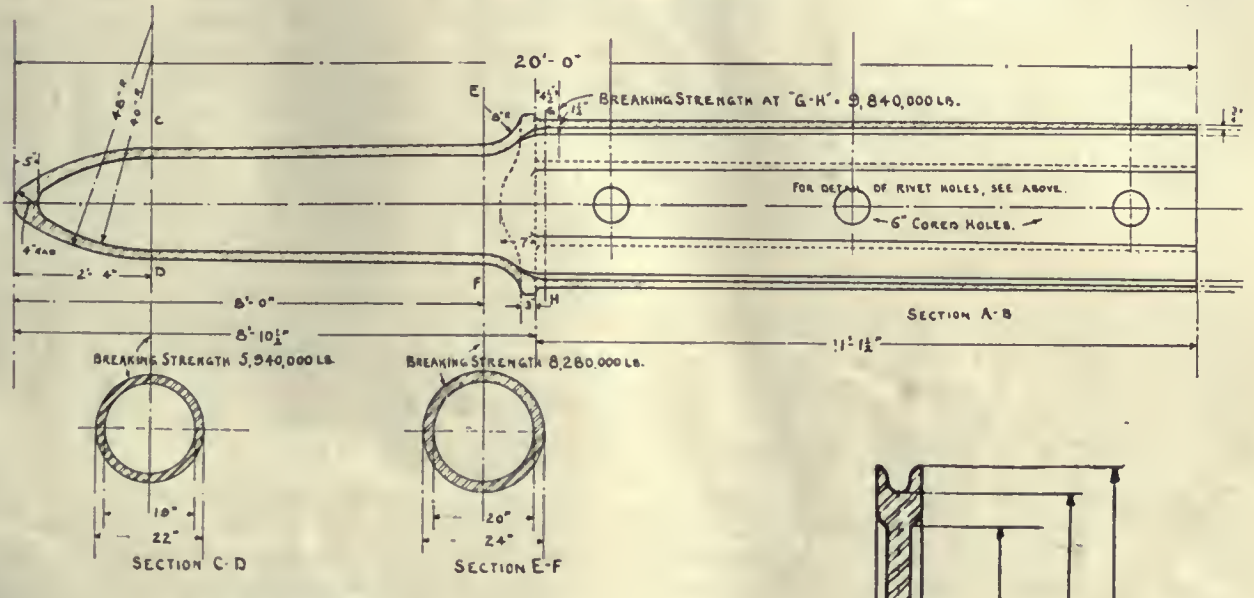
Section Showing Cast Steel Point Riveted in Place.



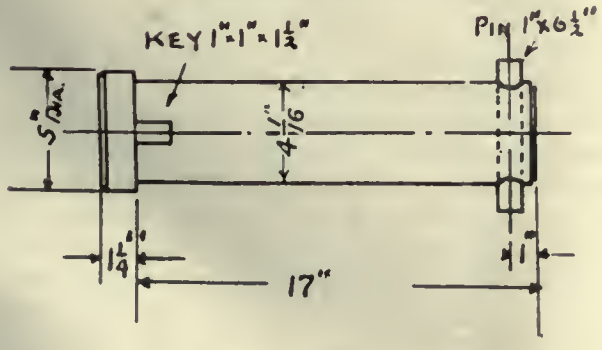
Longitudinal Section. Cover Plates 1¼ by 26 in. by 50 ft.; Angles 8 by 8 in. by 50 ft., of 1¼ in. Steel; All Rivets 1¼ inches, Flush on Outside.



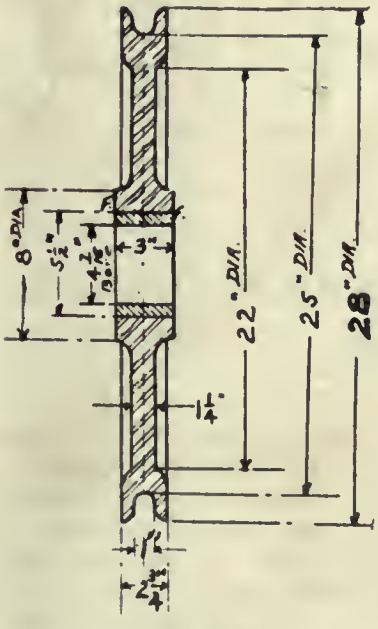
Spud-Head, Showing Sheave.



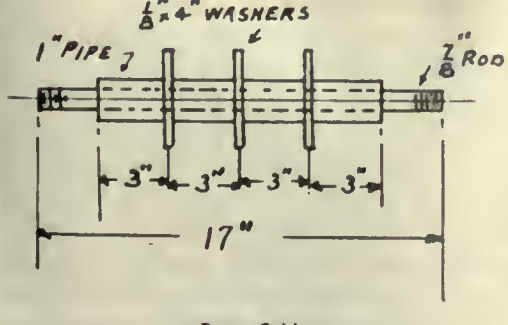
Cast Steel Spud Point.



Sheave Pin.



Cast Steel Sheave.



Rope Guide.

built has increased, the problem of building from stock material has had to be abandoned, and now specially rolled plates and beams are demanded.

In general, spuds are now made of steel beams set side by side and covered by plates. The whole is riveted together, and a possible element of weakness is that it has been customary to use many small rivets; this necessarily involving many holes in the plates. A spud of this construction is exceedingly difficult to repair, since there is no opportunity to work inside, and it must be torn to pieces. W. S. Noyes of the El Oro Dredging Co. has recently designed a box spud. The accompanying figures show the construction in such detail that but a few additional words are necessary. In making this

spud heavy plates and relatively few units were used, and the centre is left clear except for bulkheads, as shown. The steel point is round for a distance of 8 ft. up; rather more than the usual height. Since the point is buried in the mud, it is obvious that it must be round to reduce torsional strains as the boat swings. Indeed, a round spud would have advantages in this connection, but it would impose difficulties in regard to guides and

No.	MATERIAL	SIZE	WHERE USED	GROSS	CHIPS	NET.
1	STEEL CASTING	20FT LONG	POINT	10524 LB.	1824 LB.	8700 LB.
4	ANGLES	18"×8"×50'-0"	CORNERS	11380 "	734 "	10646 "
2	PLATES	⅜"×34"×50'-0"	WEBS	10115 "	627 "	9488 "
2	"	18"×26"×50'-0"	COVERS	9945 "	755 "	9190 "
4	ANGLES	½"×4"×4"	SHEAVE BRACKET	140 "	6 "	134 "
2	PLATES	¾"×32"×32"	" "	494 "	9 "	485 "
2	"	¾"×12"×12"	" "	62 "	9 "	53 "
2	"	⅜"×24"×31½"	BULKHEADS	385 "	95 "	290 "
8	ANGLES	½"×4"×6"×6"	"	68 "	12 "	56 "
1	PLATE	1"×20½"×11'0"	SPLICE	900 "	180 "	720 "
3	"	½"×12"×12"	HAND HOLES	45 "		45 "
4	SHEAVES	28" DIA	HOIST	828 "		828 "
1	PIN	4¾"×17"	SHEAVES	100 "	20 "	80 "
5	RODS	⅝"×17"	ROPE GUIDE	15 "		15 "
15	WASHERS	⅝"×4"	" "	15 "	5 "	10 "
	RIVETS	1"×3"		55 "		55 "
	"	1¼"		3055 "	50 "	3005 "
			TOTAL WEIGHT	48126 "	4526 "	43800 "

Size and Weight of Parts.

wearing surfaces. Where the steel point and the plates join, the contact surfaces were carefully machined and every precaution has been taken to secure an exact fit. This spud was built at the Indiana machine-shops from plates furnished by Cambria Steel Co. An interesting incident in connection with its construction was the first use of an oxy-acetylene blow-pipe in the California dredging fields. A long flaw being discovered in one of the cover plates, the blow-pipe was called into service and melted a strip of new metal into the plate with surprising speed and success.

MINERAL LANDS CLASSIFIED

During January 470,664 acres of public land was appraised as coal land by the U. S. Geological Survey, at a value of $10,835,848, and 447,383 acres was classified as non-coal land, making a total coal appraisement of 14,119,447 acres, valued at $635,959,358, and a total non-coal classification of 34,298,900 acres. At the minimum price allowed by law, the price the lands would have brought but for this appraisal, the lands thus far classified as coal land would have a value of only $216,960,426. The 470,664 acres of coal land appraised during the month, valued at $10,835,848, and restored to entry, would have brought at the minimum price only $5,621,532, involving a loss to the Government of $5,214,316. One coal-land withdrawal of 468,107 acres was made during the month in Colorado, and five restorations were made in Colorado, Montana, New Mexico, Utah, and Wyoming, aggregating 1,369,849 acres. The total area withdrawn as coal land on February 1 was 80,547,481 acres. Two withdrawals of oil land were made during the month, with a total area of 392,154 acres, and one restoration of 189,710 acres.

Simple Methods of Making Ditch Surveys

By JAMES W. PHILLIPS

*The first miners were gravel-miners. They put in ditches to carry the required water, though few, if any, knew how to figure the flow of water. A crude method of measuring water flowing through orifices under a head was developed, and the amount of water was the area in square inches of the orifice, regardless of its shape. The gravel-miner wanted to get water to the place where it was needed, and the possibility of washing the ground away was the only thing that prevented him from running his ditches in a straight line if possible, instead of following a grade. In many instances tunnels were cut and straight flumes put across valleys. Following the first miners, and practically at the commencement of the hydraulic-mining era, there followed a generation of men, many of them surveyors and engineers, who used the following adaptation of the Eytelwein formula for open ditches:

$$v = \sqrt{(9000\ rs + 0.012)} - 0.11$$

or the following adaptation of the Poncelot formula

$$v = \sqrt{\left(\frac{9000\ as}{p}\right)} - 0.11$$

and for pipes the following adaptations of the Hawksley and Poucelot formulas:

$$v = 48\sqrt{\frac{dh}{1 + 54d}}$$

in which v = mean velocity in feet per second; a = area of cross-section of water, in feet; p = wetted perimeter in feet; r = hydraulic mean radius in feet = a ÷ p; s = sine of slope = h ÷ l; h = fall in feet in any length; l total length in feet on the slope; d = diameter of pipe in feet.

The foregoing formulas were printed in many handbooks given away by firms dealing in tools and machinery used by miners, and also in miners' pocket-books. They seldom appeared, however, in the forms here given, but were painfully expressed in words like rules in arithmetic, with worked-out examples. They were used by a great many men who would have been scared by the sight of a formula. A tremendous amount of practical data has been stored in the heads and notebooks of the older miners, but the engineer of experience in this line of work is better equipped than the practical man without scientific education.

As the mines grew larger, and the operations were conducted on a mammoth scale, the engineer was employed to run the ditch-lines and do all the work that called for education and skill in the handling of water. When the larger mines were finally shut down by the court, a large number of engineers had to seek other employment, and many of them engaged in irrigation, but found it hard to come down from grades of 10 ft. to the mile to that

*Abstract from 'Hydr[illegible] Auriferous Gravels,' *Jour.* West. Soc. Engi[illegible]

many inches sometimes. The classic experiments of Hamilton Smith on the flow of water in pipes were made for hydraulic miners, and the engineers employed from early in the '70s to the time the work was stopped were men of whom the State might well be proud, and were a credit to their great profession. With the engineers employed by the larger companies, as with the engineers employed today, the favored formula has been the Chezy; that is,

$$v = C\sqrt{rs}$$

with the factor C computed by the Kutter formula, or the following modification of it, which is close enough for practically all use:

$$C = \frac{42 + \frac{2}{n}}{1 + \frac{42n}{\sqrt{r}}}$$

using the following values of n: planed boards, n = 0.010; common boards, n = 0.012; rubble, n = 0.017; earth, n = 0.025.

In surveying for a line, flumes and abrupt turns should be avoided wherever possible. It is always well to hit a hill hard in going around a point, so there will be a good outer embankment. There should be a good roadway along all ditches, and on the lower side all obstructions, bushes, etc., should be removed in order that the lower bank, made by fill, will be solid. A number of hints might be given, but they are all summed up by saying that the ditch should be in as firm ground as possible and constructed so it will not destroy itself.

Many of the older generation of miners have damaged the appearance of much of the country because of the steep grades on their ditches, and many abandoned ditches have become ravines. The modern engineer and ditch-builder pays some attention to the character of the material through which the ditch runs. Careful attention to the following table of safe velocities, given by Sir John Neville in his Hydraulic Tables, is recommended for mean velocities:

0.42	feet	per	second	in	soft alluvial deposits.
0.67	"	"	"	"	clayey soils.
1.00	"	"	"	"	sandy and silty beds.
2.00	"	"	"	"	gravelly earth.
3.00	"	"	"	"	strong gravelly shingle.
4.00	"	"	"	"	shingly soil.
5.00	"	"	"	"	shingly and rocky.
6.67	"	"	"	and over, in rock.	

A limit of about 15 ft. per sec. is set for first-class masonry and wood, the bottom velocity being about two-thirds to three-quarters the mean velocity. The Dubuat formula for bottom velocity is as follows:

$$v_b = v\,11\sqrt{rs}$$

in which v_b = bottom velocity in feet per second; v = mean velocity in feet per second; r = mean hydraulic radius; s = sine of the slope.

In the reconstruction of these old ditches to meet the requirements of hydraulic mining, I have always had to [illegible] observance of the character of the material through which the ditch runs, and a careful stepping down of the grade at intervals of from one-eighth to one-fourth of a mile, would reduce the initial cost of construction as well as of maintenance. Throughout this section a grade of 6 to 12 ft. to the mile is as much as should be used.

The pioneer miners were a resourceful body of men, and many difficult problems were solved by them in the construction of their tunnels, ditches, and other engineering works of magnitude. Miles of ditch-grades were run with only a buckskin thong with a rock tied to it for a plummet, attached to the apex of an A-frame made of three small spruce poles. I remember, when, as a lad of eight years of age, I drove grade-pegs upon a ditch-survey run by my father, assisted by my brother, through five miles of the roughest country in northern California, with one of these 'instruments of precision', and how in veneration I stood upon the brink of a deep canyon, the precipitous sides of which precluded a measurement with chain or tape, and witnessed the chief of party triangulate the distance across with accuracy and dispatch, and establish the grade with this simple contrivance with as much ease as the present day engineer would accomplish it with his transit and stadia, or with the gradienter attachment.

The A-frame is made as follows: Construct with any light material an A-frame with the legs extending 2 ft. below the cross-bar, and having a span of from 10 to 12 ft.; at the apex drive a nail and hang a plumb-bob from it with line sufficient to permit the plumb-bob to hang below the cross-bar. This instrument is adjusted over two pegs as follows: Drive two pegs in the ground at a distance apart equal to the distance spanned by the legs of the frame; place the frame upon the pegs and note the position of the plumb-line at the cross-bar; reverse the frame and note the second position of the plumb-line between the two positions already noted, and drive the highest peg down until the plumb-line covers this midway mark on the cross-bar; the tops of the two pegs will then be at the same elevation. Several methods are used for graduating the cross-bar to permit of grades being run, and one method is to rest the ends of both legs on the pegs after their tops have been brought to a level. Then one man at one end will raise the leg he holds to certain heights measured on a rule he holds on the peg, while another man will mark the position the string occupies on the cross-bar and will mark it on the grade. Thus falls of 1/16, 1/8, 1/4, etc., of an inch per station will be obtained, the stations being equal to the spread of the triangle, or base of the A-frame. It is not claimed that the A-frame originated among the pioneer miners of California, but it was used by them to lay out some of the longest ditches and tunnels constructed in the early days of mining in that State.

Borax is used in the enameling industry for making kitchen and sanitary ware, about one-half of the output being so used.

Discussion

Readers of the MINING AND SCIENTIFIC PRESS are invited to use this department for the discussion of technical and other matters pertaining to mining and metallurgy. The Editor welcomes the expression of views contrary to his own, believing that careful criticism is more valuable than casual compliment. Insertion of any contribution is determined by its probable interest to the readers of this journal.

Arizona Copper Belt M. Co.

The Editor:

Sir—In the prospectus of 'The Arizona Copper Belt Mining Company' of Wickenburg, Arizona, there is a sheet containing a wholly unauthorized letter over my signature; I have never been in Arizona, much less examined any properties there. The whole appears to me to be a very scurvy trick of what is probably a 'wild-cat' company, and if it is allowed to pass unnoticed, may react seriously against me. In a letter to the president of the above company, I have demanded that the objectionable letter be withdrawn, and, as one of your subscribers, I shall consider it a great favor if through your columns you can help me refute their false statement.

R. W. GROO.

Bingham Canyon, Utah, March 26.

Suppressing a Government Report

The Editor:

Sir—In connection with the subject to which attention was drawn by Louis Lane in your issue of March 4 and in addition to your own comment thereon, it may be well to record a few additional facts.

When field-work was done in the Bullfrog district by the geologists of the U. S. Geological Survey in the winter of 1905-6, permission to examine the Montgomery-Shoshone mine was refused, and this unusual attitude on the part of a mine's owners was noted in the preliminary account of the district published in 1907 (Bull. U. S. Geol. Survey No. 303, p. 52). Anyone contemplating the purchase of stock in the mine might have drawn the obvious conclusion from this refusal and been warned in time. In March, 1908, Henry Krumb made a report on the condition of the mine. His results, which were decidedly unfavorable, were not only printed, but were widely commented upon in the mining journals. Here again, one might have supposed, would have been ample warning for the intending investor. It was not until July 1908 that opportunity to study the Montgomery-Shoshone mine was granted to a Government geologist, and the final report on the district appeared as U. S. Geological Survey Bulletin No. 407, early in 1910, the interval of time between the completion of field-work and the publication of the report being shorter than is generally required for the preparation and the publication, through the Government Printing Office, of an illustrated scientific report that must take its turn with many others. Finally, as is very truly suggested in your comment, the Government geologist who sought access to mines in order to evaluate them or to cry prompt warnings to investors would soon find himself barred out from his field of activity. The fact that a geologist of the Federal survey can almost invariably secure free access to a mine is due to the confidence of the owners that the objects sought are chiefly scientific, that the data obtained will be used in reaching conclusions of value to science and to the district as a whole, and that information imparted and received in confidence will not be divulged. The owners know, too, that although the geologist will not connive at misrepresentation, he will not go out of his way, on the other hand, to pass judgment on management or finance.

F. L. RANSOME.

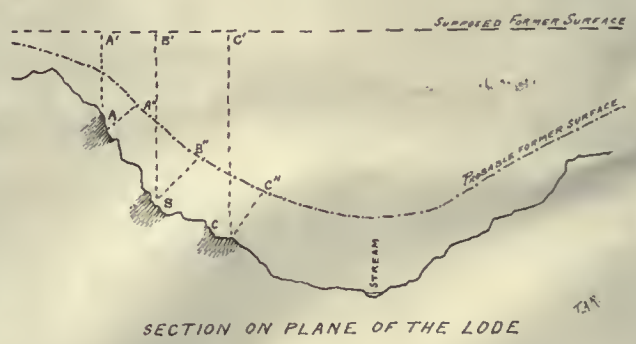
Washington, March 9.

Ore-Shoots

The Editor:

Sir—I have just been reading the suggestive article by Mr. W. H. Storms in your issue of October 22. My discussion of it may seem belated, but you will, I trust, deem the perennial interest of the subject sufficient to warrant the publication of even these late remarks.

In that article Mr. Storms draws upon his wide experience among the mines of the Mother Lode, in California, and lays stress on the inference to be drawn when a gulch is seen to cross the strike



SECTION ON PLANE OF THE LODE

of a vein. He argues that such a depression in the surface indicates the existence of disturbed ground likely to terminate an orebody. Hence if you are following an orebody you may find it die out or end abruptly at the fault whose zone of shattered rock gave erosion the chance to make a gulch. But if you look at the occurrence from the opposite side of the supposed gulch and you are prospecting a promising vein that yet does not carry any continuous orebody, then, on reaching the fault, you may hope for more favorable conditions on the other side of it, and, provided the faulting is not so confusing as to make it impossible to trace the vein on the far side, you proceed more hopefully to search for ore beyond the fault. Speaking broadly, we may say that no rules will fit all cases, because the study of ore deposits has not yet reached the dignity of an exact science, but such suggestions as Mr. Storms offers are of the greatest value in stimulating intelligent observation. To the mine superintendent any change of rock or structure is unwelcome when he is in pay-ore, and conversely any change will seem promising when his drift is in barren ground. Old miners have

fancies, for which they can give no reasons, but that are nevertheless the expression of a life-long experience. It is a rule-of-thumb ratiocination, but it is well worthy of respect. Thus the idea that water is a good sign is confirmed by scientific reasoning. Most ore deposits are formed by the action of water circulating along the clefts, fractures, and fissures made by earth-movements. Water was the medium of migration whereby the valuable metals have been concentrated in orebodies. The presence of water in a vein suggests a favorable agent. Where the rock is so hard and tight as to prevent the passage of ground-water, it is likely to have been similarly opposed to the free circulation of thermal waters at an earlier period. Moreover, when the workings of a mine continue to be wet to a great depth, it argues the existence of fairly open ground and conditions favoring the passage of descending waters, which, in many cases, are the agents of secondary enrichment. The Butte lodes, with their chalcocite at 2000 feet in depth, constitute a remarkable example. When, on the other hand, a lode becomes so dry as to be dusty when broken, the condition is unfavorable to persistence of ore, and particularly to such secondary enrichment as is due to descending waters. A mine that is dusty is below the zone of ground-water and therefore beneath the horizon in which chemical interchanges have free scope. Another fancy of the miner is, as Mr. Storms says, a fondness for a vein that has a gouge streak. Gouge is clay or rock crushed to a clay-like consistence. It is the product of movement and the accompaniment of faulting. Apart from its testimony to a line of weakness and a plane of dislocation, the gouge serves as a barrier to the free passage of waters, either those of today or those that may have deposited the ore. This means that the impregnation of the rock encasing a water-way is limited or restricted by the gouge, so that enrichment is prevented from being spread over too great a width. To the miner the intensity of mineral concentration by Nature measures the difference between pay-ore and worthless rock.

Before closing I venture to offer an observation, the correctness of which I have tested in many mining regions. It is this: Depth of ore deposition is not to be measured from an imaginary horizontal former surface, but from a line approximating that of the present-day contour. For example, if ore is found at A, B, and C, it should not be assumed that these represent the stumps of ore-shoots that, before erosion, extended to A′, B′, and C′, the three equivalent points on the horizontal surface of a remote geological period. On the contrary, I would measure the persistence of the ore from a former surface not much unlike that of today, as at A″, B″, and C″: in other words, I would infer that the concentration of mineral now constituting an orebody has been effected in late time and in a period during which the contour of the surface was possibly different from that of today but not wholly unlike. Therefore, I would measure persistence at right angles to the surface of the hill. I would not argue because the ore at C is 500 feet lower than at A, that therefore the orebody A will continue at least as deeply as the level of C. On the contrary, I would hasten to ascertain whether the orebodies extended into the mountain, as measured from its slope, and until I had proved that they did so I would be sceptical, believing that the enrichment is associated with conditions that exist to their maximum degree near the surface. An example in point is afforded by the silver-lead veins of Grand Clos, in the Hautes Alpes, France. There ancient workings disclosed several parellel lodes in which a series of orebodies had been stoped for a short distance into the steep side of a canyon. The faces of the stopes showed ore, which, I believe, was poorer than that previously extracted. An English company was formed to work these mines, and all went well for a short time, but the grade of the ore decreased as the stopes penetrated the mountain; finally, the yield becoming below the economic limit, all work was stopped. In this case the evidence amply corroborated the idea that the enrichment diminished in a line at right angles to the present surface, and not vertically. This note may prove suggestive. Personally, I have always demurred strongly to the inference, common in flamboyant prospectuses, that because some rich ore is found at the bottom of a hill and some more near the top of it, this proves the continuity of the ore for a depth measured by the difference of altitude.

T. A. Rickard.

London, March 15.

Surface Indications of Ore-Shoots in Depth

The Editor:

Sir—In the issue of the *Mining and Scientific Press* of February 18, R. P. McLaughlin, in referring to the influence of gulches crossing ore-shoots, says, "Concerning the supposed rule of ore-shoots in relation to gulches, which generally has failed of application at the various mines and prospects that have been under my observation," etc. Mr. McLaughlin would confer a great favor upon all of us if he would kindly state the whereabouts of the exceptions to the "rules." A number of engineers and geologists have questioned the correctness of my theory, but with a single exception, that of Charles Janin, none of them have attempted to state where the exceptions of which they have knowledge may be found. In previous communications on this subject I have given numerous instances where ore-shoots terminate upon reaching a gulch or depression at the surface, and I think it but fair to those interested in the discussion for any who disagree with my "theory" to state where these exceptions may be found, that all may be better able to determine the important question, whether the "rules" have wide application, or whether, when an instance is found which fits the "theory," it is merely a coincidence.

William H. Storms.

Berkeley, California, February 22.

Concentrates

Most of these are in reply to questions received by mail. Our readers are invited to ask questions and give information dealing with the practice of mining, milling, and smelting.

Silver added to gold in small amount forms a green alloy which is employed by manufacturing jewelers.

Copper-matte can be successfully made in either blast-furnaces or in reverberatories. The latter type of furnace is generally used for the treatment of fine ore and concentrate.

Burning oil, gasoline, alcohol, or other burning liquid should be extinguished with sand, soil, or even flour. Never throw water on a blazing liquid, for it is likely to cause the flames to spread.

Black manganese oxide has a market value if the cost of mining it and getting it to market is not greater than it will sell for. First-class ore is worth about $10 per ton at San Francisco, California.

Potash may be derived from organic sources, as from wood ashes and sea weed. The giant sea weeds of the California coast contain potash salts, but no experiments have yet been made to recover them on a commercial scale.

Copper sulphate in water in small quantity will destroy organic matter in it. Reservoirs that have become foul by growth of algae and other organisms have been purified by means of a weak solution of copper sulphate.

Outcrops of siliceous iron ores which show no sign of copper at the surface sometimes develop into valuable mines. The Iron Mountain copper mine of Shasta county, California, was one of that kind. The siliceous iron outcrop was first worked for silver, no copper being seen in the ore.

Oro City was the original name of the camp where Leadville now stands. It was a rich placer-mining district twenty years before it became famous as a silver camp. The present outlook is that Leadville will have many more years of profitable existence. It has been an important producer of silver, lead, and zinc ores since 1877.

A patent was obtained by W. D. Johnston in 1893 for the use of barium peroxide as an accelerator in the dissolution of gold in cyanide solutions. The process never became popular for the reason that other and less expensive methods of accomplishing this were introduced, among them being agitation by compressed air.

Abandonment of water rights has been defined by the Supreme Court of California, which has held that "the failure on the part of A to make any beneficial use of water for a period of more than five years next preceding the commencement of an action by B claiming adverse rights, results in the forfeiture of A's rights held by appropriation."

Innovation in underground methods has been as much a feature of mining practice the past few years as the numerous changes in metallurgical treatment of ores. The methods which a few years ago were considered the best, as indeed they were, have been abandoned in some districts for those that are newer and better, because less expensive, safer, and in some cases easier than the old methods.

Side-marks on the reels of hoisting-engines are the only safe indication of the position of the cage or skip in the shaft. No hoisting engineer will trust wholly to the needle of the indicators which form a part of most hoisting outfits, being operated by gearing; for these are only roughly approximate at best, a small fraction of an inch on the indicator equaling a foot or more in the shaft. Serious accidents have resulted from failure to provide side-marks on the hoisting-reels, which indicate accurately the position of the skip.

White-lead (lead carbonate), may be precipitated from a solution of sodium hyposulphite containing lead by means of soda-ash, the lead falling as a flocculent white precipitate. When the lead has completely settled the solution may be decanted to another tank, and if it contain silver it may also be recovered by addition of either sodium or calcium sulphide, which throws down the silver as sulphide. The refining of this precipitate is often a most difficult metallurgical operation, and when such is found to be the case it is the better plan to ship the silver sulphide, after drying, to a refinery. It will be found more economical to do so.

Chuckblocks in stamp-mills are intended to keep the height of discharge as nearly uniform as possible, the principal object being to prevent sliming of the ore. Where sliming is objectionable, those ores which have a natural tendency to slime should be crushed with the use of chuckblocks. As the die wears down, the high chuckblock is replaced by a lower one, thus preventing to some extent the sliming which would take place if the change were not made. In some mills the chuckblock has a copper plate attached to its inner edge; in others it is fixed to a permanent block inserted below the chuckblock. The former practice is generally considered the better.

Amalgamation-plates in front of a stamp-battery should be free from the jar and vibration due to the falling stamps, as the shock appears to have a tendency to disintegrate the amalgam, thereby causing loss. It has been demonstrated, however, that an amalgamated copper-plate on a Gilpin county 'bumping-table', or on a vanner, from which the belt has been removed, will hold passing particles of gold better than a plate that is stationary. In the latter case the machine was given the usual vibratory movements, only the 'travel' being out of use. A small piece of copper plate placed on the spreader of a vanner directly beneath the feed-pipe, will accumulate gold if there is any present, and free, in the pulp.

THE MINES COMPANY OF AMERICA

The Mines Company of America, which operates the Dolores, El Rayo, Creston, and La Dura mines, in Chihuahua and Sonora, Mexico, made an operating profit on each property for 1910, as follows: Dolores, $423,943; El Rayo, $374,267; Creston, $218,294; La Dura, $41,329, making a total operating profit of $1,057,834 from the four mines. After deducting general expenses, there remained a total net profit of $1,012,898. There was effected during the year a noteworthy reduction in operating costs. Those of Dolores were reduced from $15.57 per ton in 1909 to $12.58 per ton in 1910. El Rayo costs decreased from $10.21 per ton in 1908 to $6.23 in 1910; Creston costs fell from $5.91 to $4.74. By the use of additional equipment now being provided at the different properties, a still further reduction in costs is anticipated. The estimated valuations of the ore reserves of the four mines are as follows: Dolores, $1,875,288; El Rayo, $889,300; Creston, $1,750,860; La Dura, $1,108,060. The operations and development of these properties are under direction of George A. Schroter, consulting engineer.

PHOSPHATE ROCK IN MONTANA

Mention was recently made of the discovery of beds of phosphate rock on the Oregon Short Line railway, about 30 miles southwest of Butte, Montana. Analyses of samples from these deposits show the material to be of good grade, and the evidence obtained indicates its occurrence in beds of commercial quantity. The deposits are described as resembling those of the southwestern Idaho and western Wyoming fields, from which phosphate has been shipped for several years. The nearness of the phosphate beds to the Washoe smelter at Anaconda, where sulphide ores are reduced, is important, for the smelter produces great quantities of sulphurous acid fume which now goes to waste through the smokestack. As is known throughout the country, the ranchers and some experts have contended that such fume destroys vegetation and is a detriment to the raising of cattle; and it was sought to compel the smelting company to condense or otherwise dispose of the acid fume. Now a use is found for the sulphuric acid. The reduction of the phosphate rock by means of the acid would be a means of utilizing what has long been a waste product at the smelter.

TWO NEW COPPER PRODUCERS

Much attention is focused upon the two Arizona copper properties which last month started their new concentrators and began their records as producers. The Miami, situated in the Globe district, has a normal mill capacity of 2000 tons of ore per day, and is operating on ore that assays about an average of 2.65% copper. The concentrate product is to be smelted at the plant of the Cananea Consolidated Copper Co. at Cananea, Sonora. It is estimated that there will be a recovery of 35 lb. of copper per ton of ore, at a cost of 9c. per pound. The estimated Miami ore reserves are given at 20,000,000 tons, and the prospective annual production of copper is 40,000,000 lb. It is probable that the mill can be operated in excess of its rated capacity. The Ray Consolidated, having an estimated reserve of 80,000,000 tons of copper ore in its mines at Ray, near Kelvin, has a mill capacity of 6000 tons per day, and it is probable that this can be exceeded. The Ray mill and power-plant are at Hayden, situated on the Gila river, a short distance east of Kelvin. This company must bear the expense of transporting its ore 15 to 18 miles, which is the distance from Ray to Hayden. However, it is not intended that its concentrate shall be shipped, as the Ray company is engaged in building a smelting plant in close proximity to its mill. Ray ores, according to sampling and assaying, have a copper content of 2.17%, and the estimated extraction of copper is given at 34½ lb. per ton of ore. The prospective output is estimated at 100,000,000 lb. of copper per annum at a cost of 8½c. per pound. The plants of the two companies began operating at about the same time, and have hardly reached their rated capacities as soon as this, though both mills are reported as operating satisfactorily. The copper turned out by the Ray company will be marketed by the Guggenheims under a favorable contract; that of the Miami company will be handled by the Amalgamated company, which is considered to have control of the United Metals Selling Co. Both companies have plans matured for building additional mill units, and greatly increasing the capacity of each plant.

THE NEW ALVARADO MILL

The Alvarado Mining & Milling Co., owner of the Palmilla mine, situated three miles from Parral, Chihuahua, has completed and put in operation its 60-stamp mill and cyanide plant, and we give herein a brief description of the equipment and its arrangement. The mill and power-plant are separated from the mine by several thousand feet, requiring the use of a surface gravity tram-line, and an aerial tramway for conveying the ore from the mine to the mill. The ore is carried over the surface tramway in 5-ton cars which are discharged into loading-bins at the nearest terminal of the aerial line of buckets, the latter having the capacity to deliver ore at the mill-bins at the rate of 30 to 40 tons per hour. The ore is discharged by gravity from the receiving bins, passing over six grizzlies to three 9 by 15-ft. Blake crushers, thence by plunger feeders to three 19-in. belt-conveyors, the latter delivering the crushed ore to three battery-bins, each of 800 tons capacity. The ore passes from these bins by gravity through Challenge feeders to the twelve 5-stamp batteries, the mortars being of the El Oro type, and the stamps of 1160 lb. each. Each battery is driven by a 30-hp. motor, and the stamps make 102 drops per minute. The mortars are set on a concrete foundation extending the length of the battery floor. The pulp discharged from the mortars is passed through cone-classifiers to Deister sand-tables, the tailing from the latter passing to four Dorr classifiers which separate sand from slime. The sand product of the Dorr machines is then pulverized in four 5 by 22-ft. tube-mills; the tube-mill pulp is carried by three 10-in. bucket-elevators to three cone-classifiers, the oversize being returned to the Dorr machines for reclassification, the slime passing to Deister slime-tables, by which it is re-concentrated. The tailing from the slimer is then passed to six dewatering cones, each 16 by 18 ft., the clear water flowing to two 15 by 30-ft. tanks, and is pumped thence to storage-tanks for use in the batteries again. The slime from the dewatering cones is pumped to Pachuca tanks, of which there are 12, each being 15 ft. diam., and 47 ft. deep. After the aeration and cyanidation takes place in the Pachuca tanks, the slime is passed to Butters filters of 180 leaves, divided into two sections, each section having three hoppers, with a 13 by 13-in. Wheeler discharge valve for each hopper, through which the clear solution passes to the precipitating department.

The power-plant contains five Babcock & Wilcox water-tube boilers, each of 250 hp.; a Nordberg cross-compound, two-stage air-compressor, with the capacity to deliver 1800 cu. ft. of free air per minute; four cross-compound Corliss engines, three of which are direct-connected to that number of Allis-Chalmers generators. Each generator is a 3-phase, 480-volt, 600-ampere, 60-cycle machine. The electrical equipment, including transformers, providing for the delivery of power to all parts of the mill and to the Palmilla mine, is the most complete that can be devised. The Allis-Chalmers Co. supplied the generators and electrical equipment, while the Minneapolis Steel & Machinery Co. constructed the power-plant. The Alvarado M. & M. Co. is under the management of John I. Long of Parral. The mill was designed by Bernard MacDonald, consulting engineer for the company. The construction work of the mill was under direction of T. H. Gracey.

Special Correspondence

KALGOORLIE, WESTERN AUSTRALIA

Gold Production for January.—Associated Mine.—Bullfinch Sampled.—Golden Horse-Shoe Mill.—Boulder Perseverance.—Automatic Pulp-Distributers.

The January gold output of Western Australia was valued at $2,535,000, some $165,000 less than the yield for the same month of 1910, while dividends amounted to $490,000, against $560,000. Development and general work has proceeded along the following lines: The contemplated shut-down of the Associated for a month to re-skid the main shaft and overhaul the mill has taken place. The shaft was fitted with jarrah skids 6 by 3½ in. for 2000 ft. in depth in a little over two weeks, working three shifts with two men in each of four gigs, and four winches. Skips to hold about two tons each are being made at the mine, and should soon be finished. Advantage was taken of the shut-down to do a little development work and fill up stopes from the waste dump. The main hoist was overhauled, as was also the mill engine and condensing plant; while the low-pressure turbo-generator was completed along with its new switchboard. The new No. 7½ type K, Gates crusher is ready, and the milling, roasting, grinding, and treatment departments were thoroughly overhauled. Motors are installed for driving every part, there being over thirty of them. The new plant has been started, and so far is doing well, the usual little adjustments being necessary. Treatment costs should eventually drop to $2.40 per ton. At the No. 7 level of the Associated Northern, the company has been diamond-drilling east and west, but without cutting profitable ore.

The Bullfinch has been thoroughly sampled by the management, with the following interesting results, although no estimates of reserves are announced: No. 1 shaft: average 7 ft. worth $172 per ton, with rich ore on each side; the west drift at 100 ft. is in 73 ft., averaging 9 ft. 3 in., assaying $250 per ton; good ore in the end and average value of $172 per ton for whole drift. No. 2 shaft: at 60 ft. average width 8½ ft., worth $77 per ton, with good ore on each side; lode 21 ft. wide at 67-ft. depth. Water shaft, 275 ft. southeast of No. 1: from sinking on crosscut and short drift, width 16 ft., worth $26 per ton at 60-ft. depth; now sinking in good ore, which is supposed to be a continuation of the main lode at No. 1 shaft. The prospecting shaft 500 ft. west of No. 1 is being sunk in ironstone ore at 23 ft., worth $11 per ton. It is a large body and is improving with depth. Work on the other lodes in an ore channel 200 ft. wide is not sufficiently advanced, but is promising. In connection with the notorious Chaffinch mine, the late manager and two Melbourne mining men have been charged with conspiracy to defraud the public. It is a peculiar business, and at present one fails to see how the charge is to be proved. The railway is now open to the Bullfinch field; so, within about three months, the field has been provided with the telegraph, railroad, and water supply. The last commodity is being sold now at $1.20 per 100 gal., rather a difference from the former price of $7.20 per 100. The Golden Horse-Shoe has its new milling plant at work, comprising 170 stamps, more Wilfleys, tubes, and pans, and a tailing-wheel 60 ft. diameter. The Great Boulder Perseverance is gradually increasing its profit, although only treating $6.45 ore. It is a great pity that the Great Boulder is not able to find any length of payable ore at 2800 ft. It is not for the want of energetic exploration by drill, driving, and cross-cutting. The South Kalgurli has opened ore at 1500 ft., and work at 1800 ft. is in progress. The affairs of one of our former big producers, the Westralia Mt. Morgans, 180 miles northeast from Kalgoorlie, are being wound up. Development work has failed to reveal more ore. To date 588,880 tons of ore has yielded $6,340,000; and $1,500,000 has been paid in dividends. A modern 60-stamp mill, of 1600-lb. stamps, and a complete cyanide plant ran successfully.

In the January *Journal of the Chamber of Mines*, W. R. Degenhardt discusses the automatic pulp-distributers in use at the Sons of Gwalia and Lake View & Star, for feeding pans and Wilfley tables in those mills. In the main, they consist of distributers which equally divide the pulp into as many launders as there are pans. I have had experience in feeding pans from mixers, from which a pipe ran to each pan, and the feed was even; but with mixers discharging direct into a launder with a gate for each pan, the result was very unsatisfactory. An interesting distributer at the Bunker Hill & Sullivan mill was described by Gelasio Caetani in *The Mining Magazine;* and the Kiddy distributer was described recently in *The Engineering and Mining Journal.*

NEW YORK

Interest in Porcupine. — Concentration of Copper Refining. — Chino Bond Issue.—Lumber in Mexico.— Consolidated Gold Fields Expansion.—Calumet & Hecla Merger.

The possibilities of Porcupine as a mining camp; the possibilities involved in the attitude of the public; the possibilities in the way of promotion enterprises, are absorbing the entire attention of the Eastern mining markets. Railway shares and the industrial issues traded in on the New York Stock Exchange have aroused no public interest for many months. It is not at all surprising, therefore, that a show of interest throughout the country should be immediately, almost instantly, followed by a flood of promotions. 'The Porcupines' have already achieved something of a market triumph in that all the activity is centred in these issues. The trading in these stocks in the open market has grown to such proportions that there is some talk of the formation of a new mining exchange to be organized under the Canadian laws, to handle

Map of Eastern Canada.

Porcupine stocks exclusively. It is not as yet known whether such a move can obtain the sanction of the New York Stock Exchange authorities or not. There is no question but what the Stock Exchange houses are about as hungry for business as are the outside curb brokers. The leader is Hollinger; a large interest in this company is said to have been taken by Bewick, Moreing & Co., with the result that London has been buying the stock, thus making an excellent market on this side, where it has been easily advanced to $10.50. The company has a capital of $3,000,000; 600,000 shares of a par value of $5. On the basis of the market for this week, the property would have a valuation of $6,000,000. The Dome property is organized as a close corporation; bids have been made in the open market of $80 for the stock, which would be giving that property a market value of something like $16,000,000. The day is counted wasted that does not see a new issue added to the list, and the activity of the

traders can only be likened to a bunch of ravening, half-starved dogs at feeding time. It has been many a weary day since the outsider has come into Wall Street, and the few who are venturing now are fallen upon with an enthusiasm that stops short of murder only. One of the well-known brokers of the Street was asked what he thought about the future of the market in Porcupine issues. His response was: "They will sell 'em the ice-fields 'Doc' Cook traveled over going to the pole if the people will keep on buying." The one absorbing problem at the moment is whether the present movement is the first lift of a great flood-tide or just a ripple that will pass as quickly as it came. The supporters of the camp are all pointing to the investment of English capital, by the Bewick-Moreing people, the Consolidated Gold Fields of South Africa, the MacArthur-Forrest company of Glasgow, and others, as being indicative of great possibilities.

Coppers are for the time neglected. The International Smelting & Refining Co. is extending its activities. The Raritan plant of the company is to handle the blister from the British Columbia Copper Co.; the Miami blister will also go to the Raritan plant for refining, after being sent from the Miami to smelter at the Greene-Cananea. Perhaps this forms as patent an illustration as any of the concentration already accomplished in the making, handling, and selling of copper. Ores from British Columbia and from Arizona alike pay tribute to the Standard Oil interests as represented by the International Smelting & Refining Co. In truth, this element is also the predominant reason for the lack of interest in the general stock market and is the main cause of the public interest manifested in a possible new goldfield. The individual very naturally prefers to get into a field where individuals can still play a part, and to avoid commitments in a field where the domination by large interests is as complete as it has come to be in railways and the larger industrials. In copper, the centralization of interests can only be likened to the movement that took place when the iron-ore and steel-mill interests were gathered into the present steel trust. The various steps are now being made without attracting much attention. Butte & Boston is soon to be wound up, and, like the Boston & Montana and the Trenton, will cease to have a separate corporate existence. There are some enormous vital economic problems to be worked out in the future as to centralization of control of great natural resources. More has been heard recently perhaps in regard to timber, lumber, and coal than in regard to copper, but there is no more striking example of the elimination of the individual and the concentration of ownership than the present situation in copper.

The final financing of the Chino Copper Co. has been arranged for by the issuance of $1,000,000 in promissory notes, maturing July 1 next, at which time there will be a $2,500,000 bond issue made which has already been underwritten by Boston interests. The note issue is made necessary by reason of the fact that the charter of the Chino Copper Co. forbids any increase in the capital stock or the incurring of any indebtedness in excess of $1,000,000 within a period of two years from the date of the organization of the company, which was June 9, 1909.

The disturbance in Mexico has ceased to frighten the Eastern investors. It is believed in the East now that within a few weeks tranquility will be fully restored. In the meantime, it may be said that the so-called revolution has not apparently interfered with the operations of the active mining companies.

The American Finance & Securities Co., which owns, through its subsidiary, the Guanajuato Mines & Reduction Co., the old Valenciana property at Guanajuato, Mexico, credited by history with being the greatest single precious-metal mine in the world, is about to embark in the lumber field. The company is now offering to the public a $4,000,000 bond issue, the proceeds to be used in the purchase of a tract of timber land on Vancouver Island.

Mr. John Hays Hammond is to become once more prominently identified with the Consolidated Gold Fields of South Africa, Ltd. This company has recently increased its capital by the creation and issuance of $6,250,000 of second preferred cumulative 6% stock. The proceeds of this stock issue are to be utilized mainly in the mining enterprises recently undertaken on this side of the water. Mr. Hammond is to head a staff of consulting engineers to act for the company and to have headquarters in New York.

The management of the Calumet & Hecla is considering the erection of a second plant for the treatment of old sand. The new plant is to be equipped with tube-mills, and it is thought a higher recovery can be effected than is obtained now by the first plant which is treating the tailing from the mill. The hearing on the restraining order preventing the merger of the Calumet & Hecla and the Osceola has been adjourned from Grand Rapids to Detroit, Michigan, and is now proceeding before the United States District Court.

LONDON

Hodgkinson Patents.—Soda Deposits in East African Protectorate.—Transvaal Mining.—Mysore Gold Mines.

Some sensational paragraphs have recently been published in the English and American papers relating to a new process for refining salt, invented by James Hodgkinson, of Bowman, Hodgkinson & Co. Announcements in the American daily papers of new discoveries are usually exaggerated, and it is advisable to state the facts of the case. In the present case Mr. Hodgkinson's invention relates to an improved method of refining brine, and it is reported in America that United States capitalists have paid a million pounds for the rights. There is not much profit in salt-refining, and Mr. Hodgkinson would be delighted to part with his invention for so large a sum, just as Lord Lansdowne would be glad to sell an old oil painting for £100,000 to any millionaire in America that wants it, or as the shareholders in the White Star Line were pleased to sell their shares through J. Pierpont Morgan for four times their real value, when they had the opportunity forcibly offered them. The Hodgkinson English patents have been provisionally acquired by the Salt Union, but they will not be bought until the value of the process has been proved.

In various parts of the world natural deposits of soluble salts are found. The deposits of potash salts at Stassfurt, Germany, are perhaps the most renowned, and those of borax in California are of hardly less importance. An unusually large deposit of natural soda has been found in the British East Africa Protectorate, at Lake Magadi, not far from the Uganda railway. A company has been formed in London for the purpose of working it, under the auspices of H. Samuel & Co. of 'Shell' oil fame, and Wernher, Beit & Co., and £1,250,000 in cash has been raised for the purpose of building a branch railway and the necessary plant for treating the soda. The deposit consists of trona or urao, sometimes called sesqui-carbonate of soda. This salt is composed of two molecules of bicarbonate, one of monocarbonate, and three of water. It has been found from time immemorial in Egypt and other parts of north Africa, and more recently in Hungary, India, and Western America. It has generally been formed by the evaporation of sodium carbonate solutions, and as it is taken away more is deposited. The deposit at Magadi is so extensive that there is every reason to believe in its commercial value. The method of treatment will be to heat it to a dull red, thus expelling water and forming soda ash. This treatment will not only produce a readily salable product, but it will expel all the water and part of the carbonic acid, and so reduce the bulk and weight of the material shipped. The heat required for this treatment will be supplied by oil fuel. Unlike many deposits of the kind, that found at Magadi is practically free from admixtures of other salts, such as sodium chloride and sulphate.

The gold mines in other parts of the Transvaal than

the Rand have given much trouble to English investors. A good example of this is the Lisbon-Berlyn Company which was originally formed in London in 1885 to acquire properties in the Pilgrim's Rest district. This company has been reconstructed no less than five times. The last time was in 1906, when the control passed to the Hamilton-Ehrlich group. E. T. McCarthy was then made consulting engineer, and a drastic reorganization of mining and milling methods was made. The old properties, Lisbon and Berlyn, were abandoned, and the work concentrated on the more recently acquired Frankfort property. The deposits are found in bedded form intercalated between dolomite and shale. There are two principal beds, the Theta and Bevitt's, the latter 250 ft. above the former. Their outcrops have been traced for a considerable distance, and the amount of ore must be immense. The ore is oxidized at the surface, and as the drifts go in, pyritic ore is found. So far the treatment of the oxidized ore only has been considered. The old plant was in a dilapidated condition, and it was decided to build an entirely new one on modern principles. The new plant was completed in November, and the old plant was kept running until the end of June. The new mill contains 20 stamps, amalgamating tables, tube-mills, cone-classifiers, sand vats, and Brown agitators, otherwise Pachuca vats. The capacity is 3000 tons per month, but so far it has not been possible to treat more than 1300 tons per month on account of lack of water. To make up for the deficiency of water-supply, a gas power-plant has been ordered and should be ready for use in May. The recovery in January was 86%, which is a great improvement over the results obtained in the old plant. In spite of the drawback of short power, profits have been made since the starting of the new plant amounting to £3948 during the four months, November to February, inclusive. Mr. Hunter, the manager, estimates that the ore blocked out on September 30 amounted to 19,615 tons, averaging 9.8 dwt. The amount of development work done during the year was 8115 ft., and 2.6 tons of payable ore was uncovered for each foot of work done. Prospecting has been renewed at the Lisbon and Berlyn properties, and a number of rich leaders have been found on the former. Probably the company will not work these, but they will be let on rent or royalty to tributers.

In a recent issue I gave a history of gold mining in India, and I recorded that some of the old mines were now in as productive and promising a condition as ever. John Taylor & Sons, the managers of the mines in the Kolar district of Mysore, do not publish anything but official news, and any Stock Exchange speculation that takes place is due entirely to outside influence. Just recently adverse rumors have been circulated about the premier mine of the district, the Mysore. Of course, a mine that has been a regular producer for 25 years and is down 4000 ft. may be supposed to have, by the law of averages, an expectation of life that does not warrant the present quotation of 10s. shares at £5 10s., although the year's dividend has been 115%, the reserves sufficient for 4 years, and the developments satisfactory at a greater number of points. It is well, under the circumstances, to quote the report for 1910, so as to show that adverse reports are mere inventions. During 1910 the largest yearly amount of ore was treated, and the largest yield produced since the commencement of operations, and though the deepest workings are 2800 ft. vertical from the surface or 4000 ft. on the incline, the ore reserves and the development results are as satisfactory as at any time in the history of the mine. These facts are naturally a cause of great gratification to such old believers in the Kolar district as Captain McTaggart and General Beresford, and, of course, to John Taylor & Sons. During 1910, 246,425 tons of ore was crushed in the stamps, and 201,056 oz. bullion recovered by amalgamation; in addition, 190,530 tons of tailing was cyanided and yielded 27,631 oz. The total production of gold was worth £895,467, which was £600 more than during 1909. The yield since 1884 has been £12,575,989. During 1910 the working cost was £355,489, royalty to the Mysore government £47,910, income tax £25,131, depreciation £8503, and expenditure on plant, etc., £73,524. The dividend absorbed £350,750, which was at the rate of 115%, and £40,000 was placed to the reserve fund. The actual amount of profit was apparently less than that for the years 1904 to 1907, but it must be remembered that nowadays all expenditure is charged against revenue instead of as in former times special expenditure being provided for by the issue of new shares. For some years the grade of the ore has been slightly diminishing, but improved methods of mining and extraction have more than counterbalanced the fall in contents. In fact, the costs per ton during 1910 were 4s. less than those for 1909. During the past year, 32,383 ft. of development work has been done, and the ore reserve has been increased by 87,803 tons, standing on December 31 at 1,100,453 tons. The report by the superintendent, Arthur Gifford, shows that the developments continue to be satisfactory. The equipment of the new vertical circular shaft, Edgar's, sunk for the purpose of facilitating operations in the northern part of the mine, has been completed for some time, and the surface plant is now being erected. It is proposed to sink another vertical shaft with circular cross-section at the southern end; the present shaft is not convenient for hauling, and the winding engine has come to the limit of its capacity. The new shaft will be 16 ft. diameter and is to be sunk to 2400 feet.

MEXICO

Transportation of Ores Interrupted. — Smelting Operations Curtailed. —Mines Short of Blasting Powder.—Electric Power in Jalisco.— Mining Operations in Hostotipaquillo. — The Mazapil Copper Mines.

Railroad communication with Chihuahua from the south, interrupted by Mexican rebels a few weeks ago, has been re-established, and if it can be maintained the Chihuahua smelter of the A. S. & R. Co., the Santa Eulalia mines, and other concerns will not be forced to shut down. The smelter was running short of fuel, and the mines of fuel and explosives. The Mexican Central line between Chihuahua and El Paso continues out of commission, and due to this interruption and to traffic interruptions on the Mexico Northwestern, the El Paso smelter, also an A. S. & R. Co. plant, has been forced to curtail operations. Rebel activity at the Naica camp in Chihuahua, and the traffic interruption south, have affected both the San Luis Potosi and Torreon smelters, by stopping shipments from the lead mines of the Compañia Minera de Naica. The latter has been unable to close its old contract with the San Luis Potosi plant, or to start deliveries under its new 300,000-ton contract with the Torreon plant. The company has been supplying an average of 4000 tons per month to the San Luis Potosi smelter, and has still to deliver about 2000 tons. When the rebels became active in Durango, some time ago, the Government extended its order against transportation of explosives to the railroad lines in that State, and as a result it was recently announced that the Velardeña smelter and mines of the American Smelters Securities Co. would be closed April 1. Later, however, it was stated that the Government had consented to allow shipments of dynamite, and the threatened shut-down probably will not take place. Mine operators of the Parral district of Chihuahua are in need of dynamite, and early shipments will be necessary to enable them to continue operations. The question of supplies has become serious in some of the Chihuahua mining camps, forcing companies to suspend work. Recent rebel activity along the Nacozari railroad, in Sonora, has caused apprehension among the mining companies dependent on that line for supplies and the transportation of their products. These include the Moctezuma Copper Co., and the Lucky Tiger Mining Co. The occupation of Cananea has been threatened by the rebels, but so far no attack has been made. The cutting of railroad communication with Cananea would force the

Cananea Consolidated to cease operating, through inability to secure fuel oil. The Mexican Congress has suspended certain constitutional guarantees for six months, making all classes of rebel depredations subject to summary punishment. José Ives Limantour, the finance minister, has returned to Mexico from Europe, and interesting developments are expected. President Diaz has announced that big tracts of land will be purchased and divided by the Government, and sold on easy payments. The mobilization of American troops near the frontier has caused much speculation and some uneasiness.

The transmission of power over the new line of the Chapala Hydro-Electric Co., of Guadalajara, has been commenced. The Amparo Mining Co., of the Etzatlan district, and the El Favor Mining Co., of the Hostotipaquillo district, of Jalisco, are receiving current. The Amparo company has a credit on its power contract of ₱63,000, the contract specifying a penalty of ₱100 per day for failure to deliver power from July 1, 1909. Under a similar provision, El Favor will be credited with ₱50 per day from October 1, 1909. In the Hostotipaquillo district a pole-line has been built from the El Favor camp, where the tower-line ends, to the reduction plant of the Virginia & Mexico Mine & Smelter Co., of Richmond, Virginia, and the company's mines were shut down last year. The plant will be operated under a lease by the Espada Mines Co., and an aerial tramway will be built to deliver ore. Pole-lines will be built to the Casados, Amajac, Mololoa, Mirador, and other properties in the district. Ore shipments, resulting from development work in the Casados mine of the Consolidated Mining Co., run from ₱15,000 to ₱20,000 per month. Work is in progress on a 150-ton reduction plant. The Amajac Mines Co. is completing the remodeling of the old Amajac reduction works, and will have a 75-ton sucton plant in operation within a few months. This company has developed 50,000 tons of ore in the Trinidad property, and will build an aerial tramway to give the mine connection with the mill. Work has started on a 15-stamp concentrating and cyaniding plant for the Mirador Mining Co. The power contract of the Amparo company calls for 700 hp. at ₱100 per horse-power-year, and a big saving in operating costs is certain. In 1910 Amparo earned profits of ₱637,000, and paid 12% on its capital of $2,000,000.

To avoid, it is said, possible forfeiture of the concession, the Franco-Español Bank syndicate, financing the projected railroad across the northern part of the State of Zacatecas, has purchased all rights of the Madero interests. Gustavo Madero, a brother of Francisco I. Madero, interested the French in the project, and obtained from the Zacatecas government a guarantee of 5% on the money invested for 20 years. It was recently announced that work would be commenced April 1, but the present trouble in Mexico may delay construction. The line will extend from Camacho, on the Mexican Central, to Mazapil, with a branch to the Bonanza mining camp. According to the plans, the Bonanza line will eventually be extended to Gomez Farias, on the National. The line will be of much importance to the mining industry in northern Zacatecas. It is stated that the same French interests may take over Coahuila coal properties owned by the Maderos. The Mazapil Copper Co., the most important of the mining concerns of Zacatecas, in 1910 earned about 20% on its capital of £300,000. The company is continuing its policy of devoting a large part of its earnings to betterments and extensions. The Santa Rosa Mining Co., recently launched in London by the Exploration Co., Ltd., to operate the Santa Rosa properties in the Mazapil section of Zacatecas, is proceeding with plans for a reduction plant at the mines. Under an option, the Exploration company spent a large sum in development work, and a few months ago took over the mines. The Clement-Williamson interests were the former owners. In February the Cananea Consolidated Copper Co. produced 3,906,000 lb. of copper, 98,424 oz. of silver, and 468 oz. of gold. The copper production was 300,000 lb. greater than in January, and the heaviest of any month since last July.

JOPLIN, MISSOURI

American Zinc, Lead & Smelting Co. Secures Rich Leases. — Recovery of Slime Key to Profitable Mining. — Open Pit Mining at Galena, Kansas. — Zinc and Lead Notes.

The biggest deal in the history of the Missouri-Kansas-Oklahoma zinc and lead district is pending, the American Zinc, Lead & Smelting Co. having taken over 640 acres of the Charles B. Guinn land, in the sheet-ground district northeast of Webb City. The lease carries with it an option to buy the fee within a year. The expansion of the American company's holdings is considered convincing evidence that this colossal company, the largest operating in this district, has found it cheaper to mine its own ores than to purchase them in the open market, despite reports that operations in the thin sheet-ground districts, where the ore-content will not run more than 4% of the material milled, have been at a loss. The American company, working in ground that is recognized as the thinnest regularly producing area in the district, has made the largest ore returns of any of the companies. The Guinn leases carry virtually the same grade of thin sheet-ore. Big producing companies now operating on the Guinn land are the Hea Lead & Zinc Co., the Ground Floor, the Ice Plant, the Osceola, the Electrical, the Home Run, the Holdout, and others. All these companies operate large plants, ranging in capacity from 200 to 500 tons per shift. Several of the companies work a number of mills. The total production from this property has been well up toward the top of the Webb City lands. The production coupled with that from the present big mines of the American company will bring the aggregate to approximately 1,300,000 lb. of zincblende and 800,000 lb. of lead ore weekly, and this is a very conservative figure, especially the blende, which, under favorable circumstances, could easily aggregate 2,000,000 pounds weekly. H. S. Kimball, president of the American company, and J. H. Polhemus, general manager of the mines, have gone to Wisconsin with the view to considering the erection in this district of an electrostatic separating-plant similar to the ones now working in the Wisconsin zincfield and in the Western zinc district.

At the mill of the Oronogo Circle Mining Co., operating on the Granby Zinc & Lead Co.'s property at Oronogo, especial attention is given to the recovery of slime, and a new process, by which even greater recovery may be made, is receiving attention. After the tailing has been dewatered over a revolving screen, it passes onto a second revolving screen and then to the third. The first revolving screen has been in use several months and has proved successful. The two additional screens have just been erected, and the percentage of slime saving is being watched with interest. The screens are of 1½-mm. mesh, are 4 ft. in diameter and are 3 ft. long. At intervals of 10 in., wooden sections or paddles are inserted, these are 6 in. wide and run the length of the screen. They may be removed and new ones slipped in place promptly. These dividing partitions prevent the tailing from slipping when it is precipitated on the surface of the slowly revolving screen. Troughs, passing through the screens, receive the slime-laden water that passes through. At the first trough, the one passing through the revolving screen installed a number of months ago, the saving of the slime is about 70%; through the second revolving screen about 22% of the slime passes, and through the third screen 8% passes, thus making the total recovery 100%, according to the estimates of the company. This slime-laden water passes into settling-tanks. From the first tank it passes into a second, then into a third, from which it is permitted to flow into the sludge-pond. After passing through the third tank it is clear, yet despite this fact, a small percentage of slime escapes, and an occasional cleaning of the sludge-pond becomes necessary. The plant is equipped with ten sludge-tables.

Zinc ore, which outcrops in lodes, and which comes to within 5 ft. of the surface over the greater portion of the lease, is being mined from a 5-acre tract of the Wind-

sor land at Galena, Kan., by the Galena-Open Cut Mining Co., a new concern composed of Niagara Falls capitalists, which has just been incorporated. The tract has been mined in the old-style manner of driving for more than 30 years; ore has been worked down to the 100-ft. level in the early-day mines. The new company has opened a pit, 100 ft. across and 50 ft. deep, and has erected a concentrating plant with a capacity of 200 tons per shift. Everything from the surface down is shot in and milled. An inclined tramway leads down to the level of operations. When it becomes necessary to go deeper the company intends to take up a stope 30 ft. high.

Tailing-mills are handling the product of the old mines of the Alba district, which was considered the phenomenally rich quarter of the district a number of years ago. Few of the mines are now operating, but the reworking of the tailing is netting a profit to the operators. The ore of the Sitting Bull mine, on the Brinkerhoff land, at Toms Station, north of Joplin, is showing the almost unbelievable record of running 60% zincblende, mill recovery, and the tailing is not well cleaned at that. The ore is found at 187 ft., and occurs in a veritable mud-hole, requiring the closest kind of timbering. It is the richest recovery ever made in the district from a mine of any size, but, due to the pockety formation of the ground, no assurance is felt by the operators that it will long continue so rich. Prior to mining this land, Jess Short, the superintendent, sunk a drill-hole in the centre of a hog-wallow. Other holes were sunk near-by, and all showed more or less pay-ore.

GLOBE, ARIZONA

Drill Work at Arizona Commercial.—Opening Summit Vein at 600 Ft. —The Miami Mill. — Inspiration Development. — The Live Oak, Warrior, Superior, and Boston.

Recent drill prospecting at the mine of the Arizona Commercial Co. has disclosed high-grade ore below 1000-ft. depth. This is in line with the predictions of those familiar with the property, based upon the evidence of extensive leaching in the upper levels of the mine, presaging a zone of secondary enrichment beneath. The diamond-drill passed through 14 ft. of 16% copper glance at a depth of 1000 ft., and cut into a body of 11% sulphide ore at about 1200-ft. depth. The drill did not penetrate the latter, being withdrawn after boring into the sulphide 10 ft. The contract of the drilling company had expired, and as the Arizona Commercial management had decided to sink immediately and explore that section with drifts and cross-cuts it was decided not to resume drilling until the 1000-ft. level is opened sufficiently to install the air-drills there. At the summit mine cross-cutting has been commenced at the 600-ft. level, to open the Pasquale vein 500 ft. west. If the size of the vein and the grade of the ore at this depth are similar to those above, where the vein contained chalcopyrite sampling 30% copper, and widened from 10 in. at the 200 to 4 ft. at the 400-ft. level, the Summit will become one of the best copper properties in the Southwest. The 30% ore occurs in a streak within an 8-ft. vein carrying 16% copper at 400-ft. depth. A 200-ton concentrating mill will be built at the Summit as soon as the equipment can be placed on the ground. The old dumps of the mine consist of concentrating ore of high grade, and abundance of ore of lower grade has been exposed in the mine. A hoisting-engine and air-compressor have been moved to the New Keystone group from the Miami, and operations there will be resumed soon. Work at the Copper Reef continues, and considerable ore has been found at the face of the California adit, now about 750 ft. from the portal. The value of the ore is not definitely known, but it is probably of commercial grade. The stockholders will meet at Globe, April 23, when doubtless it will be decided to push development work at an increased rate.

The Miami Copper Co.'s concentrator is in operation, three units handling ore the last day of March. Everything in and about the mill and mine has been ready for operation since March 14, but the non-arrival of 14-in. pipe for the water-line from the pumping plant at Burch to the mill delayed full operation. Units 2, 3, and 4 are complete, but units 1, 5, and 6 will not be in operation for some time because portions of the equipment have not yet arrived. Considerable water is being supplied by a temporary 8-in. pipe-line, and while the three units now running are handling about 900 tons of ore daily, they are expected to treat 500 tons each per day when in perfect running order. At the mine the caving method is well started and working with precision. Electric locomotives are in use underground, hauling the ore to the ore-pocket at the south side of shaft No. 4. The hoisting engines, cages, and skips are in perfect order. There is now a considerable tonnage of concentrate in the cement tanks on the western side of Miami butte. The mill is on the top and eastern slope of the butte; a tunnel leads through the hill, and the concentrate is passed from the mill through it by means of a trough, and is emptied into six cement tanks at the farther end of the tunnel, where it it dried by vacuum pumps, set beneath a false canvas bottom in the tanks. The Burch rolls are apparently a success. They differ from other ore-pulverizing machinery in that one of the rolls is moved slowly back and forth in the direction of its axis, thus preventing the grooving that limits the life of stationary rolls. The expected selection of the Inspiration's concentrator-site has not yet been made. Company surveyors have been at work near Wheatfields, ten miles northeast of the mine, but nothing definite has been done toward providing for a site there. The placing of a mill at that point would involve building a branch of the Arizona Eastern railroad along the survey of its proposed Globe-Durango line. Development undoubtedly would yield a water-supply three miles west of the mine, as drilling by the Cactus company tapped what is apparently a large underground flow in that region. This company's Colorado shaft is finished, and a pocket has been cut on its south side. Station-cutting is almost completed and a drift will be started early in April to connect with the 500-ft. level of the Joe Bush shaft. This drift, a portion of the main haulage-level, will contain a 36-in. gauge track when finished. Churn-drill holes 1001 and 1007 are still in ore. Hole 1008 passed through the ore at a depth of 450 ft. No. 1009 has just been started. Between 10 and 15% of the Inspiration ore is being found in granite. Various tables are being tested at the Inspiration's 75-ton test mill.

Two shafts are being sunk on the Live Oak group. The old shaft is being sunk from its former 308-ft. station. It will be sunk 70 ft., to a point about 180 ft. below the adit that formerly exposed the sulphide orebody. At the bottom of the shaft a new station will be established and the work of blocking out the orebody will be begun. The new shaft, work on which began April 1, is situated on the western part of the company's ground, about 1600 ft. west of the old shaft. The new one is to be sunk to a depth of 1200 ft. The ground it will open has been proved by drill-hole 38. The drilling at the Live Oak continues to give favorable results. Ore 200 ft. thick was penetrated in hole 50; 47 is still in ore at 950 ft., and the other holes are showing satisfactory progress. The Warrior Development Co.'s underground exploration is progressing as usual, and churn-drilling will be begun soon. The main west drift is still in ore at about 140 ft. east of the Winnie shaft and less than 500 ft. from the Warrior's west side lines. From 100 to 125 tons of 9½% ore is being shipped daily to the El Paso smelter. The Superior & Boston company recently completed the raise on the Great Eastern vein from the 800 to the 600-ft. level, which marks the last of the extensive dead work that has been necessary in this mine during recent months. It provides ventilation and establishes a channel for extraction of the ore developed on the 600-ft. level, and along the raise. A drift is being driven in a southwesterly direction from the 1000-ft. level to cut the Great Eastern. When the vein is reached the drift will be extended along its strike, and a cross-cut will be driven north to cut the Old Dominion fault.

General Mining News

ALASKA

KENAI PENINSULA

The placer-mining claims recently staked on the Kenai river cover an area of nearly a mile in width on each side of the stream, and extend along its course from Skilak lake as far as the town of Kenai. This river flows through a broad valley in which are extensive deposits of gravel, believed to be rich enough in placer gold to make this a profitable dredging field. It seems certain that the gravel will be thoroughly tested next summer.

PRINCE WILLIAM SOUND

The Cliff mine, near Valdez, has a stamp-mill which was operated profitably last year, and it is to be started again this month with increased capacity. The Cliff is a gold mine, and some dividends have been paid out of its proceeds. It is owned mostly by Valdez people.

ARIZONA

COCHISE COUNTY

The Bisbee-Sonora Development Co. has maintained a small force of miners on development work during the last four years, and it now has a sufficient tonnage of ore exposed to enable it to ship ore to the smelter regularly. The property is situated in the Chiricahua mountains, 18 miles from Rodeo station. The orebodies are opened by

Copper Queen Power Plant.

adits to a depth of 400 ft. The ore to be shipped samples $40 to $50 per ton.

The Copper Queen Co., which operates the Copper Queen mines at Bisbee, and the big smelting plant at Douglas, smelted 589,900 tons of ore in 1910, recovering therefrom 122 lb. of copper per ton, an aggregate for the year of 71,928,357 lb., which was produced at the cost of 6.5c. per pound. The company marketed its product at an average price of 12.826c. per pound. The Lowell shaft of this company, at Bisbee, has reached a depth of 1600 ft., at the bottom of which a station has been cut, and driving has been commenced at the 1500 and 1600-ft. stations in the direction of the Sacramento. A new shaft, to be known as the Dallas, has been begun, on which three shifts per day will be employed, with the expectation of sinking at the rate of 100 ft. per month. A pipe-line, connecting with an air-compressor at another plant, has been laid to supply power for the drills. This sinking is expected to extend to a depth of 900 ft. in limestone before cutting the orebody.

The Hartford-Arizona mine, in charge of Henry Hamburg, is to have an aerial tramway, two miles in length, to carry the ore from the mine through a box canyon to the shipping bins. A 125-ton steam boiler was put in lately at the mine. The property is in the Huachuca mountains. High-grade gold and silver ore is being shipped regularly from the Herschel mine, at Tombstone, the mining operations being under direction of Douglas Gray.

GREENLEE COUNTY

The New York-Arizona Gold & Copper Co., which has developed bodies of gold and silver ore in the Clifton-Morenci district, is making tests to determine the method of extraction best suited to the ore. It is anticipated that a cyanide plant will be erected.

PIMA COUNTY

The Arizona Con. Smelting & Mining Co., organized in New York, is said to be considering bids for the construction of a smelting plant within three miles of Tucson. It is stated that the smelter and accessories are to cost $350,000. H. A. Thompson, the manager, is entering into contracts with mine operators for securing their ores.

The Twin Buttes Mining Co., which has thoroughly developed its copper mines at Twin Buttes, situated 20 miles south of Tucson, and which has been shipping about 2000 tons of ore per month to the El Paso smelter, is considering the recommendation of Michael Earle, president of the company, to discontinue its shipments, and begin the construction of a smelter of 350 tons capacity at the property. It is said the orebodies have been opened in 20 different places, and that the ore samples 6 to 10% copper. The superintendent is J. E. Higgins, formerly of Butte, Montana. The company has a narrow-gauge railroad extending from Tucson to the mines.

YAVAPAI COUNTY

The Eleanor Placer M. Co., with Joseph Mackin as manager, has its gold dredge in operation on French gulch, with plenty of water for floating the boat. W. J. Deam has taken the contract to drive a 1000-ft. adit on the grounds of the Copper Queen Co., on the Agua Fria river, five miles east of Mayer.

CALIFORNIA

BUTTE COUNTY

Natoma dredge No. 8, which has been operating about two months at Folsom, has proved so satisfactory that the Natoma Consolidated Dredging Co. is building what is to be Feather River Dredge No. 3, of the same capacity and pattern as the former; but No. 3 is being built on the company's ground at Thermalito. This dredge is 150 ft. long, 60 ft. wide, and has a chain of 15-cu. ft. buckets, capable of digging to a depth of 55 feet.

The Wyandotte quartz mine, belonging to John McBain of San Francisco, has been leased to S. Foden, also of that city, who is to operate it this season. It is said to be a paying mine, and the lessee has provided an air-compressor and power-drills, and has employed 10 miners.

ELDORADO COUNTY

The Hydro-Electric M. Co., composed of Colorado mining men, has acquired the French Hill claims, situated three miles north of Greenwood. The property covers a system of veins and reefs on the Mother Lode. Work on a small scale has been conducted for many years, the ore taken out having been treated in a 10-stamp mill that was built in early years of mining.

KERN COUNTY

The Mascot mining claims, four miles south of Randsburg, are being developed with good results. Five tons of gold ore taken from the vein recently opened is said to be worth $150 per ton. The general average of ore in a shoot 5 ft. wide is reported at $35 per ton. The claims belong to Powell and Humphreys. C. G. Illingworth and associates are mining high-grade ore on the 300-ft. level of the Pearl Wedge claims, in the Stringer district. They recently milled 15 tons at the Osdick plant. J. Cronan and Fred Williams, having a lease on the William R. mine,

in Springer district, opened a 2-ft. vein of ore assaying $40 to $50 per ton. This is a recent discovery, and is considered important. The claims belong to Houser brothers, F. Williams, and P. Byrne.

NEVADA COUNTY

The Coan mine, owned by a Pittsburg company, and in charge of D. McGonigal, has been equipped with a 10-stamp mill, and a new hoist. Five of the 10 stamps are in operation on ore being taken from the old workings. In the meantime, an incline shaft is being driven, by which the mine is to be more thoroughly developed. The Holbrook mine, at Grass Valley, has been leased for three years to H. Reber, O. A. Edholm, E. C. Webster, John Bolander, D. D. Enyeart, and T. K. Richardson, who contemplate sinking a new shaft for the purpose of tapping the gravel channel, which they believe is an extension of the Blue Lead channel. It is estimated that the bedrock will be reached at a depth of 125 ft. Hoisting and pumping equipment has been purchased.

PLACER COUNTY

The Annie Laurie and Red Bird mines, situated near Colfax, have been examined recently in the interest of San Francisco men who have under consideration the purchase of those properties. Both are gold-quartz mines.

RIVERSIDE COUNTY

The Calzona Mines Co. and the Steece Copper Co. are operating in Riverside mountains, situated near the Colorado river, and not far from the Parker branch of the Santa Fé railroad. The Steece company has a 380-ft. shaft, and is still sinking. The Calzona has a shaft, also, where a gasoline hoist was installed some time ago. The ore found in these properties consists of copper-iron sulphide, accompanied by some gold.

SHASTA COUNTY

The copper output of the First National Copper Co., operating the smelter at Coram, was 260,000 lb. less for February than was the January production. The January output consisted of 932,000 lb. copper, 41,232 oz. silver, 822 oz. gold; the February product was 676,705 lb. copper, 28,373 oz. silver, 526 oz. gold.

SIERRA COUNTY

The Four Hills mine, situated in the region of deep snow, half way between Sierra City and Johnstown, is attracting attention by reason of the recent opening of a shoot of ore in that mine, samples of which are said to have assayed $100 per ton. This mine is on the same mineralized zone as that on which the Sierra Buttes, Plumas-Eureka, and Jamison mines are located. The Four Hills belongs to Hood & Breesi, for whom J. B. Lassiatt is acting as superintendent. Mr. Breesi is a New Yorker, and Mr. Hood is an Englishman. They put in store a stock of provisions last fall, and have kept a force of miners at work at the mine all winter.

SISKIYOU COUNTY

The Hamburg Dredging Co. is reported ready to start work with its suction dredge, by which the fine gold is to be taken up with the sand on the bed of the stream. Its operation is near Yreka. The River Bend M. Co. is to operate this season between Walker and Oak Bar with its steam-shovel dredge. The Garvey Bar Dredging Co., having leased ground from the La Sheil M. Co., is to work this season with a clamshell dredge, which is being built. Several mines are in operation in the vicinity of Hawkinsville, including the Lemos, Phillips, Borba, and St. George, which are placer properties. There is plenty of unworked ground in the camp, and the prospects for the season's clean-up are good.

TRINITY COUNTY

(Special Correspondence.)—Persons reported to be representing the Guggenheims are understood to have taken options on the La Grange, Union Hill, Hupp, Spanish Flat, Woodbury, Field, and other hydraulic and placer-mining properties, together with W. W. Young's water rights on East Weaver creek. The options were secured by W. A. Boland of the Union Hill M. Co., and extend to October of this year. It is said that the deal will involve the investment of $15,000,000 to $25,000,000. It is understood that the holders of the options plan the construction of a series of reservoirs that will assure sufficient water to operate the great hydraulic mines continuously. The La Grange ranks as the largest hydraulic mine in California, while the Union Hill and Hupp are also noted properties. The flourishing condition of hydraulic mining in this county is due to the fact that the rivers are unnavigable and drain directly into the ocean; thus the anti-hydraulic regulations do not apply to the operation of Trinity placer properties. The success attending the operation of the Headlight mine at Carrville has attracted much attention to the district. As a result owners of near-by mines are arranging for vigorous work with the beginning of the dry season. It is reported that several men identified with the Butte Creek Con. Dredging Co., of Los Angeles, are about to commence the exploration of dredging lands near Lewiston. Representatives examined the holdings last year.

Weaverville, March 31.

TUOLUMNE COUNTY

(Special Correspondence.)—The Carlotta mine, near Tuolumne, recently bonded to John Oleson, of San Francisco, has been unwatered to a depth of 150 ft., and several tons of ore is now being taken out for a mill test. Development work has been resumed at the Carlin mine, west of Jamestown, under the direction of John Witney. For a time work will be confined to sinking. Preparations are being made for the resumption of development operations at the Copper King and Iron Mountain claims, situated southwest of Jamestown and owned by D. L. Mann. C. Allen has been appointed superintendent of the Tarantula mine, vice T. J. Russell, resigned. It is understood that the management will conduct development work on a very extensive scale. The Hazel Dell mine, above Columbia, has been bonded to Peter Bahten, and operations will shortly be commenced. The Black Oak mill is running steadily and the general outlook is decidedly good. R. A. Nicholls and associates, who are operating the Draper mine under lease, have begun milling ore. It is said rich returns are certain from the present mill-run. Work will shortly be resumed at the Hamburg mine, near Jamestown, in which S. W. Ludwig and several Eastern men are interested. Five stamps will be added to the Soulsby mill. The plant will then consist of four 5-stamp batteries. The prospecting-drill formerly used by the Phoenix Lake Mining Co. is being moved to a point on the Stanislaus river near Melones, where tests will be made to determine the value of gravel deposits. If results are satisfactory, a dredge will be built there. The 5-stamp mill at the O'Donnell mine, south of Jamestown, has been started on good ore. A hoisting plant is being installed at the Badger mine, situated south of the Rawhide. The property, which is owned by A. L. Ellis, of Gilroy, will be unwatered, so that it can be thoroughly examined by intending purchasers. The Mandich pocket mine, near the O'Hara, at Brown's Flat, which yielded liberally in years past, is to be re-opened and worked by Dusan Mandich, a brother of the former operators.

Tuolumne, April 2.

COLORADO

BOULDER COUNTY

John R. Wolff and associates are building a crushing-mill and cyanide plant in the vicinity of Sugar Loaf mountain for the treatment of ores of that district. The Colorado Metals & Chemical Co. has acquired the Bailey mill, at Eldora, which is being remodeled and equipped for the cyanide process. This company will operate the mill on ore from its own property near Eldora. The Metal Mining Association has plans for the construction of a cyanide plant for custom ores.

CHAFFEE COUNTY

It is reported that a milling plant will be erected on Lake

creek, close to Twin Lakes, for the concentration and cyanidation of custom ores of the Mt. Elbert region. It is stated that both local and Eastern men are interested in the project.

CLEAR CREEK COUNTY

(Special Correspondence.)—Poles are on the ground and wires will soon be strung for the conveying of electric power from the Sternberger plant up Fall river to the portal of the Lucania adit on Bellevue mountain. The contract for driving this adit 1500 ft. will be awarded during the next few days. An average of two carloads of smelting ore is being shipped each week from the Money Muck mine. The average value of the product is $30 per ton. A shipment of 300 tons of smelting ore from the Peters mine made a short time ago brought a settlement of $28 per ton. Gus Carlson is manager. Work on the King Bee mine will be started through the surface levels, supplementary to operations being carried on through the Newhouse adit. Shipments from the lower workings bring returns averaging close to $100 per ton in gold and silver.

Idaho Springs, March 30.

GILPIN COUNTY

The Frontenac Con. Mines, Ltd., operator of the Frontenac and Addudel mines near Central City, and the new concentrator at Black Hawk, is mining and milling 200 tons of ore daily, producing 70 to 80 tons per day of concentrate. These properties are under direction of Henry P. Lowe, as manager, and Sydney Tyler as engineer.

LAKE COUNTY (LEADVILLE)

The mines on Fryer hill which are being operated are Chrysolite, Seneca, Hayden, Virginius, Muidoon, Climax, Dunkin, Silver, Pittsburg, Robert E. Lee, Matchless, and Progressive, making that part of the district a busy place. The active properties on Breece hill are the Ballard, Penn, Galesburg, Highland Mary, St. Louis, Black Prince, Garbutt, and the Ibex with its many sets of lessees. The mines on California and Iowa gulches are likewise active, as are those on Carbonate hill and Big Evans gulch.

SUMMIT COUNTY

The dredging season has opened at Breckenridge, and all the dredges have begun operations. The Bucyrus dredge of the Colorado Gold Dredging Co. is at work on Swan river, where it handled 1,300,000 cu. yd. of material in 1910. The French Gulch Gold Dredging Co. has its Reiling dredge in operation on French gulch. This dredge has been overhauled, and provided with new buckets with manganese steel lips, and is expected to handle 600,000 cu. yd. of gravel this season. The Reliance dredge is also in operation on French gulch.

TELLER COUNTY (CRIPPLE CREEK)

The mines of the El Paso Con. Gold M. Co., situated on Beacon hill, are opened by four vertical shafts. The main shaft has a depth of 1000 ft., and connected with it there are seven working levels, whereby the El Paso, Tillery, and C. K. & N. ore-shoots have been developed. A drill-hole was sunk 332 ft. vertically from the bottom of the main shaft to the Roosevelt drainage tunnel, which served to relieve all the workings on and above the 1000-ft. level of water, rendering the 3000-gal. pump at the seventh, and the 1800-gal. pump at the sixth stations no longer of use there. The Roosevelt tunnel penetrates El Paso territory a distance of 1880 ft., and the Tunnel company drove a cross-cut, at its own expense, from its tunnel to the C. K. & N. water-channel, a distance of 540 ft., by which 4000 gal. of water per minute was added to the flow of the Roosevelt tunnel, the total volume now being over 11,000 gal. per minute. This work will result eventually in draining the company's system of ore-shoots to a depth of nearly 1300 ft. The development work performed between January 1, 1910, and March 1, 1911, as given in the company's report, amounted to 8262 ft., the greater portion of which was done by lessees, of which there have been 20 to 25 sets. All leases now in force are of blocks of ground on and above the fourth level; all below that level is to be worked on company account. During the last year the principal tonnage of ore mined on company account was taken from the fifth, sixth, and seventh levels of the C. K. & N. vein. It is stated that considerable ore is already broken on the seventh or 1000-ft. level. The Tillery and C. K. & N. veins have been connected by a cross-cut on the fifth level, a good shoot of ore having been opened in the latter. Other shafts, on the north end

The El Paso Mine.

of the property, consist of the Chance, Ajax, and Nicholls, the last named being over 700 ft. deep, and from it the Ajax ore-shoot has been developed. The superintendent of the mine is John H. Nicholls, T. R. Countryman being the company's engineer.

IDAHO

SHOSHONE COUNTY

The Bunker Hill & Sullivan Mining & Concentrating Co., on April 4, paid dividend No. 163, amounting to $81,750, making total dividends to date of $12,620,100.

ILLINOIS

HARDIN COUNTY

(Special Correspondence.)—The operators of the Rosiclare Lead & Fluor Spar Mines, situated on the Ohio river, have about completed a mill of 500 tons daily capacity. There are three steel buildings, one each for the power-plant, separating and sorting equipment, and concentrating machinery. The equipment was made from the most modern patterns which have been devised. An electric haulage system has been established in the mine to facilitate the movement of ore to the mill.

Rosiclare, March 27.

NEVADA

(Special Correspondence.)—Mine Rescue Car No. 4, in charge of Sumner S. Smith, which was called to Nevada from Wyoming by the recent disaster at the Belmont mine, at Tonopah, made a stop of a few days at Reno on its return trip in order to give the students at the Mackay School of Mines an opportunity to learn of the equipment and work of the car. A lecture was first given by Mr. Smith at the University on the work of the mine rescue cars. This lecture was illustrated by numerous views of the work done. Each class visited the car, and each of the students was given practice with the Draeger oxygen helmets. While wearing the helmet each student was given some manual labor to perform in order to better acquaint him with its use. The error on the part of most of the students at first was that there was a tendency to work faster than their air-supply, but they soon got used to this, and in the cases where the student did not overexert himself he experienced no difficulty in working with the apparatus on. After using the helmets, work was given in providing first aid to the injured. A short course in first-aid practice is given at the University to each mining class of the School of Mines before graduation.

Reno, March 27.

ELKO COUNTY

(Special Correspondence.)—The second season in Jarbidge district opens favorably, with conditions promising

for the future. The developments of the past year have resulted in opening many large bodies of ore, which, with further development, will require several reduction plants, some of which may be built this season. The new map of the Jarbidge district, revised to date, prepared by W. W. Fisk, covers an area seven miles north and south by nearly four miles east and west, throughout which properties of proved value exist. The greater part of this area, however, has received as yet but little systematic prospecting or development. Numerous veins have been discovered upon which no development work has been done to find the ore-shoots. But the experience of the last year has given the prospector a better knowledge of the formation.

The Jarbidge Nevada Co., which has a group of claims lying west of Bear creek, is doing work to develop a large quartz vein. Ore of low value has been found on the surface, and an occasional panning can be obtained. An adit is being driven and a shaft is being sunk. On this outcrop fluorine stain is observed, which in Cripple Creek is taken as an indication of rich ore. This cropping is believed to be the extension of one of the Pavlak veins. The Ham And-Jarbidge Co., owner of the Valley View, is preparing for extensive development, expecting good results, as the Rainbow-Amazon Co. drove a 150-ft. adit just south of the Valley View, and opened an orebody 20 ft. wide, the samples of ore taken out assaying $8 to $16 per ton. The Ham And-Jarbidge Co. is developing leased ground lying south of the Pavlak tunnel, having driven 175 ft. on the Ham And vein, in which there is 5 ft. of milling ore, and 20 in. of high-grade ore. The orebody found in the Rainbow-Amazon was opened by an adit 150 ft. below the surface, and this is considered one of the largest bodies of ore of milling grade thus far found in the district. The lessees on the block of ground north of the Pavlak tunnel have opened two veins, in one of which is ore 6 in. to 3 ft. wide, most of it high grade. A shipment of ore made from this lease last fall netted $1360. The Pavlak tunnel which cross-cuts the vein system at 200 to 350 ft. in depth, has intersected some of the veins at a place where they are contracted by a quartzite dike. Four veins were cut before reaching the dike. The 150-ton cyanide plant of the Pavlak company will be completed in a few weeks, and it is probable that it will be operated partly on custom ore for some time, while the Pavlak company is developing.

Jarbidge, March 30.

NYE COUNTY

The West End Con. Mining Co., for which S. H. Brady is manager, is reported to have purchased the 20-stamp mill of the Midway M. Co., at Tonopah, and that it purposes remodeling and partly re-equipping the plant to make it more adaptable to the recognized Tonopah mill practice. It is announced, also, by the Tonopah *Miner*, that the MacNamara M. Co. has decided to erect a milling plant of a capacity of 2000 tons per month, to be equipped with stamps, tube-mill, agitating-tanks, and slime-filters. The MacNamara adjoins the West End mine, and is under the management of Herbert Haas. There are two veins on the property, in both of which the orebodies are well developed. There are now four mills operating on Tonopah ores, and with the building of two more Tonopah will become still more conspicuous as a camp of interesting and successful mill-work.

For the week ended April 1, the output of the mines at Tonopah amounted to 8493 tons of ore, distributed as follows: Tonopah M. Co., 3500 tons; Belmont, 2509; Montana-Tonopah, 1054; Tonopah Extension, 980; West End, 450 tons. The estimated realizable value of this ore is $212,325.

(Special Correspondence.)—The marble claims, 7 miles southeast of Gold Centre, held for several years by Sam Callicotte and son, have recently passed to the control of the American Marble Co. of Chicago. The locality is about 3 miles east of Chloride siding of the L. V. & T. railroad. A carload of machinery is on the ground and is being put in position, together with camp buildings and other structures. The machinery now on hand is principally for testing the marble deposits and consists of Ingersoll-Sergeant core-drills, and an air-compressor run by gasoline power. The marble is of the pure white kind, as well as the variegated, and takes a good polish. Some of the strata are thick-bedded, and it is believed that when the surface outcrops of the different measures are removed, the material will be of excellent character, and can be quarried in large blocks. The wagon-haul is down hill to the railway. Mr. Graves of Chicago is directing operations for the company.

Rhyolite, April 1.

WHITE PINE COUNTY

Mine Rescue Car No. 4, in charge of Sumner S. Smith, was at Copper Flat, Giroux, Ely, and McGill a few days last week.

NEW MEXICO

SOCORRO COUNTY

(Special Correspondence.)—The Maud M. Co. began recently to put the Maud S. shaft equipment in such condition as will make it possible to unwater the mine and begin mining operations. This is an old property and is considered one of merit. The clean-up at the Socorro mines for the first half of March consisted of 17,000 oz. of gold and silver. About 150 tons of ore per day is being milled. The Ernestine M. Co. cleaned up 6920 oz. of gold and silver during the first ten days in March. For one week 43 sacks of concentrate was produced from 660 tons of ore. The week's work at the Deadwood mine consisted of milling 240 tons of ore, and producing 15 sacks of concentrate. Much water has accumulated in the mine, which is being brought to the surface by an air-lift, the effectiveness of which has been demonstrated. Engineers of the Oaks Company have been making mine examinations at Parsons, for Chicago people.

Mogollon, March 30.

OREGON

BAKER COUNTY

The operators of the Ben Harrison mine, situated in the Greenhorn district, have sent 200 sacks of their ore of average grade to the California Ore Testing Co., at San Francisco, to have determinations made as to the best method of treating it before building a mill. Connor brothers, owners of the Golden Chariot mine, are mining ore, and treating it in a small mill.

JOSEPHINE COUNTY

The Almeda Con. Mines Co. is making good progress in building an auto-truck road from the railroad to its mine and smelter at Galice. When this is finished, coke is to be hauled in, and the smelter will be blown in.

UTAH

JUAB COUNTY

Cyanide tests have been made on certain typical low-grade ores of the Grand Central, Sioux, and other mines of Tintic district, controlled by C. E. Loose and associates, and the Eureka *Reporter* states that, as the results have been satisfactory, a cyanide plant may be erected in the district to treat this class of ore. The May Day mill, which is a concentrating plant, is treating 50 tons of ore per day. The mill has been operated several years. The Carisa mine, in charge of Edward Riggs, is again in operation, two machine drills being in use on the 500-ft. level. The Victoria is being provided with a hoist of larger capacity, and a 6-drill air-compressor. The Victoria is producing two cars of ore per week and is being well developed. The drift on the 1050-ft. level has been extended 350 ft. in quartz.

SUMMIT COUNTY

During 1910 there was concentrated in the Daly West mill, Park City, 83,119 tons of ore, the average content of which was 7.95% lead, 8.93 oz. silver, and 8.39% zinc. F. W. Sherman, mill superintendent, figures the extraction at 97.48% of the lead, 82.8% of the silver, and 71.4% of the

zinc. The product for the year consisted of 16,123 tons of lead concentrate, containing 38.14% lead, 32.54 oz. silver per ton, and 13.06% zinc; and 7879 tons of zinc concentrate, running 5.55% lead, 17.42 oz. silver per ton, and 37.78% zinc. The lead concentrate brought $576,122; the zinc concentrate, $111,293. Important changes have been made in the mill to make it adaptable to zinc concentration.

WASHINGTON

FERRY COUNTY

(Special Correspondence.)—During the year 1910 the Republic Mines Corporation shipped 415 cars of ore, aggregating 19,360 tons, from the Surprise mine. Up to March 24 of the present year 51 cars shipped contained 1510 tons. The Imperator-Quilp company shipped during the part of 1910 that it operated the Quilp mine, 37 cars, containing 1110 tons, and this year, up to March 23, 51 cars, containing 1510 tons. In the Surprise mine the workings on the Jim Clark adit-level are in ore averaging about $20 per ton. On the intermediate level, 40 ft. deeper, the average assay of the ore is about $40 per ton. At a depth of 240 ft. the miners are breaking into the 'bonanza' shoot, the ore in which is assaying from $12 to $35 per ton. At a depth of 550 ft. the best showing of ore in the mine is in a stope situated about 200 ft. north of the dividing line between the Surprise and Quilp claims, the ore assaying $30 to $260 per ton.

Republic, March 28.

OKANOGAN COUNTY

(Special Correspondence.)—The Granby company of Grand Forks, B. C., has bonded several claims on Copper mountain, in Myers creek district, and is establishing a camp. A large force of men will be employed in exploring the property through old workings, and a diamond-drill will be employed in the exploration of undeveloped ground. The miners in the Gold Axe mine, Copper mountain, report that a body of ore 8 ft. wide has been opened in an adit which was driven to tap the vein, and the ore is of a grade that will stand the expense of shipping and pay a profit. Northeast of the Gold Axe is the property of the Cain Gold Mining Co., which is driving an adit 1100 ft. on the Jim Hill claim. A wagon-road is being made, so that an air-compressor and power-drills can be hauled in. Some gold-bearing ore was developed in a shaft before the adit was started. The adit is now in 230 ft. The company has established good quarters for its men.

Oroville, March 27.

STEVENS COUNTY

(Special Correspondence.)—The Washington-Ohio company, owning the Noble Four group of claims, covering an extension of the main vein of the Napoleon mine of the British Columbia Copper Co., and situated two miles south of Bossburg, reports having driven seven adits on the vein, from 80 to 306 ft. in length. The No. 3, of greatest length, has cut a stringer of ore, assaying 13% copper, accompanied by some lead, silver, and gold. A bond for the sale of the Big Bear mine, situated between Marcus and Bossburg, has been taken up by Spokane people, who will provide an air-compressor and machine-drills to develop and operate the mine on an extensive scale. The purchase price is reported at $5000.

The British Columbia Copper Co. has completed its cyanide plant at the Napoleon mine and made some test-runs on iron-carbonate and oxide ore for which the plant was especially built. The capacity of the mill is 100 tons per day, and its cost was $20,000. The iron sulphide ore of the Napoleon mine is shipped to the company's smelter at Greenwood, British Columbia.

Orient, March 30.

CANADA

BRITISH COLUMBIA

The British Columbia coalfields are attracting much attention this year. The sale of the Dunsmuir properties to Mackenzie, Mann & Co., Ltd., is to be followed by the opening of new collieries, both by this company and the Western Fuel Co. of San Francisco. The Pacific Coast Co., Ltd., has plans for extensive improvements. Warren R. Roberts, of Roberts & Schaefer Co., Chicago, specialists in building coal-treatment plants, recently visited the coalfields, and it is probable that one modern washer, and possibly others, will be built.

NOVA SCOTIA

(Special Correspondence.)—The Scheelite Mines, Ltd., operating a tungsten property, situated at Moose River Gold Mines, Halifax county, is to erect a milling plant for concentrating its ores, and for the separation of the magnetic from the non-magnetic metals. Victor G. Hills, of Denver, Colorado, recently appointed general manager and consulting engineer for this company, is now at the property.

Moose River Gold Mines, March 27.

MEXICO

Advices from the managers of the Mexican properties of the Mines Company of America are to the effect that while the transportation facilities have been interrupted at times, there has been no destruction of mining property or interference with operations. In fact, both the insurrectos and the Government are seeking to aid and encourage the regular operations of the large companies. Both the Mexican Government and the opposition are specifically pledged to the full protection of property rights of foreigners. Owing to the policy of carrying large stocks of supplies at the mines, the interruption of transportation has not necessitated the closing or curtailment of output of any one of the four operating mines owned by this company, which are the Dolores and El Rayo in Chihuahua, and the Creston and La Dura in Sonora.

SONORA

The Sonora Copper Smelting Co., which has developed the Cobre Grande mine within the last three years, has erected a copper-smelting plant of 100 tons capacity, which is nearly ready to operate. The property is situated three miles from Noria station, on the Nogales-Guaymas railroad. A 3400-ft. aerial tramway of the Leschen type is being erected. A. M. Conrad of Nogales is the company's manager.

(Special Correspondence.)—Martin Hickinson, owner of the San Lorenzo mine, situated 30 miles west from Cumpas, has been in El Paso arranging with the smelter for ore shipments he will make in the near future. The San Lorenzo property was, about a year ago, under option to El Paso people, but because of great distance from transportation it was given up, since when Mr. Hickinson has proceeded with the development. He has uncovered a body of low-grade copper ore, running 2.5%. In the past year he has been developing a body of high-grade ore, which averages 24% copper, 75 oz. silver, $3.50 gold, and 10% bismuth. This is the ore he intends shipping, of which there are 180 tons now on the dump. The shoot of this ore is 60 ft. long and 5 ft. wide. This ore will be packed on burros to Nacozari, thence by rail to El Paso. The burro charge is $15 per ton; but as this ore will run above $80, it will pay to ship. At the Transvaal mine, he reports a discovery by the diamond-drill of 200 ft. of solid ore. There are two deep drill-holes on the Transvaal, one 1300 and the other 1200 ft. H. C. Beauchamp is manager of this property, on which 75 men are working.

Cumpas, March 25.

CENTRAL AMERICA

COSTA RICA

J. H. Hartley of Berkeley, California, is now manager for the Compania Minera del Porvenir, at San Jose, Costa Rica. The Porvenir is said to be an interesting property. The Denver company which had an option on it failed to make final payments, and the mine reverted to the original owners. W. F. White, of New York, arrived at San Jose, March 15, and went thence to the Aguacate mines, in which he is interested. The Aguacate Mines Co. is putting up a 10-stamp mill.

Mineral Production of Colorado

Figures showing the mineral production of Colorado in 1910 have been compiled by the State Bureau of Mines and are published below, through the courtesy of T. J. Dalzell, Commissioner of Mines.

COLORADO	GOLD		SILVER		LEAD		COPPER		ZINC		TOTAL
Name of County	Fine Ounces	Value	Fine Ounces	Value	Pounds	Value	Pounds	Value	Pounds	Value	
Boulder	6,430.075	$132,909.65	44,161.82	$23,613.32	51,373	$2,306.64	21,851	$ 2,759.78	.....	.....	$ 161,589.39
Chaffee	3,524.866	72,853.98	170,768.69	91,310.02	1,026,297	46,080.74	185,314	23,405.16	1,254,637	67,624.93	301,279.83
Clear Creek	23,552.950	486,839.48	457,976.45	244,880.00	2,457,290	110,332.32	607,543	76,732.68	1,910,432	102,972.28	1,021,756.76
Costilla	112.151	2,318.16	9.27	4.96	.....	.....	.....	.....	.....	.....	2,323.12
Custer	442.150	9,139.24	7,268.74	3,886.60	15,712	705.47	4,242	535.76	.....	.....	14,267.07
Delta	3.439	71.08	.....	.....	.....	.....	.....	.....	.....	.....	144.96
Dolores	741.599	15,328.85	87,777.09	46,934.41	198.648	8,919.29	14,025	1,771.36	52,813	2,846.62	75,800.53
Douglas	4.005	82.78	.....	.....	.....	.....	.....	.....	.....	.....	82.78
Eagle	1,416.322	29,275.38	80,538.68	47,876 33	395,895	17,775 68	211,119	26,664 33	1,340,370	71,245 94	192,837.66
Garfield	175.346	3,624.40	304.25	162.68	.....	.....	499	63.02	.....	.....	3,850.10
Gilpin	28,037.398	591,935 02	143,732.57	76,853.80	570,845	25.630.94	518,631	65,503.10	.....	.....	759,922.86
Gunnison	11,482.855	237,350.61	45,074.09	24,101 44	560,094	25,441.56	22,306	2,817.25	357,394	19,263.54	308,977.40
Hinsdale	289 745	5,980.03	55,642.98	29,752.30	248,756	11,169.14	460,961	58,219.37	.....	.....	105,129.84
Lake	57,215.569	1,182,645.81	3,045,312.37	1,628,328.52	12,728,195	571,495.96	3,749,721	473,589.76	41,757,155	2,253,710.71	6,100,770.70
La Plata	18,953.339	391,765.23	142,167.34	76,016.58	373	12.26	152	19.20	.....	.....	467,813.57
Mineral	5,634.123	116,457.32	769,442.38	411,420.84	8,131,421	365,100.80	25,520	3,223.18	3,129,157	168,661.56	1,064,863.70
Montezuma	422.241	8,727.72	214.57	114 75	.....	.....	217	27.41	.....	.....	8,889.86
Ouray	107,007.180	2,211,838.41	417 080.04	223,493.93	4,043,070	181,533.84	654,295	82,637.46	.....	.....	2,699,503.64
Park	12,838.681	265,375.54	116,939.80	62,527.71	2,051,812	92,126.36	86,254	10,892.83	940,760	50,706.96	481,630.45
Pitkin	31.436	649.78	472,597.05	252,697.64	13,407,805	602,010.44	24,426	3,085.00	.....	.....	858,442.86
Rio Grande	63.188	1,306.10	61.19	32.72	246	11.04	.89	11.24	.....	.....	1,361.10
Routt	254.096	5,252.16	35.64	19.06	.....	.....	.....	.....	.....	.....	5,271.22
Saguache	52.263	1,080.28	6,296.83	3,366.92	193,823	8,702.65	7,429	938.28	.....	.....	14,088.13
San Juan	33,447.194	691,353.50	756,234.87	404,358.78	10,887,752	488,860.06	1,146,134	144,756.72	5,161,542	278,207.11	2,007,536.17
San Miguel	120,716.810	2,495,216.58	1,156,663.27	618,467.85	7,431,312	333,665.91	538,158	67,969.36	1,762,879	95,019.18	3,600,338.88
Summit	18,078.218	373,676.77	172,857.71	92,427.02	6,154,629	276,342.84	25,426	3,211.30	4,808,508	259,178.58	1,004,836.51
Teller	530,453.204	10,964,467.73	50,269.42	30,087.26	3,421	153.60	.....	.....	.....	.....	10.994,708.59
Total	981,980.440	$20,297,535.69	8,215,327.71	$4,392,735.72	70,565,369	3,158,380 54	8,304,312 Boulder County's production	$1,048,834.60	62,475,647 n of Tungsten	$3,366,437.41 for 1910.....	$32 263.923.74 $736,700.00
											$33,000,623.74

NOTE.—In the above table the calculations are made on the average price of the mineral for the year. Gold, 20.67; silver, .5347; lead, .0449; copper, .1263; zinc, .0539. The zinc figured on actual spelter recovered.

Decisions Relating to Mining

Specially reported for the MINING AND SCIENTIFIC PRESS.

INJURY TO MINER—MEASURE OF DAMAGES

An employee, or miner, negligently injured is entitled to damages fairly compensating him for his mental and physical suffering, loss of time, permanent impairment of money earning power proximately resulting from the injury, not exceeding the amount claimed in his petition.

West Kentucky Coal Co. *v.* Davis, (Ken.) 126 Southwest. 1074. June 1910.

REASONABLE AND ORDINARY CARE

Reasonable or ordinary care, as applied to a miner, to avoid injury by a locomotive and cars on a railroad track, operated in connection with a mine, is such care as an ordinarily prudent person will usually use under circumstances the same or similar to those proved in a similar case.

West Kentucky Coal Co. *v.* Davis, (Ken.) 126 Southwest. 1074. June 1910.

LOCATION OF MINING CLAIM—RIGHTS OF SUBSEQUENT LOCATORS

The law requires the locator of a mining claim to make his location so definite and certain that from the location notice and stakes or monuments on the ground the limits and boundaries of his claim may be ascertained, and so definite and certain as to prevent the changing or floating of the claim. And where a discovery is made on a vein and mineral-bearing rock, and the notice provides that such claim extends 700 ft. in a northwesterly direction and 800 ft. in a southeasterly direction from such discovery, and the corner stakes on the southeasterly end are so placed as to take in more than 800 ft. of such vein, subsequent locators may legally locate this excess of ground, as the first location is valid only to the extent of 800 ft. southeasterly from the point of discovery.

Flynn Groupe Mining Co. *v.* Murphy, (Idaho) 109 Pac. 851. June 1910.

LIABILITY FOR INJURY TO EMPLOYEE IN OPERATION OF A MINING RAILROAD

The employees in charge of a locomotive and cars on a railroad operated by a mining company in connection with its mine, are bound to keep a lookout for employees working near the track and to give reasonable warning of the approach by blowing the whistle and ringing the bell. And an employee in a mine working near a railway track, used in the operation and in connection with the working in the mine is bound to use ordinary care to discover an approaching locomotive and to avoid collision; but in such case whether the servants in charge of the locomotive were negligent, or whether the injured employee was guilty of contributory negligence, are questions for the jury. The rule is that the liability of a mine company for injury to an employee, caused in the operation of a railroad in connection with its mine, is governed by the rules applying to ordinary railroads; but the operator of the coal mine is not guilty of negligence in failing to equip the coal car with a fender or pilot.

West Kentucky Coal Co. *v.* Davis, (Ken.) 126 Southwest. 1074. June 1910.

Recent Publications

SUMMARY OF OFFICIAL REPORTS ON THE METRIC SYSTEM. 2nd ed. London, 1911.

ANNALES DA ESCOLA DE MINAS DE OURO PRETO. No. 10. 1908. Pp. 171. Ouro Preto, Brazil. This includes a series of technical papers dealing with the iron ores, railways, and irrigation works of Brazil.

PERMISSIBLE EXPLOSIVES. By Clarence Hall. Bureau of Mines, Miner's Cir. 2. Pp. 12. Washington, 1911. An account of the explosives tested at Pittsburg prior to January 1, 1911, and of precautions to be taken in their use; written in simple language.

SOLAR EPHEMERIS, 1911. By A. Lietz Co., San Francisco. This is an ephemeris in pocket form, containing complete tables for the determination for azimuth by observations on the sun, and also on Polaris. It forms a convenient appendix to the civil engineer's notebook.

BIENNIAL REPORT OF THE STATE GEOLOGIST. By H. A. Buehler. Missouri Bureau of Geology and Mines. Pp. 68. Ill. Jefferson City. While this is mainly an administrative report prepared for the Forty-sixth General Assembly, Mr. Buehler has included a preliminary account of the coal measures by Henry Hinds, and notes on the southern part of the State by V. H. Hughes and Wallace Lee. With these papers are hitherto unpublished maps that are of considerable value. Evidently the Missouri survey is doing good work and deserves consideration from the legislature.

DATA. This is a new monthly publication issued from 92 La Salle street, Chicago, and costing $1 per year. It bears the quotation, "Every engineer should make his own pocket-book," and proposes to aid in the making by publishing monthly on sheets of card-index size diagrams, tables, and data of value to engineers that may be filed in an ordinary desk card-file. This has much to commend it, but misses the point of the quotation. The reason why an engineer should make his own book is that by putting a sufficient amount of work into it he becomes familiar enough with it to make it really useful to him.

MINE RESCUE STATION COMMISSION, STATE OF ILLINOIS. Report to the Governor and General Assembly. Pp. 31. Ill. Springfield, 1911. In this modest little pamphlet is detailed briefly the record of a lot of good work. It will be remembered that following the Cherry disaster there was an investigation of conditions in Illinois mines as regards safety and that advanced legislation was shortly thereafter enacted. Among other things a mine-rescue commission was established. It includes representatives of the men, the operators, the inspection force, the Universities, and the U. S. Bureau of Mines. Under this commission three stations have been established for training men in rescue and first-aid work. In connection with them, cars have been equipped with men and apparatus to rush to the scene of any accident. It is pleasant to record that of the three cars one was given, fully equipped, by the Chicago & Northwestern railroad, another by the Chicago, Milwaukee & St. Paul, and the third, sold at a nominal price by the Pullman company, was equipped at the shops of the Toledo, Peoria & Western. This only illustrates the generous spirit of co-operation that has been called forth by the work of the commission. So far the rescue cars have not seen service, and it is hoped they may long remain idle. The training of men so as to prevent accidents, the real work of the commission, will necessarily be slow. Much has been accomplished by calling attention to the need and methods. In the long patient routine ahead of it the commission will have the good wishes of all interested in bettering conditions in the mines. Illinois has started a work that other States would do well to undertake.

H. F. B.

Company Reports

BRITISH COLUMBIA COPPER CO., LTD.

The annual report of this company for the year ended November 30, 1910, shows that during that time 441,672 tons of ore and converter slag was smelted, yielding 7,199,034 lb. of blister-copper, containing 24,962 oz. gold and 84,180 oz. silver, the average cost of production of copper being 9.048c. per pound. Most of the ore was derived from the Mother Lode mine, but the Wellington Camp, Oro Denoro, and Napoleon contribute about 15,000 tons each, while about twice this amount was smelted for custom work. The balance on hand is $731,265.75. The authorized capital is 600,000 shares at $5 each, of which 591,709 have been issued. The value of the properties as given in the balance sheet is $3,333,897.80.

ARIZONA COPPER CO.

During the year ended September 30, 1910, this company mined and treated 754,187 tons of ore of an average copper content of 2.13%. Of this, 559,250 tons of sulphide ore was milled with a concentration ratio of 5.14 tons into 1; 115,223 tons was treated by the oxide concentrator, and tailing amounting to 102,831 dry tons was leached, the copper production from the latter amounting to 11.3% of the total of 32,210,000 lb. of blister-copper for the year. The sulphuric-acid plant produced 2971½ tons of acid. The mine equipment and methods of work are being greatly improved; the square-set and fill method is being abandoned, and the use of electric power is being extended. In the Boulder mine 30,000 tons of 5% ore has been exposed, while in the Coronado mine there is 100,000 tons of broken ore in the stopes. In the latter property a shoot of sulphide ore averaging 3% copper has been discovered east of the main shaft on the 700-ft. level. West of the shaft on the same level a valuable body of ore was also found. This orebody is now practically exposed for 600 ft. along the vein. The ore retains its high-grade nature, the cross-cut nearest the breast exposing four feet in width of very high-grade sulphide with 12 ft. of good concentrating ore.

TEMISKAMING MINING CO., LTD.

The report of this company for the eleven months ended December 31, 1910, shows that 18,456 tons of ore was mined and 21,683 tons was milled. There was shipped 390.19 tons of hand-sorted ore of an average content of 3446.36 oz. silver per ton, and 651.77 tons of concentrate of an average silver content of 814.97 oz. per ton. The actual cost per ton of mining and development can be obtained only by wearisome computation, as the management has included over 10,000 tons of waste in computing the tonnage-cost of this work. The cost of milling was $2.54 per ton milled, and the cost of smelting the concentrate amounted to $1.31 per ton milled. The cost of hand-sorting was 55.3c. per ton of ore sorted. The total received from ore sales and shipments was $1,022,390.52, the cost of operations being $303,071.01, leaving a profit for the eleven months of $719,319.51. Of this, $22,605.63 was written off as depreciation, and $275,000 was paid in dividends, leaving a balance on hand of $431,017.56. As in the balance-sheet the value of the property is assigned as $2,421,117.73, and the equipment of the mine as $203,450, the amount set aside for depreciation is entirely inadequate; the 18,456 tons of ore extracted during the period under review represents a depreciation in the book value of the mine of $698,280, and no statement is given of any increase in the ore reserve to counterbalance this. The authorized capitalization is 2,500,000 shares of $1 each, of which 2,499,172 have been issued. A useful feature of this report is the appended drawings showing the mine-workings, the mill, and flow-sheet of the mill. A brief and lucid explanation of these would greatly increase their usefulness.

Personal

Professional men are invited to send news of their engagements and travels. Such news is interesting to friends.

A. F. McEwen, of Duluth, has gone to Nevada.

H. F. Bain and Charles Janin are at Angels Camp, California.

Frank A. Keith, of Los Angeles, was at San Francisco last week.

E. W. Carson, of Los Angeles, is making an examination in Nevada.

Charles Butters has gone to Salvador, expecting to return in June.

C. W. Purington is expected in London on April 15, from Chito, Siberia.

Morton Webber has gone to Porcupine and expects to be there for some time.

J. W. Thompson is law examiner for the Bureau of Mines, Washington, D. C.

John E. Pelton, F. W. Stall, and G. E. Hall, of National, Nevada, are at San Francisco.

Alexander H. Smith has gone to South Porcupine, Ontario, to remain several months.

Huxley St. John Brooks is metallurgist for the Major Mining Co., Benguet, Philippine Islands.

John Donaldson, secretary-treasurer of the Denver Fire Clay Co., was at San Francisco last week.

George R. Trask, of Wallace, Idaho, is in the Harshaw mining district, Arizona, making an examination.

R. Van A. Mills is at Tientsin, China, where he is professor of mining in the Imperial Pei-Yang University.

Jesse J. MacDonald has returned from an inspection of the Paradise Mining Co.'s properties, near Dagget, and is on his way to the Dale mining district.

W. H. Weed has finished the examination of the Petrazzini mine at Arizpe, Sonora, and is now examining the property of the Transvaal Copper Co., at Cumpas, Sonora, Mexico.

Andrews Allen and John A. Garcia have formed the Allen & Garcia Co., to act as consulting and contracting engineers. The offices of the new firm will be in the McCormick building, Chicago.

Marden W. Hayward, having recently completed a geological survey of the property of the Summit Copper Co., at Bellevue, Arizona, is now engaged in examining a number of mining properties in California and Nevada.

Frank H. Probert is at Ray, Arizona, looking over the Ray Central company property; in a few days he will go to Guanajuato, Mexico, to make examinations of the properties owned by the Proprietary Mines Company of America.

R. B. Lamb, of Toronto, has been in Cobalt and South Lorrain on professional work, and has left for Porcupine before returning to Toronto. He has recently been appointed consulting engineer for the Swastika mine in Otto township, Ontario.

The Los Angeles aqueduct in 1909 ordered a set of Pacific car wheels and axles, Anaconda type, from the D. D. Demarest Co. of San Francisco. These were designed especially to operate in gritty water. After a trial of more than a year the results were so satisfactory that repeat orders were given from month to month until they now have a full equipment for 120 cars. No engineering project is more carefully and economically conducted than the building of the Los Angeles aqueduct, and the result of the test given the Pacific Anaconda type of car wheels and axles speaks well for the engineering ability of the manufacturer.

Market Reports

LOCAL METAL PRICES.

San Francisco, April 6.

Antimony	12—12¾c	Quicksilver (flask)	$52½
Electrolytic Copper	14—15¼c	Tin	45—46½c
Pig Lead	4.75—5.70c	Spelter	7—7¾c

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

METAL PRICES.

By wire from New York.
Average daily prices in cents per pound.

Date.	Electrolytic Copper.	Lead.	Spelter.	Silver, per oz.
Mar. 30	12.05	4.43	5.46	52⅝
" 31	12.05	4.43	5.44	52½
Apr. 1	12.05	4.43	5.43	52⅝
" 2	Sunday.	No market.		
" 3	12.05	4.43	5.41	52¾
" 4	12.05	4.43	5.40	53⅛
" 5	12.05	4.43	5.40	52⅞

ANGLO-AMERICAN SHARES.

Cabled from London.

	Mar. 29. £ a. d.	Apr. 6. £ a. d.
Camp Bird	1 11 10½	1 13 4½
El Oro	1 4 9	1 4 0
Esperanza	1 14 4½	1 14 4½
Dolores	1 5 0	1 5 0
Oroville Dredging	0 5 9	0 5 9
Mexico Mines	7 13 9	7 12 6
Tomboy	0 15 0	0 15 0

(By courtesy of W. P. Bonbright & Co., 24 Broad St., N. Y.)

MINING STOCK QUOTATIONS—NEW YORK.

(By wire from Catlin & Powell Co., New York.)

	Closing prices, Apr. 6.		Closing prices. Apr. 6.
Amalgamated Copper	$ 62¾	Miami Copper	$ 19
Arizona-Cananea	3	Mines Co. of America	5⅛
A. S. & R. Co.	74¾	Montgomery-Shoshone	⅛
Braden Copper	3¾	Nevada Con	18⅜
B. C. Copper Co.	5⅜	Nevada Utah	⅞
Butte Coalition	17⅝	Nipissing	10⅜
Chino	22⅛	Ohio Copper	1⅝
Davis Daly	1½	Ray Central	1⅜
Dolores	5⅛	Ray Con	15⅞
First National	2	South Utah	⅞
Giroux	6	Superior & Pittsburg	14⅛
Greene-Cananea	6⅛	Tenn. Copper	38¼
Guanajuato Con	⅛	Trinity	4⅛
Inspiration	7⅜	Tuolumne Copper	4⅞
Kerr Lake	6¼	United Copper	4¼
La Rose	4⅜	Utah Copper	43⅞
Mason Valley	8⅞	Yukon Gold	3⅞

COPPER SHARES—BOSTON.

	Closing prices, Apr. 6.		Closing prices. Apr. 6.
Adventure	$ 5	Mohawk	$ 36½
Allouez	31⅛	North Butte	27⅛
Atlantic	3⅞	Old Dominion	36¼
Calumet & Arizona	53¼	Osceola	100
Calumet & Hecla	483	Parrot	11
Centennial	12⅛	Santa Fe	1
Copper Range	60⅛	Shannon	10
Daly West	4¾	Superior & Pittsburg	14
Franklin	9	Tamarack	37
Granby	35½	Trinity	4
Greene Cananea, ctf.	6⅞	Utah Con.	13
Isle-Royale	12⅛	Victoria	1⅜
La Salle	4	Winona	6½
Mass Copper	6	Wolverine	110

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

SOUTHERN NEVADA STOCKS.

San Francisco, April 6.

Atlanta	$ 10	Mayflower	$ 5
Belmont	5.75	Midway	19
Booth	13	Montana Tonopah	78
Columbia Mtn	2	Nevada Hills	3.15
Combination Fraction	11	Pittsburg Silver Peak	72
Fairview Eagle	50	Rawhide Coalition	3
Florence	1.52	Round Mountain	57
Goldfield Con	6.10	Sandstorm Kendall	9
Gold Kewenas	6	Silver Pick	5
Great Bend	1	St. Ives	16
Jim Butler	23	Tonopah Extension	1.10
Jumbo Extension	29	Tonopah of Nevada	8.00
MacNamara	12	West End	55

(By courtesy of San Francisco Stock Exchange.)

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EDITORIAL

IDITAROD has been swept by fire, with a resulting loss of $100,000, and the development of this promising new Alaskan district is likely to be seriously hindered by the disaster.

DR. RAYMOND, after twenty-eight years of devoted service as Secretary of the American Institute of Mining Engineers, has been appointed Emeritus-Secretary, to afford him in his seventy-first year the leisure his labors have so richly earned. Fortunately the ripe judgment and long experience of Dr. Raymond are not to be entirely lost to the Institute for many years, we hope. The Council has appointed Mr. Joseph Struthers, who has served as Assistant Secretary and Editor, to the position made vacant, and he will take up the work which the veteran Secretary has laid down.

THE RAND has paid dividends more substantial than those in coin. Mr. J. H. Dobson, in a valedictory address before the South African Association of Engineers, discusses at length the novel problems that presented themselves in the development of the art of mining and treating the deep-level ores, and the means by which the ingenious and capable engineers of the Rand accomplished their resolution. The roll of those who have made history in South African practice is a long and honorable one, and the Association may well pause for an hour to review what has been accomplished and to survey what still remains to be done.

IT has long been the fashion among leaders of finance in New York to ignore the fact that the gold in their vaults, the very basis of their monetary system, is the direct result of mining industry, and to treat with scorn all mining enterprises as being too highly speculative to be worthy conservative consideration. It is exceedingly interesting to watch the development of interest in the new gold camp of Canada. The 'big board', as the New York Stock Exchange is called by Wall Street, has always frowned upon mining investments, possibly because that body has believed that all of the money diverted into mining enterprises represents an equal amount lost to the Exchange. Now, however, trading has dwindled to such small proportions that even the New York Stock Exchange is welcoming the activity that has sprung up in Porcupine shares, as an evidence that there is a public that may be interested if the appeal is strong enough. The attitude of the Government in raiding various houses engaged in fraudulent promotions, and the strong intimation that newspapers carrying advertisements of such schemes were no

better than the promoters, has evidently had the effect of quieting the newspaper support for the Porcupine boom. Porcupine has continued to gain ground, but that the movement is largely psychological is shown by the growth of the excitement, for the most part, without any basis in actual news.

A RECENT REPORT of the Denver Chamber of Commerce on the mining industry of Colorado calls attention to the solid foundation upon which the industry is based, and concludes with the assertion that "the two great enemies of the mining industry are: (1) that class of promoter whose ability does not extend beyond separating other people from their money; (2) inexperienced, inefficient management." The former can be reached by legal means, but the campaign against the latter must be one of education, and every recruit to the forces that are making toward the placing of the business of mining in a sound and healthy state is welcome.

SCRANTON, Pennsylvania, will certainly have the best professional advice in settling the mine-cave problem. Messrs. William Griffith and E. T. Connor having studied the conditions for four months, the whole situation was recently reviewed above and below ground by an advisory commission including Messrs. John Hays Hammond, D. W. Brunton, L. D. Conkling, H. S. Drinker, Charles Enzian, J. A. Holmes, J. F. Kemp, W. A. Lathrope, J. F. McClelland, G. S. Rice, H. L. Smythe, and Lewis B. Stillwell. We understand that a preliminary paper will be published now, but that the United States Bureau of Mines will undertake some further tests before the final report is made.

PHILIPPINE dredging has not yet been particularly profitable to stockholders, if we may judge from the experience of the Paracale Gold Dredging Company. The net bullion returns on this enterprise in 1910 are given as $55,000, and there was some dissatisfaction among the shareholders at the absence of dividends. The teredo, it seems, ruined one hull, and a new one had to be built and protected by sheathing. The enterprises so far launched in the Paracale district are small. Just what could be accomplished with a large California dredge and resulting low working-costs is unknown. Probably the Philippines will have to pass through a period of small, expensively operated dredges, as California did, and the Nome district is doing, before a really large boat will be built in that district.

EXPERIMENTAL work in the mine as well as at the testing station is being conducted by the United States Bureau of Mines. In an interesting paper read before the Western Society of Engineers, April 5, Mr. George S. Rice, chief mining engineer of the Bureau, gave details as to the plans and purposes of the experimental mine recently opened near Pittsburg. Since explosive force travels through a mine in waves, there is distinct promise of finding a method of localizing any explosion. If Mr. Rice and his associates succeed in devising means of quarantining against blown-out shots, the achievement will rank with the discovery of means of controlling yellow fever. We are glad to see that the work at Pittsburg is standardized with that of the Canadian and European stations, thereby avoiding waste and duplication.

WISDOM and folly often come into conflict, and wisdom by no means always gets the best of the encounter. Now that science and fashion have warring interests in the platinum industry, it is extremely likely that science will be the one to suffer. For some years past the use of platinum in jewelry has been growing, and more recently a jewelers' association has been endeavoring to make it the metal of fashion for the coming year. Platinum is as necessary a commodity of scientific work as food is of the scientist's life; the price has always been so high as to constitute a serious burden on scientific research, and has recently nearly doubled. With the output of the present source of supply steadily decreasing, and the discouraging results of extended search for other deposits, the present tendency to increase the use of platinum as a decorative metal is much to be deprecated. The color of platinum is not so pleasing as that of silver, and the only advantage it possesses over the latter metal is that it does not tarnish. Public protest is unlikely to have any more effect than did the wielding of Mrs. Partington's broom. Apparently the only ray of hope left for the scientist is that a satisfactory method of making utensils of platinum plated-ware may at last be found.

Recklessness Again

Little more than a month ago we recorded the story of the disaster at Tonopah—a great matter kindled by a little fire, underestimation of danger, unpreparedness, and heroic efforts when attention and effort were too late to be of avail—and pointed out how similar it was to that at Cherry, Illinois, a year before. Now comes the story of Throop, Pennsylvania, where a small fire started in an engine-house at the opening of a slope leading from the Diamond seam, seven hundred and fifty feet from the surface. There were four hundred men at work in the mine, sixty of them in 'blind' workings at the end of the slope. The fire was discovered at nine o'clock in the morning, but no attempt was made to get the men out until eleven o'clock. By midnight seventy-three were dead, including John Evans, engineer in charge of the Bureau of Mines rescue car which had hurried to the scene. Only telegraphic accounts of the disaster have yet been received, but one lesson stands out plain: the grave responsibility which those in authority incurred in not promptly notifying the miners of the existence of possible danger. To have brought the men out early in the day might have resulted in the interruption of a shift's work for a very slight matter; leaving them at work has resulted in a long roll of dead. It is a national characteristic, this recklessness of danger. The small boy steals rides on street-cars and railroad trains, the grown man takes chances equally great, while many regard their actions with approval,

as exhibiting a virile and courageous spirit. It is easy to show the error involved in such a mental attitude, while the taking of chances with the lives of others as the stake is criminal. We get too business-like sometimes. The thoughtful address on 'The Balanced Life,' in our issue of February 18, lays stress on the responsibilities which no manager can escape. It would be well if every manager would take these lessons to heart.

Concrete

On another page Mr. Del Mar presents a discussion of the increasing use of concrete in mill and smelter construction. This is a recent development that promises to be so far-reaching in its effects that any discussion of it must necessarily be from many different standpoints in order that we may obtain a comprehensive view of the whole. Perhaps the most striking of its salient features is the probable effect upon the development of forestry. The great demand for timber for the enormous amount of construction work which had been created by the rapid development of our industries during the century past, has made serious inroads upon the forests of our country, and their impending destruction brought in its train questions of serious import to the National life. These have now been largely met by the increased care of the forests and the lessened demand resulting from the increased use of concrete. Of only slightly less importance from the standpoint of commerce and industry is the converting into valuable assets of the deposits of clay, shale, and limestone which until the advent of cement manufacture were almost worthless, but now have, in many cases, become the basis of great industries.

A most natural mistake in the development of a new method or material is the attempting to use it for many purposes to which it is unsuited, just as the small boy goes about with his new jack-knife, trying it on window-sills, doors, and on objects of metal and stone. It must be remembered that concrete is not at all suited to the construction of any building or other structure that is at all likely to require extensive alterations or to be temporary in its nature. When a prospector comes to a new gulch he does not proceed to erect a brick house: he puts up a tent, so that he may move on quickly and with little expense if the results of his prospecting prove unpromising. Even where ore-dressing mills have been so carefully designed and upon such reliable experimental data as in the case of those of the Nevada Consolidated, the Ray Consolidated, and the Miami, changes are at times necessary for the simple reason that no man can be sure of what he may want to do next year. In the case of ordinary small-sized mills the changes that the experience of actual operation proves necessary are often radical and sweeping. Wooden structures are quickly and easily altered, the old material often being of much use in the new arrangement, but concrete structures require much effort to change them, at correspondingly great expense, and the old material is frequently entirely useless. A timber foundation, for example, can be altered by the use of a saw and hammer, but to remove a concrete foundation dynamite is often the only effective agent, and unless the machinery is moved to a distance the effect upon it is likely to be disastrous. The razing of the seven-story reinforced-concrete building of the Baltimore *News* has called attention to this limitation to the use of that material and to a possible danger which is more seriously regarded in England than in this country. The strength and durability which make concrete a desirable material for many structures are distinctly undesirable qualities in a structure, or part of structure, which may soon require alteration or removal. The danger referred to is the possible rusting of reinforcing steel. While the steel in this building was in general in perfect condition, it appears that wherever any amount of water came into contact with the concrete, as in the roofing slabs and the floors of rooms containing shower-baths, a certain number of rust-pits were found. The concrete was apparently of good average quality, and the fact that no dangerous rusting had occurred may be due only to the short life (six and a half years) of the concrete. Possible protection against this danger is suggested by the good condition of the steel in the footings. These are below the ground-water level, but the greater thickness of concrete seems to have prevented rusting.

These are but two of the problems now under consideration by engineers concerned with, or interested in, the use of concrete. Among the more important and interesting of the many others are the increase in density and decrease in permeability of concrete by grading the sizes of the aggregate; the water-proofing of concrete; the effect of alkaline and other impure waters during and after setting; and the hydra-headed question of reinforcement—percentage, form, and position. Volumes have been written, and more will be written, before these questions can be answered with any authority, but a few practical conclusions have been reached. By screening the aggregate and mixing the different sizes in proper proportion, a mixture of one cement to ten aggregate may be as dense and rich as an ordinary 1–2–4 mixture, as has been shown in practice in construction of the new swimming pool at the University of California. A fairly dense concrete may be made practically impervious by adding powdered alum and ground clay, in almost any proportion not exceeding five per cent of the cement. Soap and alum have also been used with success, on the theory of the well-known Sylvester process of water-proofing brick-work. The effect of alkaline water is uncertain, and may depend on the characteristics of the cement and aggregate used, but is undeniably harmful in some cases. Any water containing salts which may be deposited as crystals will scale the surface of any but the densest concrete. A small proportion of clay or silt in mixing-water is not dangerous, unless organic matter is present. Acids, of course, are always dangerous. It would require a volume to even indicate the questions of reinforcement, but the chief difficulty in their discussion seems to arise from the lack, as yet, of reliable empirical data on which to base theoretical reasoning.

Modern Zinc Problems

By H. Livingstone Sulman

*In no department of metallurgy has development been more rapid than in the treatment of 'complex ores.' Just as the terms 'free milling' and 'refractory', as applied to gold ores, have lost their older significance, so a few years hence the word 'complex' will cease to be used as a prefix to zinc-lead-silver-copper ores, and as a reproach to reduction practice. Their treatment will, in the main, become normal, in the sense that each constituent metal will permit of the profitable recoveries now possible with its simple ores. Many millions of tons of such material have been found, and in some instances partly developed, whose contained metals at current prices render them equivalent in value to two-ounce gold ore. The importance of this outlook is now realized, and capital is being invested in such deposits with the assurance of their great ultimate value. The 'complexity' is due to the presence of blende, generally more or less ferruginous, in intimate physical association with galena and other minerals, but varying considerably in degree. It is unnecessary to detail the varying characteristics of the many typical complex ores, and I content myself with brief reference to one or two.

Most lead mines are also blende producers, and, similarly, every zinc deposit carries lead. When dressing operations suffice to yield the major part of the lead as a galena concentrate, and a substantial zincblende product, carrying from 45 to 50% of metal, the ore is not 'complex'; the lead mines of Cardigan, Cumberland, and Joplin are familiar examples. The finer or slime products from the crushing and dressing of such ores are still, however, complex, in the sense that the mechanical, or, indeed, other separation of an intimate mixture of blende and galena, still awaits a satisfactory solution. The Broken Hill deposits, with their intercrystallized galena and ferruginous blende, with the rhodonite and garnet gangue which formerly prevented the separation of the zinc, are now of decreasing complexity; and from being material affording but 16s. profit from £8 worth of metal content per ton, their tailing accumulations have, through the application of flotation processes, become a substantial source of supply for the world's zinc.

The slime reserves, however, still present considerable difficulties in treatment. A more truly complex problem (though on the eve of solution, if not indeed already solved) is that which occurs in the great deposits on the west coast of Tasmania, typified by the Rosebery and Mount Read ores. Their metallic contents are of somewhat higher value than those of Broken Hill, while the presence of copper adds to their complexity; the difficulty in this instance is that the ore contains but little gangue, say from 7 to 15%, its place being taken by pyrrhotite and pyrite intimately intercrystallized with blende and galena, the whole constituting massive mineral. Proximate methods of separation are therefore useless, and flotation could at best only concentrate 10 parts into 9, and with but incomplete separation of the individual sulphide minerals. Successful means of reduction must be sought in other directions, either by direct smelting, hitherto inefficient, or the removal of the zinc from the roasted ore by leaching processes, leaving the residue, carrying the lead, silver, and copper, to be dealt with by the smelter; such methods appear to promise well.

The San Francisco del Oro mine supplies another type of complex ore, one difficulty being the presence of a large proportion of fluorspar in the zinc concentrates, which render them unsuited to retort distillation. It is hoped to treat them in the De Laval electric zinc-furnace. As an example of an oxidized complex ore the zinc-lead carbonates, etc., of Rhodesia Broken Hill will be recalled. The variety of such ores is thus great, and while the main factor of difficulty, zinc, is surmountable in several ways, it is not to be supposed that any one process will attain to pre-eminent success with each and every ore-type to the exclusion of other methods.

Reviewing the various means by which such ores may be attacked, they appear to divide themselves into two broad classes—proximate or mechanical methods, and ultimate or leaching and smelting processes. Proximate methods are necessarily subject to the limiting conditions imposed by the crushing of heterogeneous material, and therefore to the possible complexity of even the fine particles. While generally cheaper in application than the ultimate method of hydrometallurgy, they involve less complete separations, and often the marketing of several grades of product, or loss of profit when by admixture these are sold as a single grade. Where both types of method are applicable there is the possibility of keen competition between them, and the final advantage can only be determined by the balance-sheet. Among proximate methods 'flotation processes' have rapidly come to the front, greatly modifying previous metallurgical practice; these are also referred to somewhat indiscriminately as 'oil' and 'surface-tension' processes. While all depend upon the molecular forces, small in range but of high intensity, which are exhibited at the surface of both solids and liquids, their mode of utilizing these forces varies considerably.

The simplest type is represented by the De Bavay process, used in the treatment of the zinc tailing or 'middling' by the Amalgamated Zinc Co. at Broken Hill; and by the 'Macquisten tube' employed at the Adelaide mine for the concentration of chalcopyrite from vanner tailing. In these, the surface-tension of water is used to float off the sulphide particles, which are not readily wetted, whereas the more readily wetted gangue particles sink, when a mixture of both is suitably presented to or upon a flowing water surface. Bradford, in 1885, was one of the first to use such a method for sulphide mineral concentration, but its application to the grading and cleaning of graphite has long been known and practised. The principle upon

*Presidential address delivered before the Institution of Mining and Metallurgy, March 22.

which these processes are based is seen in the tendency of a pyritic or gold tailing to float away during a hand-panning operation. None of these methods claims the use of oil in enhancing flotation, and they appear to be limited to separation of particles of sensible size, for the reason that slime particles in suspension offer great mechanical difficulties in their presentation afresh to a water-air surface.

A second variety is the Potter process, employed at the Proprietary mine; in this method, submerged mineral sulphide particles are caused to rise to the surface of a hot acidified pulp by the fixation of gas bubbles; the gas in this instance is carbon dioxide generated by the hot acid from the siderite contained in the ore. Calcite appears to be of little value in this particular case.

The third variation includes the well-known 'oil' processes of Elmore and Minerals Separation, Ltd., which secure the flotation of submerged mineral particles by means of bubbles of air, such particles having previously received a slight film covering of oil for the purpose of effecting the air or gas attachment. With flotation processes designed to raise submerged particles to the surface by means of gas it is apparently necessary for the gas to be generated in the pulp itself. Elmore effects this by liberating the air dissolved in the water by means of a vacuum; Minerals Separation accomplishes the same object by vigorous agitation and supersaturation of the pulp with air. The oil film used by both is for the better attachment of gas generated from solution, or, in figurative language, for cementing the oiled particle to the air bubble.

It will be obvious that these modified oil processes differ essentially from older methods in which metallic particles were brought into contact and held entrapped by sensible bulks of oil, the whole then being removed and the mineral recovered therefrom, although the somewhat obscure physical reactions by which the oil attaches itself preferentially to sulphide minerals, and water to gangue, are still utilized to the full. In place of the phrase 'preferential oiling to mineral,' it would be more correct to define these processes as dependent rather upon the 'preferential wetting' of gangue by water; and it is to surface energy of the various particles in regard to the liquids they preferentially attach, rather than to the surface tensions of these liquids, that we must refer the phenomena.

The use of oil for collecting or separating certain metals and minerals from worthless gangue is ancient of days. It is mentioned by Herodotus, in 'Melpomene' (194—IV), where he states, "* * * near them (the Carthaginians) lies an island called Cyraunis, 200 stadia in length, inconsiderable in breadth, easy of access from the continent, and abounding in olive trees and vines. They add that it contains a lake from the mud of which virgins draw up gold by means of feathers daubed with pitch"—an altogether charming vista. Two thousand years later Haines (in 1860) mixed ore powders with various fatty and bituminous substances, and thereafter kneaded out the gangue from the mass in hot water. Several others introduced modifications into this crude method. Robson was the first to wet the ore with water before adding the oil and mixing, while to a metallurgist of the fair sex, Miss Carrie Everson, we owe the important discovery that acidification of the ore pulp is necessary for the sharp oil-differentiation of mineral from gangue. It is, however, to the Messrs. Elmore that the undoubted honor belongs of first bringing oil-mineral processes into the region of commercial applicability and of securing the first success therein; their work focused the attention of metallurgists upon the great possibilities of these methods. That their original process has since been superseded both by their own later work and by that of others, cannot detract from the credit due to them as being the practical introducers of 'oil-separation' methods, and this will not be forgotten in the history of metallurgy.

To Froment, and especially to Cattermole, we are indebted for the next important development. The latter first demonstrated the efficiency of a very small quantity of oil in place of the large bulk hitherto employed. He used it to cement the mineral particles together into small shotty granules which were then capable of separation from the barren sands in a water upeast. Modern oil processes owe much to his researches, though, as is natural, further advances resulted in again reducing the quantity to the exceedingly small amounts now commonly employed for securing adhesion of gas or air to submerged mineral particles. The minuteness of the quantity of oil required to secure this result is remarkable, amounting as it does in some instances to but a few ounces to the ton of ore, which may carry 50% of its weight of mineral. Calculation demonstrates that the necessary uniform oiling of the countless millions of sulphide particles produced by the crushing of half a ton of friable mineral through a 60-mesh screen implies a thinness of oil film which approaches the lower limits of molecular attraction, being of the order of some 20 micro-millimetres, or considerably under the millionth part of an inch; such dimensions are far below the range of vision of the most powerful microscope.

The physical reactions which underlie all such methods have been insufficiently explored, and in many respects are still obscure; the striking practical results so far achieved have been reached quite empirically. I may perhaps be permitted to mention a new fact in relation to the measurement of the 'contact angles' which exist between the surfaces of aqueous liquids, and those of certain sulphides, silicates, and other solids. In investigating previously accepted figures for these, G. W. Thomson and I found a series of curiously discrepant readings, which on further research proved to be due to the existence of a variable range of the contact angle between various liquids and solids, though of constant magnitude of variation for each. This range of angular variation has been termed by my friend, C. G. Lamb, 'the angle of hysteresis,' and its existence and magnitude in regard to many substances have been independently con-

firmed and quantified by A. Howard Higgins. It is not a fact of merely academic interest, as it appears to be intimately connected with the ability of a given solid to condense upon itself a gas film; and when submerged in a liquid to determine the attachment of a gas when generated, or on the point of generation, from solution. It follows that angular hysteresis reaches its highest values for minerals which are the most susceptible of flotation, and *vice versa*. Some hundreds of observations have been taken, under the microscope and by lantern and screen methods whereby this relationship has been placed beyond doubt. Besides roughly quantifying the gas-condensing power due to the surface energy of solids, it brings us somewhat closer to an explanation of the efficiency of acidification. Thus, whereas the angular hysteresis of silica in plain water may exceed 30°, thus indicating that substance to have a definite power to occlude gas and to float, it drops from 4 to 0° in water acidulated with sulphuric acid. Galena, on the other hand, retains its full measure of angular variation, or is but slightly affected.

Returning to the practice of the various flotation processes at Broken Hill, the Zinc Corporation at present employs both Elmore and Minerals Separation systems, while the latter is also in use at the Central mine. The general result so far is the recovery of zinc concentrate, which, according to the process adopted, and the after treatment of the concentrate, may vary from 44 to 49% of zinc, together with substantial values in lead and silver. The latter minerals are in some cases partly removed by subsequent vanning, but even thereafter the main zinc product always carries a considerable amount of both—to the extent of 8 to 10% of lead, and some 11 to 13 oz. of silver. These concentrates are bought by European smelters, and are mainly shipped to the Continent for reduction. Taking the Central mine as an example of what is now being done with these hitherto refractory ores, and as dealing with sulphides originally containing 16.5% lead, 18.5% zinc, and 13 oz. silver, the final tailing from the flotation plant (exclusive of slime), amounting to half the weight of the ore, carrying but 5% zinc, 2.5% lead, and 3 oz. silver; this is equivalent to recoveries of 90% of the lead, 84 to 86% of the zinc, and 88% of the silver of the whole. This mine alone now supplies one-tenth of the world's total zinc requirements. The cost of the flotation process here employed is about 6s. per ton, including recrushing and payment for water. One reason for the ready sale of the concentrate is its uniformity of tenor, varying scarcely 1% in zinc per annum, a fact of obvious advantage to the zinc smelter.

They can at present, however, only imperfectly separate the floated minerals from each other, and the sale of their concentrate permits realization on but a portion of the lead and silver carried therein, owing, in turn, to the inability of the smelters to more than partly recover them. Indeed, the separation of the lead from the zinc in these concentrates could be pushed somewhat further than is practised. This is due to the zinc smelter requiring a certain proportion of lead to aid in the recovery of the silver, as prills of low-grade bullion, from the residue left after distilling the zinc. The method of recovery is by washing, that is, water concentration of the seconds, and is very generally practised on the Continent, and often in South Wales.

While certain difficulties yet remain to be solved, especially in regard to blende and galena slime—for it must be remembered that most of the methods referred to result only in the separation of sulphide particles of sensible size from the gangue—the Broken Hill problem may be regarded as solved, to the extent which proximate methods as yet permit, by the advent of flotation methods.

The zinc industry has undergone a marked change of late years; with the gradual exhaustion of calamine supplies, and even of the richer blende ores, and to the increasing demand for spelter, sulphide ores are now readily purchased which earlier would have found a poor market. It is not long since 50% of zinc in a blende product was a standard which admitted of little reduction. Smelters will now readily buy 45% and even 40% blendes if they contain other metals to recoup the loss due to decreased zinc: but such foreign metals are naturally paid for at a low price, from the incompleteness of their final recovery. That these secondary sources of profit may nevertheless become substantial is evidenced by the fact that, whereas concentrate was a short time since subject to penalty for shortage of zinc below a certain figure, and the producer therefore did his best to increase the zinc tenor and to decrease that of lead and silver, he is now in the curious position of being penalized for zinc above a certain limit, when this involves what the smelters consider to be an undue absence of silver and lead, in connection with a given smelting charge. This applies particularly to Broken Hill concentrate.

(*To be continued.*)

MARCH COPPER MARKET

By Misha E. Appelbaum

The copper market during the month of March fluctuated between 12⅜ and 12¼, delivered thirty days. The buying was still of a hand-to-mouth nature, the principal demand coming from the wire-drawers. The export deliveries were 59,000,000 lb., and the domestic deliveries were 66,000,000 lb., and if the production had been at the same rate as during the month of February there would have been a decrease in a visible supply; however, with a production of 130,000,000 lb., there was an increase of 5,000,000 lb., and while the quantity in itself is not large, yet the large production offers very little inducement for the consumers to buy more liberally than in the past. The general business conditions are quite below normal, and therefore, unless there is a sharp improvement in business, or a radical curtailment in the production takes place, the best one can hope is for copper to remain steady at the present level of prices.

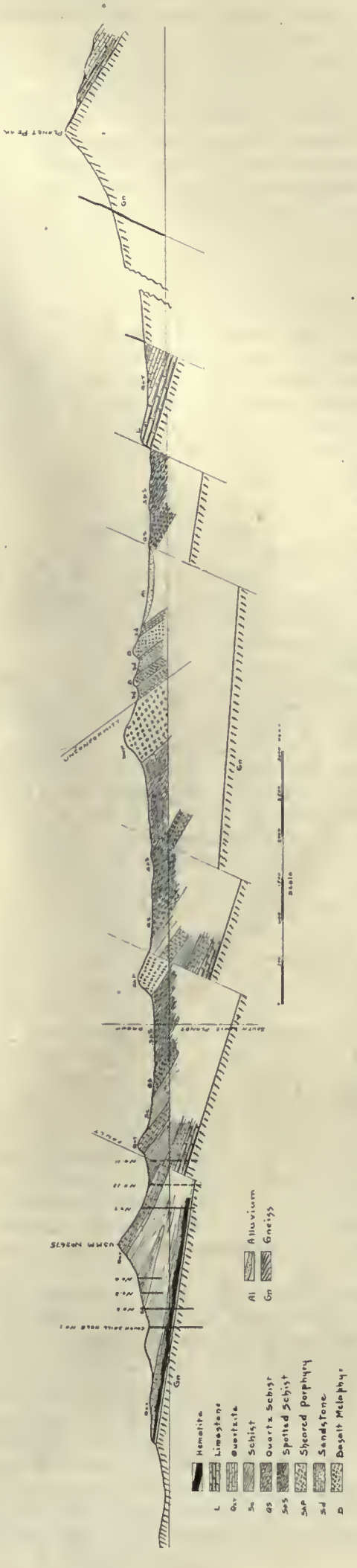
Specular Hematite Deposits, Planet, Arizona

By W. E. Upham

The Planet mine, situated in western Arizona, on the south side of the Bill Williams river, twelve miles from its confluence with the Colorado, has become quite familiar to those interested in mining affairs during the past fifty years, because of its extensive deposits of specular hematite, and of particular interest to copper operators because of the abundant association of silicate and carbonate of copper with the hematite. Deposits similar to those at Planet are rather frequent in the west-central part of Arizona, and many an engineer who has been called upon to give an opinion as to the possibility of their economic exploitation for copper or iron has been much perplexed by them. To the prospector searching for the indications of large and valuable deposits, the conspicuous outcrops of the hematite and copper minerals immediately suggest gossan, and the silicious hematitized and copper-stained croppings are reasoned to have been derived from a pyrite deposit, carrying copper, with a possible chalcocite zone of secondary enrichment.

Conservative engineers have also been prone to take a similar view of these deposits, and on the basis of favorable opinions several attempts have been made to develop them, prominent among which was that of the past year at Planet, where operations were undertaken to discover and delimit the expected pyrite ore by means of churn-drills aided by shaft-sinking and cross-cutting. None of the attempts have yet succeeded in proving relationship between the specular hematite and pyrite deposits. Nor does a close study of all the evidence available in the Planet district tend to support any theory of derivation from pyrite.

Geology.—The rocks of the Planet district, as well as a large part of this portion of the Territory, are very old. The Bill Williams drainage basin exposes the Archean complex, from which, east of Planet, erosion has left but patches of Proterozoic (Algonkian) rocks, and truncated their upturned edges in the immediate vicinity of the mine. The Archean erosion surface has lost its continuity through faulting, but nowhere in the immediate vicinity of Planet do exposures show the upper contact of the fault blocks of Archean rocks to be inclined more steeply than 7 to 9°. Local dips of the contact of Proterozoics with Archean rocks appear to be southwest, while the regional dip of the contact is northwest, the Proterozoic rocks disappearing in that direction beneath flat-lying beds of sandstone and lava flows of much more recent age. Section No. 1 shows a vertical section taken from Planet peak to the Bill Williams river, a distance of about eight miles, direction N.2°W. magnetic, cutting across the mining property of the Planet Copper Co. The faulting of the Archean gneiss, as hypothetically indicated, gives a basin-like structure to the district. It is probable that all of the

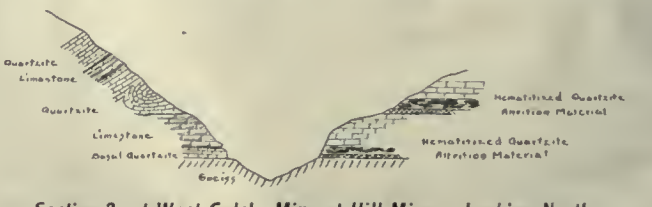


Section 1, From Planet Peak to Bill Williams River. Looking N. 88°. E. Magnetic.

upper contacts of the Archean fault blocks are comparatively flat-lying, as shown, while the Proterozoics have been tilted up into steeper positions, approximately as shown, by lateral thrusting, which has occasioned thrust faults and folding.

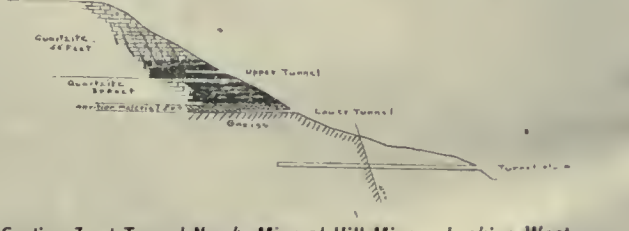
Considerable difficulty is experienced, at first sight, in acquiring a working acquaintance with these old Proterozoics, due to their extreme metamorphism and physical disturbances. Of the latter, besides disturbances due to thrusting and folding, removal of entire beds from areas represented entirely, or in part, by the tops of certain fault blocks, through leaching processes, has caused uneven subsidence of, and consequent shattering and crushing in, overlying strata. Where the leaching processes have been most active (as at the north exposure of gneiss contact, section No. 1) the basal parts of the Proterozoic rocks have been greatly affected and the apparent sequence of sedimentary deposition obscured. A section where such leaching action has been at a minimum is obtained in the west gulch at Mineral Hill mine, three miles west of the U. S. M. Mon. No. 2675 at Planet. This section is exhibited by section No. 2. The west side of the gulch shows Archean gneiss overlain by a basal quartzite (more properly arkose) 8 ft. thick. Overlying this occurs a lower limestone bed 10 to 15 ft. thick, followed by quartzite with schistose tendency, upper limestone bed 4 to 20 ft. thick and again quartzite grading into quartzose schist. On the east side of the gulch it is seen that where leaching processes have been active the basal quartzite (arkose) and lower lime beds have disappeared, their places being taken by the clayey residual matter of both beds. The upper lime bed has also disappeared and its position only recognized by an attrition material resembling indurated red sandstone. This has resulted from the intimate mixture and metamorphism of such clayey matter as was left by the limestone, and quartz sands from the leached upper part of the next lower quartzite, the processes introducing hematite. The complete removal of the lime beds and basal quartzite (arkose) is again noted in section No. 3, taken about 1200 ft. east of north of section No. 2. Here the gneiss is overlain by attrition material 5 ft. thick representing the metamorphosed residual products of the basal quartzite (arkose) and lower lime bed. The position of the upper lime bed occurs just below the upper tunnel, bottoming the upper 55-ft. quartzite bed. Its position is marked by 15 to 18 in. of material resembling indurated red sandstone (not indicated in the sketch).

A study of sections No. 2 and 3 simplifies the estimation of the basal parts of the Proterozoics at their northern exposure at section No. 1. Here the gneiss is overlain by varying thicknesses of clayey matter (1½ to 4 ft.), representing all that is left of the basal quartzite (arkose) and its overlying lime bed. A quartzite bed, largely replaced by specular hematite, follows. The sketch shows this to be quite continuous, but as a matter of fact in places this bed has been entirely leached out, leaving behind only the hematite which formerly partly replaced it. Again following is a series of quartzose schists (Sc) varying from greenish quartzites through greenish to grayish schists, with recurring variations, to a quartz schist (QS), this being a quite uniform and distinctly noticeable bed of white quartz schist. Characteristic of the Proterozoic age, the two following members are probably interbedded intrusive sheets, the lower a quartz-porphyry now mashed and sheared to a gray-colored, spotted schist (SpS), and the upper a sheared quartz-porphyry (ShP), red in color, due to the liberation and oxidation of the iron of its ferromagnesian minerals. The truncated edges of the latter form the bold, red ridges running in a parallel direction across the country, east and west,



Section 2, at West Gulch, Mineral Hill Mine. Looking North.

south of the Planet mine, and, not without reason, may be easily mistaken for porphyry dikes. Next, following an unconformity, is a series of basalt sheets, interbedded with loosely constructed sandstones with conglomerate phases. South of these,



Section 3, at Tunnel No. 4, Mineral Hill Mine. Looking West.

faulting and erosion have brought the more metamorphosed Proterozoic and Archean gneiss again to the surface.

Source and Manner of Deposition of the Hematite.—Referring to section No. 3, if it were continued back toward the south it would be found to cut through added thicknesses of a green quartzite, with schistose tendencies as variations, until a total thickness of 500 to 600 feet obtains. The exposed surface of this quartzite appears to be leached in circular or elliptical areas to a generally reddish colored quartzite or quartzose schist, which, upon close inspection, is found to be light gray in color with zonal red coloration due to deposition of red hematite along fissures which carry thin veinings of specular hematite. From the top of the series, and especially in the leached zones, the amount of the specular hematite fingering increases until the base of the series is reached at the upper tunnel, where the quartzite has been almost entirely replaced by specular hematite for a thickness of about 15 feet. The quartzite bed between the upper and lower tunnels is also largely replaced by specular hematite.

Specimens from the green and adjacent leached quartzite were taken from the part of the surface showing leached areas, before spoken of, for analysis

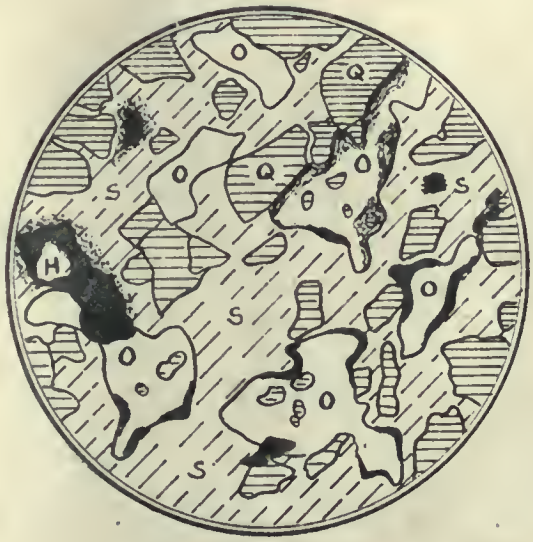
and microscopic examination. Rock section No. 1 is of green, unleached quartzite, and shows the rock to be a metamorphosed clastic rock composed of water-worn quartz grains, somewhat attacked by leaching action, with interstitial filling of chlorite. The rock from which this section was taken analyzes 7.02% metallic iron. Rock section No. 2 is of light-gray, leached quartzite. It shows a metamorphosed clastic rock with water-worn quartz grains with interstitial spaces incompletely filled by secondary quartz, the rest being in open spaces representing a condition of increased porosity. Hematite lines the open spaces in part and is incorporated with the secondary quartz, but scarcely in sufficient quantity to influence the light-gray color of the rock. The rock from which this section was taken analyzes 0.5% metallic iron.

The chlorite, then, of the green quartzite, appears to have furnished a large percentage of iron which has migrated in the leaching process. This migration has been by way of fissures, downward through the rock, leaving trails of hematite, as the ferrous solutions have encountered oxygen, until the base of the series was reached, when the conditions were such that complete oxidation took place and the hematite metasomatically replaced the quartzite. While a replacement of limestone by the hematite is frequently to be observed, still it is only too apparent that the limestone has acted the part of an unwilling host, while the quartzite has accepted the intrusion readily. The replacement of the quartzite by hematite is to be considered the primary concentration of the iron. If the quartz remnant of the partly replaced quartzite be completely removed without accompanying hematitization, then a secondary concentration is accomplished. In this manner the granular specular hematite deposits of the Planet mine have been derived. Since veins of specular hematite occur from the top of the spotted schist, down, it is probable that the ferromagnesian minerals of the original quartz porphyry, from which the spotted schist is derived, played their part in supplying ferrous iron to migrating solutions.

Rock-Section No. 1. × 20 Diam.

Q—Quartz. S—Secondary Quartz.
O Cavity. H Hematite.
Without Analyzer.

Relation of Copper Mineralization to the Hematite.—Chrysocolla (silicate of copper) appears as the most abundant copper mineral at, or near, the surface. With it is usually associated some malachite (carbonate of copper). Very rarely, small veinlets in the quartz schist carry still unoxidized copper-bearing pyrite, and at times the veinlets exhibit concentration of the copper by chalcocitization, when surface erosion has exceeded oxidation in the more impervious parts of the schist. As with the hematite, the copper-bearing solutions have been capable of replacing quartzite. This appears quite generally where hematitization has occurred and very frequently where it has not. Where the hematite is indurated and capable of being fractured, invariably the copper, as silicate, is found to fill the fractures. This general relation affords clear evidence that the movement of the copper-bearing solutions, in the main, has been subsequent to the hematitization. The source of the copper is doubtful. It is probable that igneous intrusive or extrusive sheets later than the unconformity indicated in section No. 1, now eroded, was the source of supply, the migration being effected by downward-percolating solutions. The whole series of the more metamorphosed Proterozoic rocks is cut by small copper-bearing veins, replacements by copper minerals taking place more generally in the quartzite beds (Qzt) and in the quartz schist (QS).



Rock Section No. 2. × 20 Diam.

Q—Quartz. S—Secondary Quartz.
O Cavity. H—Hematite.
Without Analyzer.

Relation of Pyrite Mineralization to the Hematite.—Pyrite is much more conspicuous by its absence in the Planet district than by its presence. It is true that sparsely disseminated pyrite does occur, and considerable importance has been attached to the fact that some of the dissemination has been within the specular hematite itself. In this case the hematite is to be considered simply as a basic rock with a rôle only less varied than that of any more complex rock because of its simple and exceedingly stable character.

Re-Soiling Dredged Areas in Victoria

In response to the request of A. C. Veatch, chairman of the Land Classification Board of the Department of the Interior, for information as to what is being done to re-soil dredged areas in Victoria, E. H. Goodenough has made a report, the following summary of which is given in the *Australian Mining Standard*. The regulations governing the dredging industry in Victoria provide that where the top soil is more than 2 ft. deep it must be advance-stripped to a depth not exceeding 7 ft., conveyed in a dry or moist condition, and deposited evenly on top of the coarse material. Where the soil is less than 2 ft. deep, as much of it as possible shall be spread over the surface. Difficulty is experienced in complying with these regulations.

At the Collegian dredge, working near Bonnie Doon, the appliance in use for replacing the soil is a chute made of sheet iron ⅛ in. thick. The total length of the chute is 80 ft., its breadth 46 in. across the top, and its depth 18 in., having curved or rounded sides and bottom, and when being utilized lies inside of and along the whole length of the ordinary timber sluice-box. With the full length of the chute in use it delivers the earthy material 27 ft. beyond the end of the wooden gold-saving sluice-box. The chute is made in four sections, the upper one, 20 ft. in length, being removable, and this is hung up clear of the sluice-box when dredging of gravelly wash is in progress. The next section is hinged at its lower end so as to admit of its upper end being raised out of the way when not required for re-soiling. The next length is fixed, and the last piece, 8 ft. in length, is on a hinge at its upper end, thus allowing it to be turned up when not in use, and lowered again into place when required to carry the soil to the farthest possible distance from the face. The upper section, 20 ft. in length, when in position for re-soiling, has a pitch of 3 in. to the foot, and is so placed that the top end nearly touches the lips of the buckets as they revolve. The rest of the chute has a grade of 1¾ in. to the foot. When dealing with soil or overburden only, the pitch is sufficient to carry the material deposited from the buckets along the chute with the help of a little water. When, however, there is an appreciable proportion of gravel deposited with the earthy matter, the mixture heaps up and requires a push to start it along the chute. The additional water required to gravitate the overburden to the top of the dumped gravel at the stern of the dredge, besides that which comes up in the buckets, is admitted to the chute through a 3-in. pipe, but this pipe does not run full. At date of inspection the discharge was about 10 cu. ft. per minute, while the volume of solid material being moved along the chute was about 30 cu. ft. per minute. Occasionally the 3-in. pipe is blocked by clay, etc., deposited in the chute by the buckets, and at such times the services of a man are required, for a few minutes, to shove the material and start it along toward the tailing dump. Sometimes a whole shift is run without the assistance of this man. It is estimated that this extra work costs about 10s. per week. Between the end of June and the beginning of August 1910, about 1¾ acres had been done, of which half an acre had been neatly leveled off by three of the dredgemen with shovels, working occasionally, and the cost of the work was estimated at about 10s. per week, or, say, £2 per acre. When leveled off, the surface of the re-deposited material is about 12 in. above the adjacent natural surface, and the depth of soil and earthy matter so replaced and leveled off averages from 2½ to 3 ft. In the working face on 5/8/10 the overburden was 4½ ft. thick, consisting of dark-colored soil, sandy loam, and clay, overlying coarse gravelly wash. The water-level in the operating pond was from 1 to 4½ ft. below the surface of the ground. The centre of the lower tumbler-shaft was 3 in. out of the water, and the cut made extended back 6 ft. from the face. The drop from the centre of the top tumbler-shaft to the bed of the soil chute is 3½ ft., of which 2 ft. is occupied by the buckets, leaving 18 in. of a clear fall. Some of the buckets do not empty freely, and most of the contents fall into the well-hole. Occasionally buckets come up with some water, but no dirt. On 5/8/10, the material deposited in the chute was mostly large clods of soil and clay ranging in size from 12 by 6 by 4 in. to 18 by 9 by 5 in.; also some stones were noticed up to 5 by 5 by 4 in. The pitch of 3 in. to the foot at the upper end enables the deposited material to get away readily and reach the tailing dump, after a few short stoppages in the flatter portion of the trough, without much delay. The depth of the material sliding along the chute was usually from 12 to 15 in. The dredge-master stated that with sandy loam soil, the discharge from the 3-in. pipe had to be cut off; such material did not need so much water to move it along as did the mixed material. The advance stripping at this dredge occupied about four hours per day; from the upper tumbler shaft to the deck 19½ ft., and to water-level 22½ ft. The cost of providing and installing the re-soiling appliance on this dredge was less than £100. To obviate the occasional attendance of a man at the head of the chute to give the stuff a start, it is intended to provide an appliance, so arranged as to work automatically from the main shafting. The cost of this arrangement will be moderate. (See illustration, showing soil chute and re-soiled ground.)

Porepunkah Dredge.—A somewhat similar re-soiling appliance to the foregoing has recently been installed on the Porepunkah Dredging Co.'s ground at Porepunkah. The overburden to be dealt with here is of a more friable nature than that at Bonnie Doon, but notwithstanding this, fairly good results were achieved on an area of about one-quarter of an acre which had been re-soiled on 26/10/10 with sufficient material to give an average thickness of 18 in. when leveled off. After that the bedrock rose rapidly, and the dredged material was insufficient, when dumped back into the deeper ground, to show above water-level in the operating pond. Since then the

dredge has been turned round to make for deeper ground, and it is likely that the soil chute will be used with satisfactory results. The overburden is a light sandy soil overlying clayey material and is of poor quality for agricultural purposes.

Good results are being obtained by Hinnomunjie No. 1 plant, working on Livingstone creek, a few miles down stream from Omeo. In this case the ordinary wooden sluice-box is utilized to conduct the soil from the buckets to the dump, but an additional 30-ft. length is brought into use when advance stripping of the overburden is in progress. This admits of the earthy material being deposited well back from the face of the dump, and there retained on top of the gravelly wash, in place of being sluiced back into the operating pond at the stern of the dredge, which would otherwise necessarily occur owing to the large quantity of water required to force the material along the comparatively flat slope of an ordinary sluice-box. The ground being treated in this locality was originally a low-lying marshy area of good black soil. As a result of the early mining operations conducted upstream, more than fifty years ago, the surface of the flat was covered by mining débris to depths of from 3 to 4 ft. Owing to the tenacity of the clayey black soil and to the fact that much of it is matted and held by roots of former vegetation of the swamp, very good results are being obtained in the way of re-soiling, as this black soil brought up from below the old mining débris is deposited in a layer 2 to 4 ft. thick by this plant on the top of its own coarse tailing in large solid lumps, practically unchanged from its virgin state. Certainly this re-soiled land is in a more useful condition at present than it has been during the past fifty years. The surface soil is advance-stripped and conveyed through a main box, where an adjustable extension carries the soil out above 12 ft. beyond the gold-saving boxes. The ground is graded and is covered to average depth of 3 ft. of soil. The area re-soiled is about 30 acres, and oats and potatoes were grown on the dredged ground the first year after treatment. The ground is about 30 ft. deep; the dredge works over 5000 cu. yd. per week. The soil in the face is black, stiff, and swampy, and is stripped separately. About 80% of soil is restored to the dredged ground.

At the Briseis company's No. 2 plant an interesting development has taken place in the matter of advance-stripping top soil and earthy overburden, and depositing it in a useful condition on top of the wash and other coarse material which has passed through the sluice-box. The Briseis company's bucket dredge, known as the Red Bluff No. 2 plant, is provided with a belt-conveyor, and is the first gold-mining dredge constructed in this State on which the use of an effective appliance to deal satisfactorily with overburden has been made a special feature. The plant may be simply described as an ordinary bucket dredge, with sluice-box and belt-conveyor. During the course of an inspection it was ascertained that the buckets, having each a capacity of 4 cu. ft., were traveling at the rate of 12½ per minute. Most of the buckets came up full of earth, but those in which the soil was well pressed did not discharge their contents wholly into the drop-chute, from which the conveyor is fed. In such cases about one-half of the material dropped into the chute, and the rest slipped down the well-hole into the operating pond. The material from the buckets may, by means of the drop-chute, be diverted into the sluice-box or to the conveyor. When overburden is being dealt with, the material from the drop-chute passes to a shaking table operated by springs and eccentric rods, thence on to a traveling belt or conveyor, which may be adjusted to any desired angle. By this appliance it is carried along and dumped well clear of the stern of the dredge, on top of the gravel, previously run through the sluice-box. The rubber belt is 125 ft. long, 2 ft. wide, ½ to ⅝ in. thick, travels over iron rollers, on a steel-framed elevator at the

Re-Soiling Chute, Collegian Dredge.

rate of about 100 ft. per minute. At the date of inspection the buckets were operating on a face of overburden extending from a depth of 8 ft. below water-level, to a height of from 3 to 6 ft. above it, while the depth of soil deposited on the gravel behind the dredge ranged from 3 to 6 ft. Probably about one-third of the alluvium was conveyed by the belt and dumped in a dry and useful condition, one-third went through the well-hole, into the pond, and one-third was scooped up with the auriferous gravel by the buckets, and after passing through the sluice-box was discharged in the form of sludgy water at the stern of the dredge. Revolving tines since have been provided to empty the buckets, and these latter could be altered slightly in shape so as to let the stuff drop out more readily. This is the first plant to install a belt-conveyor to strip and convey the surface soil to the top of the worked gravels. Overburden is deposited behind the dredge in fairly straight rows from 3 to 6 ft. high and 10 ft. apart from ridge to ridge. Area re-soiled on 7/10/09 was 1¼ acres, and requires spreading and grading. About two-thirds of overburden treated

could be transferred from the working face of the cut to the dump at the rear of dredge in a practically dry and uninjured condition.

Briseis No. 1 Plant.—At Briseis No. 1 plant good work is being done in soiling. Overburden is being replaced to depths varying from 4 to 6 ft. on top of the gravelly wash. Grass and clover are growing on those portions of the dredged ground where the re-soiling material has been exposed for two months. The general condition in regard to the character of the ground and the methods adopted for treating same, are somewhat similar to those described in connection with Hinnomunjie No. 1 plant.

Briseis No. 3 Plant.—The Briseis company's plant No. 3, recently constructed at considerable cost, has been provided with a belt-conveyor, and other appliances for re-soiling purposes. Sufficient dredging work has not yet been done with this plant to ascertain exactly what it is capable of doing in the matter of re-soiling worked ground; it promises, however, to be a success.

Another new departure has been taken in regard to re-soiling devices, so far as Victoria is concerned, by the proprietor of the Myrtle Queen dredge working in the Ovens River valley a few miles below Myrtleford. Shortly described, the contrivance consists of an ordinary chute or flume of sheet iron, say, 2 or 2½ ft. wide, with semicircular bottom and vertical sides, and long enough to extend from the upper tumbler shaft to some distance beyond the stern of the pontoon. Inside of this chute and along its whole length, a screw-like mechanical appliance will revolve, by means of which the earthy overburden delivered by the buckets at the upper end of this trough will be shifted forward and deposited on top of the dredged gravelly wash at the stern of the dredge, in almost a dry condition. It is really a screw-conveyor in an open trough, and will shortly be ready for use.

Goldfield Consolidated mill performance in March is given in preliminary figures as, 25,814 tons milled; $1,040,000 gross value; $215,000 total costs. The company expended $195,000 in purchase of additional interests in the Jumbo Extension and Vinegerone. These properties have been operated by the Goldfield Con. M. Co., though owned in part independently. C. S. Herzig, consulting engineer for the Jumbo Extension Co., estimated 73,000 tons of ore blocked out in that property last year. In some quarters this estimate has been criticized as excessive, but a recent examination of the property by G. F. Lewis more than verified Mr. Herzig's figures, Mr. Lewis reporting 87,400 tons, worth $41 per ton. That the Goldfield Consolidated has been studying the ground carefully has been shown by the reports since December.

A power station at Lanekhammer, in Germany, is now transmitting electric current at a pressure of 110,000 volts, which constitutes a record voltage as far as Europe is concerned. The transformer plant, of Siemens-Schuckert type, consists of four three-phase oil-cooled transformers, which step up the generator pressure to the transmission voltage.

The Paracale District

By An Occasional Correspondent

There has been much activity in the Paracale district of the Philippine Islands both in lode mining and placer mining, but the region as a whole has not emerged from the prospecting stage so far as one may be able to judge from the present development and the possibilities in view. Two or three mines, however, are well on the way toward being made into substantial dividend-payers, while results from one dredge in particular that is now operating, together with the returns of some hundreds of test-holes recently put down, go to prove that the

Map of Luzon, Showing Paracale District.

district will finally establish itself as a good producing centre. At the present time the means of communication and its frequency is not what it ought to be to handle the business, both mining and agricultural, that is being developed in the provinces of southeastern Luzon. The service consists of a passenger and freight steamer, making a visit from Manila twice a month. The time of the run from Manila to Paracale is about four days. An overland route to Manila has already been surveyed and it is hoped that a railroad will soon be built. This will give the district daily train service with a run of about one-half a day. Among the placers situated along the Paracale river, those that have been thoroughly tested and their worth proved are the Paracale Gold Dredging Co., the Philippine Exploration Co., the Stanley Gold Dredging Co., and the Para-

cale Extension Gold Dredging Co. Of these the Paracale Gold Dredging Co. and the Stanley are operating, while the others are about to install dredges.

The lower part of the Paracale river runs through large mangrove swamps which necessitate considerable clearing to make the ground dredgable, while farther up, areas of nipa occur, and finally, at the source of the river, there are rice paddies and meadow through which streamlets pass from the

Driving Casing and Lowering Sand-Pump.

surrounding hills. The ground on the upper river has been thoroughly tested and found to average as well as the lower river.

The usual rocks of the district are coarse granites of a gneissic character. Schists, shale, and sandstones are also common to a lesser degree. The region has a great number of quartz veins running in a more or less parallel direction. These veins occur in granite for the most part, but are also found at contacts of granites and the more basic intrusives. The shales and slates in the hills have contributed to the formation of a thick bed of clay in the placer ground. This clay varies in thickness from a few feet to as high as eighteen. It is noticeable that this clay carries gold immediately below the grass roots in the region near the foothills, while farther down the river the gold occurs for the most part close to bedrock, over which is several feet of gravel wash consisting of quartz and eruptive rocks up to 2 inches in size and mixed with the clay. The greatest quantity of gold is found in this layer. As a general rule the number of pebbles present is a sure indication of the richness of the placer. The gravel in the placer has been produced by comparatively recent erosion. The gold is bright, ranges from fine to coarse, and is often spongy in appearance. It is mixed with considerable magnetite and iron pyrite. The presence of sulphides, even in the placers, is to be expected in a region where the rainfall is great, a condition that seems to be quite common in most of the tropical countries. Some thoroughly oxidized portions of lode matter are found on the outskirts of the placers, but these are only local in occurrence. In the lodes the sulphide ores are found immediately below the outcrops in most cases. The bedrock is granite or gneiss and soft enough to drive a pick into it. The depth is variable and ranges from

Raising Casing, Paracale.

12 to 45 feet. The auriferous gravel appears to occur in streaks and follows channels of varying depth and width. It is this condition that makes it advisable to bore more test-holes for a given area than is commonly done in other placer districts. As many as five holes per acre are driven.

Drilling is done by the driving of an ordinary 3-in. wrought-iron pipe casing with smooth joints, and lifting the material out with a flat-valve sand-pump. It is not necessary to use any special means of driving through this tough clay other than the method shown in the photograph. The weight of four men standing on the cross-arms of the casing and rotation of the same by another man is found to be sufficient for depths to 40 ft. The number of feet driven per 10-hour day is about 40, at a cost of 20c. per foot.

Paracale Dredging Ground, Upper River.

Concrete

By Algernon Del Mar

The millwright of today must lay aside his saw and square and take kindly to the shovel and hoe, for concrete is taking the place of much of his heavy timber work. Not only is it more durable than timber, more economical in cost per ton of ore crushed, but it looks better. As a rule, the inside of a stamp-mill is a dirty place, and the structural work crude and unsightly. Compare this with a mill where concrete has been used to its fullest extent. We find now that the mill is neat in appearance, the structure is better architecturally, the mill does better work, the extraction is better, and the mill lasts indefinitely. To obtain the best results from concrete work the following observations and rules may be studied with interest.

The best grades of domestic cement should be used. While some foreign cements are superior to our ordinary brands, even for cementing silex brick in tube-mills, a class of work requiring the best materials, a good brand of domestic cement will answer every requirement. Except when used in large quantities, particularly where the cost of labor is high, it is better to hand-mix all concrete. The mixture of sand and rock, which with cement makes concrete, is often called the agglomerate. Concrete should always be mixed fresh; that which has been mixed over half an hour has had an initial set and should be rejected. The sand should preferably be clean and sharp, although rounded sand-grains or sand that contains from 10 to 15% of dirt has been found not to lessen the strength of the set. The broken rock used should not be larger than a size which will pass a 3-in. ring, and should be well washed before mixing to remove all dust and dirt, so that the cement and sand mortar will adhere to the surfaces.

Cement will not readily take up any more water than is necessary for mixing; the excess will come to the top, and does no harm unless the excess is carried to an extreme, causing a separation of the cement from the agglomerate, thereby weakening the mixture. Wet concrete takes longer to set and eventually becomes harder than when the water is only in sufficient quantity to create adhesion. Concrete of this latter description should be well rammed until water comes to the surface. While setting, concrete should be kept wet, for this retards the setting and, as stated above in respect to wet concrete, it produces a more lasting structure. It is not necessary for any piece of work to be of the same proportional composition throughout, for the richness of a concrete should be proportional to the strains it must bear; for example, the base of a foundation, usually being larger than the top, may be made of a poorer mixture and yet stand the same strain per square inch as the top.

Concrete mixed with fresh water should not be allowed to set when the temperature is below freezing, unless there is a heavy weight upon the structure to keep the mixture in compression, or unless fires are kept burning near the structure, otherwise the concrete may be loose and crumbly. In a recent reference to this subject it is claimed that freezing will not materially injure concrete, for while frozen the setting action ceases to start again when the water thaws. When the temperature is below freezing, the usual plan is to add some chemical to the water that will lower the freezing point. Salt is most commonly used, and when not in excess of 10 per cent of the weight of the water, it makes a stronger structure than fresh water. The salt delays the setting, and lowers the temperature at which the water will freeze. There have been various rules proposed to determine the quantity of salt necessary to prevent freezing. "Add one per cent by weight of salt to the weight of water for each degree F. below freezing", or "one pound of salt to 18 gallons of water for a temperature of 32° F., and an increase of one ounce for each degree lower."

Concrete may be mixed with hot water, and sets more rapidly the hotter the water. A temperature of 150° F. is a safe limit, unless the mass is immediately transferred to the form. It is often necessary in cold weather to heat the rock and sand which may have frozen over night. It is best in this case to thaw the sand before a fire or in a drier, for wet sand and cement mix poorly. In case it is not practicable to use a drier, then the sand should be spread out, the lumps broken up mixed with cement, and hot water used to make a mortar. This will require more work than when dry sand is used, but if time be taken, a good mortar may be made. The rock may be drenched with boiling water.

In structures where the strains are chiefly compressive, the surface of the concrete laid on the previous day should be cleaned and wetted; no other precaution is necessary. If the concrete has set, or it is necessary to lay it intermittently, the surface should be roughened or left with corrugations. Before adding the next batch of concrete, the surface should be cleaned and wetted. Concrete is mixed by volume, not by weight, and all calculations are made upon this basis, although the millwright will generally prefer the bag of cement as his unit and the number of tons of sand and rock. The conversion of volume to tons is simple. The next question is, what should the composition be for a given piece of work. The theory is that, for concrete to be at its highest efficiency, the spaces between the sand should be filled with cement, and those between the rock with cement and sand mortar; therefore the amount of voids or empty spaces between the particles of sand and rock will govern the proportion of the ingredients.

For extensive or accurate work cements are always tested, both chemically and physically, including the percentage of voids in the sand and rock it is proposed to use. The millwright, as a rule, will not bother with these refinements, and will use some arbitrary measure that has proved successful in other similar work. We will consider an average sand and an average rock, and endeavor to work

out our problem, first explaining the mode of mixing the constituents of concrete as found by experience to give the best results. This is a concrete engine-foundation specification for one of our big railroads, and is a fair example of what is considered necessary when mixing concrete.

"About half the sand shall be spread evenly over the bed of the mortar-box, the cement shall be spread evenly over the top of the sand, and finally the remainder of the sand shall be spread on top. The sand and cement shall be thoroughly mixed by turning and re-turning with a shovel. The mixture shall be drawn to one end of the box, water poured in at the other end, and the mixture drawn down to the water with a hoe, a small quantity at a time, and mixed vigorously until there is a stiff mortar. The mixture shall then be leveled off and the required amount of broken stone shall be thoroughly wetted and spread over it. The whole mass shall then be thoroughly mixed by turning and re-turning with shovels into rows, at all times preserving the same thickness of the mass until the mortar completely fills all the interstices of the rock. After transferring to the forms, ram with 20-lb. hammers until water comes to the surface."

The requirements for good concrete are, then, thorough mixture of dry sand and cement, the addition of water to form a mortar, and the thorough mixture of broken stone with this mortar.

To make a concrete where all the voids in both sand and rock are filled, and using the figures for sand and rock as above, the mixture should be 1 cement, 2.5 sand, and 4.6 rock. This is a mixture in which all the spaces between the sand and rock are filled. Experience teaches us that a better result is obtained when the rocks are separated by a layer of mortar and the grains of sand by a layer of cement. This 1:2.5:4.6 mixture does not allow for mistakes in testing or leave allowance for variations in sizes of the material used. By actual tests the best mixture for concrete has been found to be nearer 1:1.5:2. This mixture should bear compressive strains up to 2900 lb. per square inch. When the weight on a foundation is excessive, or subject to sudden changes, the concrete must be at its highest efficiency: therefore a rich mixture such as 1:1.5:2 must be used, but the less the strain on the foundation the poorer the mixture may be, leaving always a safe allowance for the unforeseen, which always happens. Good concrete made with a mixture somewhat richer than that found by calculation will stand a strain of from 2100 to 2800 lb. per square inch. Under tension, concrete will stand from a sixth to a tenth of this, or 200 to 300 lb. A stamp-mill foundation figures out thus:

The base of a mortar for concrete foundation is usually 32 by 60 in., or 1920 sq. in.; the weight of mortar, stamps, dies, ore, etc., about 14,000 lb., or about 7 lb. to the square inch. Two battery-posts 12 by 28 by 21 ft. with cam-shaft, bull-wheel, cams, etc., will weigh about 14,000 lb. The base with sole-plates occupies about 720 sq. in., giving 20 lb. to the square inch. The compressive strain on the foundation of the battery-posts is therefore over twice that on the mortar base. Owing to the vibration caused by the dropping and raising of the stamps, the tension on the foundation bolts will more than equal the compressive strains, therefore the foundation must be at least ten times as strong as if the compressive strain were alone considered. The following table shows the compressive strains that certain mixtures of good concrete will bear:

Cement.	Sand.	Rock.	Pounds per square inch.
1	1½	2	2800 to 2900
1	2	3	2500
1	2	4	2300 to 2400
1	3	4	2100
1	3	5	2000
1	4	6	1700

It would appear from this that at 1:4:6 mixture, if made with good materials, would leave a big factor of safety. The mixture generally used for battery work is from 1:4:4 to 1:3.5:3.5. To bring this up to 1:4:6 and still have a big factor of safety, large rocks up to 8 inches in diameter may be hammered or punched down in the centre of the form as the concrete is built up. This makes a rubble concrete and will not materially lessen the strength of the foundations. Suppose that now we have determined upon a certain mixture, we may want to know the quantity of materials necessary. There is a simple rule which will give approximately the number of barrels of cement in a cubic yard of concrete. Divide 10.5 by the sum of the parts of all the ingredients. For example, in a 1:2:3 mixture there will be 10.5 divided by 6, or 1.7 bbl. per cubic yard of concrete. If the work is of great magnitude, the proportions may be found by actual tests. Knowing the number of cubic yards of concrete and the proportions, and figuring 22 cu. ft. of sand and 20 cu. ft. of broken rock to the ton, the weights of the ingredients may easily be found.

For example, the mortar and battery-post foundations of a 10-stamp mill will contain 20.5 cu. yd. Suppose we use a 1:4:4 mixture; then 10.5 divided by the sum of the ingredients, 9, will give us 1.15 bbl. of cement per cubic yard, or 20.5 by 1.15, or 23.5 bbl. of cement, or 94 bags of portland cement. The cement and sand being as 1 to 4, therefore, as a barrel of loose cement occupies about 4 cu. ft., the sand will occupy 16 cu. ft. per barrel; 16 by 23.5, the number of barrels necessary, will give 376 cu. ft. at 22 cu. ft. per ton, or 17 tons of sand. The rock and sand being in equal proportions, 17 multiplied by 22 divided by 20 will give us 18 tons of rock. As a barrel of cement weighs 400 lb. gross, the amount for this foundation will be 9400 lb., or about 8800 lb. net. These figures are approximate, as we have assumed our data, which, though near an average, may not be correct for some specific example. To make sure, the engineer had better allow an increase of 5% on each item for contingencies; in other words, for the unexpected. A few figures of what may be considered good foundations for water-tight work may be useful. A 4-in. concrete wall will be water-tight under a head of 4 ft.; a 15-in. wall under a head of 20 ft.; while a wall 5 ft. thick will hold water under a head of 100 feet.

Mineral Associations at Porcupine

By Cyril W. Knight

The editorial comment on the article by R. E. Hore in the issue of November 26, 1910, lays undue stress, I think, on the occurrence of carbonate (ankerite or ferro-dolomite) and the green micaceous minerals which are found in association with the gold deposits at Porcupine. It is to be hoped that Porcupine will be of as great economic importance as the mother lode, but emphasizing accidental resemblances, such as those mentioned, can do no good. When a gold camp is discovered there are plenty of boomers ready to compare it with the Rand and other famous fields. Porcupine has already been compared with the greatest goldfields. As a matter of fact, not only the gold deposits in the oldest rocks of Ontario, the Keewatin, are frequently associated with carbonates, but the deposits of iron ore and other minerals are just as frequently similarly associated. At the Helen mine, Michipicoten, there is a large mass of carbonate adjacent to the orebody. There was a stampede to the Larder Lake goldfield, lying about forty miles to the east of Porcupine, in Ontario, in the winter of 1906-7. R. W. Brock made a report on this goldfield for the Provincial Bureau of Mines. In his report, published in the Sixteenth Annual Volume, he thus refers to carbonates and to green minerals such as those found in the Porcupine area: "The most interesting rock from an economic standpoint near Larder lake is a rusty weathered dolomite. About 60% of the rock consists of lime-magnesic-iron carbonate, the remainder of quartz and of a soft green talcose silicate, probably serpentine. * * * This rock, especially where cut by the porphyry pegmatite, is traversed by innumerable stringers of quartz which, in places, are gold-bearing." The green talcose silicate mentioned by Mr. Brock was later studied by Morley Wilson, who, in the summary report of the Geological Survey of Canada in 1909, thus refers to it: "In the neighborhood of Larder lake and north of Lake Opasatika, are local outcrops and bands of a rusty-weathering rock, consisting of ferruginous dolomite or ankerite, with varying quantities of quartz and feldspar. It is always highly pyritic, and in most localities contains a large amount of chrome mica or fuchsite, from which the rock derives its characteristic green color. As a rule the rock is cut in a most complex manner by two or more sets of veinlets consisting of quartz or of quartz and ferruginous dolomite."

On the eastern edge of the Porcupine area, in Night Hawk lake, is Golden island, to which there was a small rush of prospectors in 1906 owing to the discovery of gold there. This, by the way, no doubt resulted in the prospectors searching farther west for gold and led to the discovery of the important deposits in Porcupine. Gold was also found on Lake Abitibi in 1906. The deposits of Lake Abitibi and of Golden island are thus referred to by W. G. Miller in the Bureau of Mines' Report for 1907: "The writer has not visited Night Hawk lake, but among the specimens shown him, from a small island known as Golden island in the northeast part by A. A. Cole, who examined the deposits for the Temiskaming & Northern Ontario railway, it is evident that the deposit there being worked for gold is similar to that described by R. W. Brock on some of the mining claims in the vicinity of Larder lake. This material consists of what appears to be a silicified limestone carrying iron pyrites. Associated with the limestone is the somewhat striking green material which Mr. Brock described as being probably serpentine. * * * The deposits on the shores and islands of the Lower and Upper Abitibi lakes visited by the writer in August last are different from those described by Mr. Brock and Mr. Cole on Larder and Night Hawk lakes, respectively. The chief point of resemblance is that the same green mineral is found in some of the deposits at Abitibi as that in the deposits of the other two lakes."

If the goldfields of the Lake of the Woods region, in western Ontario, which were operated unsuccessfully ten or fifteen years ago, be reviewed, it is apparent that carbonates also occur under similar conditions to those at Porcupine, Larder lake, and other areas alluded to. But the mining man who today has the courage to compare Porcupine with the Lake of the Woods goldfield because of the presence of carbonates would be unpopular in the camps of northern Ontario. It should also be borne in mind that the gold occurrences at Porcupine belong to rocks dating back to a remote period of the earth's history, namely the pre-Cambrian, while the mother lode occurs in rocks of Carboniferous age.

It will thus be seen that the carbonate rock and the green mineral, which have led to the comparison of the Porcupine deposits with those of the mother lode in California, are characteristics not only of Porcupine, but also of Larder lake, Lake Abitibi, Golden island, and some of the properties in the Lake of the Woods area. Hence it would seem that much importance should not be attached to either the carbonate or the green mineral. In fact, the green mineral, whether it is called mariposite or fuchsite, is of such common occurrence in the pre-Cambrian of northeastern Ontario that it is scarcely worth mentioning. The carbonate and other characteristic rocks of Porcupine are described in the notes which accompany the Bureau of Mines map published in August last.

Tripoli is used for a number of purposes, as blotter blocks and scouring bricks, but by far the most important use is for filters. These filters are made in all sizes from the small house filter to filters having a capacity of 400 gal. per hour. The flour is used principally as an abrasive or polisher in the metal-working trades, the finest grade being used as a jewelry polish, while the coarser grades are used as brass or steel polish. The flour is also used to some extent as an ingredient of scouring soaps. No doubt the flour has been used to some extent as an adulterant, as it is nearly pure white, without appreciable grit, and very heavy.

Discussion

Readers of the MINING AND SCIENTIFIC PRESS are invited to use this department for the discussion of technical and other matters pertaining to mining and metallurgy. The Editor welcomes the expression of views contrary to his own, believing that careful criticism is more valuable than casual compliment. Insertion of any contribution is determined by its probable interest to the readers of this journal.

Filter-Pressing Slime

The Editor:

Sir—Mr. J. Chisholm remarked that the patent press used by Mr. Alfred James in Kalgoorlie was invented by him in 1905. In my paper on the above, it was not Alfred James who was mentioned, but Caradoc James, now of Tarkwa, West Africa, although at the time I did not give the initials. C. James was associated with Mr. Chisholm in the experiments of sluicing out presses. I can only say that it is a great pity the invention was not pushed, as it appears to be simple and effective, and quite on a par with the Merrill system.

M. W. VON BERNEWITZ.

Kalgoorlie, Western Australia, February 18.

Liberty Bell Mill

The Editor:

Sir—In your issue of March 11, W. H. Storms has described the mill of the Liberty Bell G. M. Co. at Telluride. Some important changes have been made at this mill since the time of the visit upon which the description was based. The tube-mill discharge now goes to cones, the underflow of the cones going back to the tube-mill, and the overflow passing to ten Deister tables. These are doing good work, and have materially lowered the mill tailing. The tailing from them goes to Dorr feed-thickeners. The thickened feed goes to the storage-tanks for the Moore filters. As a result of these changes the extraction has been increased without increasing operating costs. The mill is now treating 425 tons per day.

Telluride, March 27. ENGINEER.

Avino Mines of Mexico

The Editor:

Sir—In J. Parke Channing's letter published in the *Mining and Scientific Press* of November 26, 1910, he fails to make matters quite clear with regard to the treatment of Avino ores, by stating that the trouble was due to the presence of tetrahedrite. One would assume from Mr. Channing's statement that the concentration generally was good, with the exception only of silver being carried away contained in the tetrahedrite, thus making an opening for lixiviation, which Mr. Channing claims did excellent work. Was it due, then, to being enabled to secure a capable successor to Mr. Flynn, or because the supply of ore carrying tetrahedrite had failed, that the latter process was shut down? I had been under the impression that lixiviation had not proved a very grand success at Avino, on account of the high silver values in the residues from the process.

A. J. WYLY.

Lebong Tandai, Sumatra, February 8.

Texas Mining Laws

The Editor:

Sir—I beg leave to comment on the proposed mineral law of Texas as outlined in the *Mining and Scientific Press* of March 4. The State of Texas, by inauguration of the policy of separating on its public lands the surface from the mineral rights and reserving the latter as public property, took a step in social equity far in advance of its neighbors. The El Paso Chamber of Commerce now calmly proposes to reverse this sensible policy and, except for oil and gas rights, wishes to give away lode and placer claims for a pittance in the same reckless way pursued, until recently, by the Federal Government. Without mentioning foreign countries, our own experience in the bituminous coalfields, in the Joplin zinc district, in the Mesabi iron range, and at the precious metal mines of Goldfield has shown that the leasing system is as practical for lode and placer deposits as for oil and gas.

The land laws of England were designed to maintain a privileged class, and as copied by this country have created here a class of land monopolists without even the governing responsibilities of their English prototypes. Is not the leasing system of Spanish America much better suited to all the mineral deposits of a democracy than grants in fee simple? At least the progressive English colonies think so, if anything is to be judged from Australia, Canada, and South Africa, where, inheriting like us the aristocratic English land system, recent mineral laws have been framed along the lines of the separation of underground from surface rights and of society's inalienable right to its mineral property as embodied in royalty payments from mining lessees. The Transvaal collects 60% of the profits of the Premier diamond mine, and Canada shares liberally in the gains of many Cobalt mining companies.

Should not Texas be sustained by mining producers in her efforts to retain for the community by leasing, the net value of its minerals? Should we not as American citizens begin to call a halt on mineral monopolists and speculators who have tied up most of the coal and iron deposits of the East, and of precious metal claims of the West with the object of holding them indefinitely until paid their price to let go? Why not give mental and manual productive labor the lion's share of industrial rewards which is now going to such types of social highwaymen as forestallers and gamblers in land values?

The suggested Texas policy may prove financially advantageous temporarily for some of its purposes, but is it not about time that land laws be made with some other thoughts than those plausible but deceptive slogans, 'Develop the country,' 'There is no god but Bigness,' etc.? Is not the working as compared with the gambling miner better off in a country whose unused mineral resources are always open to his enterprise than in one where they have been patented and are held permanently at little or no expense by those who either can not or will not develop them? R. B. BRINSMADE.

Morgantown, Virginia, April 1.

Revolutions and Mining

The Editor:

Sir—I read with interest T. Lane Carter's article on 'Revolutions and Mining' in your issue of January 7. Had Mr. Carter used the expression 'eastern Nicaragua' instead of plain 'Nicaragua' throughout, his contribution would have been an accurate picture of local conditions. By ignoring western Nicaragua, and by imagining Bluefields to be to Nicaragua what Paris is to France, he has been led into such inaccuracy as to impair considerably the value of his essay.

Eastern and western Nicaragua are to all intents and purposes distinct countries. They are more difficult of access, the one from the other, than New York and California; and have different currency, different tariffs, different systems of government, different aims, and different modes of thought. The Atlantic littoral has always been a hot-bed of revolution. As such it was treated by the central government very much as the English long treated Ireland, and with about as much reason. When I lived there the economic and financial control of the country was being slowly secured by a notorious foreign trust, whose name is anathema to all patriotic Central Americans, regardless of country or party. Squeezed between the Trust on one side and Managua on the other, everyone, both native and foreigner, was 'agin the government.'

On the other hand, in western Nicaragua—the dog in contradistinction to the eastern Nicaraguan tail—Zelaya was popular in the extreme. He ruled justly, wisely, and humanely. In ten years there had been but one political execution. I was a resident of that part of the country when the late revolution broke out, and was in touch with the leading British, German, and American business people there. All were in favor of Zelaya, and, to emendate Mr. Carter, "no one doubted for a moment that Estrada and his crowd would be thrown out." Estrada would never have had a chance had not a foreign power, misled by its diplomatic representatives and egged on by trusts and concessions with axes to grind, thrown its weight—in the shape of money, arms, and 'deserters'—into the wrong pan of the balance.

Zelaya was probably the best, certainly the ablest, ruler Nicaragua ever had. The stories of his cruelties and 'infamous private life' are ludicrous to those who know the man. Estrada I have not the pleasure of knowing. Those best informed consider him a tool in the hands of Chamorro and the Conservatives. To my mind, the future outlook of Nicaragua is anything but peaceful, as I don't think the people of western Nicaragua will ever submit quietly to a Conservative régime. About three years ago a couple of young Americans down in Nicaragua bought a promising looking mine 'on spec.' They paid two or three thousand dollars deposit—all they had. Pressed for payment, and without resources, they applied to Zelaya for aid. He advanced them $30,000. The other day that mine was sold for ten times that sum; the young men netting some $100,000 apiece on an investment of $1000. Many another foreigner could tell of similar kindnesses if he would; but when a man is down—hit him good and hard. Mr. Carter opines South African metallurgists think they know it all. Are they the only ones?

HUXLEY ST. JOHN BROOKS.

Benguet, P. I., February 17.

Steam-Shovel Mining

The Editor:

Sir—I must take issue with you on your editorial of March 4, in which you say that mining engineers have too long allowed civil engineers the exclusive use of steam-shovels. The present powerful shovel has been developd entirely by the mining profession, and practically upon the Mesabi range in Minnesota. The first steam-shovel that, to my knowledge, was ever used upon iron ore was put in commission in the spring of 1887 by Joseph Sellwood to load the accumulated winter's stock pile at the Colby mine, near Bessemer, Michigan. The suggestion came from Nicholas J. Cavanaugh, then an employee of the mine, who is now a resident of Vancouver, British Columbia. Mr. Sellwood procured from the Milwaukee, Lake Shore & Western railway (now a part of the Chicago & Northwestern system) a small shovel which was designed to dig gravel ballast. The whole thing was done very quietly, and about 11 o'clock in the morning the news was spread over the town of Bessemer that ore was being loaded into the 20-ton cars at the rate of a car in three minutes. Few people would credit this, and nearly the whole of the population climbed to the top of the hill to see this wonderful performance. This undoubtedly was the forerunner of steam-shovel open-pit mining. Next, the Lake Superior Mining Company, at Ishpeming, Michigan, got a steam-shovel to load its hard-ore stock-pile, and the following year nearly every mine of importance was provided with a steam-shovel.

About 1890 the Mesabi range was coming into prominence, and John Jones, of Iron Mountain, had started to strip the Biwabik mine, and used shovels at his two pits. Gradually the shovels which were used for stripping came into use for mining the ore, and in the early days it was found necessary to have at least two shovels, in order to keep one going. It was impossible to design a shovel on the drafting-board, so makers gradually increased the size of this part and that when they broke, until data were established from hard experience. It is unnecessary to show the evolution of the mammoth steam-shovel, such as is used in the Mesabi range pits and in the Culebra cut of the Panama Canal from the little sand-shovel which Joseph Sellwood used in 1887 to load the Colby stock-pile. On the Mesabi this development was made, however, and the engineers of the Panama Canal can thank the mining engineers of Lake Superior for the present magnificent machines which dig into almost solid rock as readily as the old shovel went into a sand pit.

J. PARKE CHANNING.

Miami, Arizona, March 14.

Concentrates

Most of these are in reply to questions received by mail. Our readers are invited to ask questions and give information dealing with the practice of mining, milling, and smelting.

Rutile (titaninm oxide) is used in making ferrotitanium, which is added to the steel for steel rails, the use for this purpose having grown considerably of late. It is also used in making electrodes for are-lamps.

Linseed oil is commonly adulterated. The easiest way to test this is to shake it in a flask with eqnal parts of nitric acid and then allow it to stand for 20 minutes. If the oil is pure, the upper layer will be straw colored, but if impure it will be dark brown.

Phosphorus occurs in two forms, one red and the other white. The former is harmless, the latter is poisonous and inflammable. Its use in matchmaking is attended with great danger to the workmen, and it is probable that its use will be prohibited by law.

A recent method for applying metallic coatings, consists in spraying the molten metal by the pressure of some inert gas through a nozzle in a fine spray against the surface to be coated. In this way much larger pieces can be coated than was possible by former methods.

The manufacture of steel in electric furnaces depends on several factors, but the most important is the cost of electric power. A recent plant has contracted for its supply at $6.70 per horse-power year; where the cost of electric power is not low the making of steel by this method is impracticable. The greatest progress has been made in Norway.

Asbestos board is a good covering for laboratory table tops if it is not necessary to wash them off at intervals, but it has the disadvantage that small particles of fibre detach themselves after the surface becomes worn, and these are likely to get into the material being analyzed. A good surface, for a makeshift, can be obtained by giving the board a coat of varnish. The coating must be very thin; otherwise hot objects will stick to it.

Mixing rich ore with that which is poor does not make the low-grade ore any better or any more profitable. On the other hand, it robs the rich ore of a portion of the profit that might have been made on it. It is not an uncommon thing, however, to mill ore taken out in the course of development which cannot be mined and milled at a profit, but which will yield more than the cost of milling. In such cases it is good business to mill all such ore.

Prospect-shafts should, unless there is strong reason to the contrary, be sunk at the points along the lode where ore has been found. Cross-cut tunnels, vertical shafts in the hanging, and inclined shafts in the foot, are proper means of mining after the form, character, and size of the ore-shoots have been determined. The first essential to a successful mine, however, is a good ore-shoot, and the best way to determine its presence or absence is to follow the ore.

In testing placer ground by panning, a balance is not always available. Colors may be preserved without danger of loss or confusion by making a small ball of clay and dabbing the dried pannings in it, rolling them in a little ball and drying by the fire. Before it is dry, a mark may be scratched on the outside to identify the sample. When convenient, the ball may be broken up in water and the gold panned off and weighed. This method is often a great convenience where samples have to be transported on horseback.

Gravel and sand, occurring on the public land, suitable for mixing in concrete, but having no property or characteristic giving them special value, and deriving their chief value from proximity to town, do not render the land in which they are found mineral in character within the meaning of the mining laws, according to Land Office Decision in the case of Zimmerman *v.* Bunsen. The Supreme Court of Oregon, on the contrary, has held that building sand is a mineral, and hence that land containing it is subject to placer location.

A location certificate should contain the names of all the persons interested in the claim. When the locator of a claim places the name of another person on the location certificate, the person named at once acquires a legal interest and title in the property located, and the locator can not thereafter deprive the person named in his certificate by removal of the name, even though they may have become enemies since the name was first placed on the location ertificate. In other words, you can take another person in with you in the location of a mining claim, but you can not, on second thought, for any reason deprive that person of his rights in the claim.

Slag-wool, or silicate-cotton, as it is sometimes called, owing to its resemblance to cotton-wool, is made from blast-furnace slag. The process of production is, briefly, as follows: A jet of steam is made to strike upon the stream of molten slag as it falls from the runner into the car. This steam-jet scatters the molten slag into drops, and as each drop leaves the stream it carries with it a fine thread or tail. The chilled drop, being heavy, falls to the ground, while the fine woolly fibre is sucked into a large tube and discharged into a chamber. This chamber is of large size, and is covered with fine netting. The steam and air carry the woolly particles all over the chamber, the finer into recesses in the chamber, and the heavier into the body of the chamber. After each blowing it is taken up with forks and put into bags or barrels for sale. Slag-wool, or silicate-cotton, is chiefly used for covering steam-boilers and pipes. Its perfect incombustibility, combined with its non-conducting and indestructible properties, gives this material many advantages for this class of work.

THE OLD DOMINION.

The Old Dominion Copper Mining & Smelting Co., identified with the Phelps, Dodge & Co. interests, which operates the Old Dominion mines, concentrator, and smelter at Globe, Arizona, produced, in round numbers, 28,000,000 lb. of copper during 1910, at the cost of about 10¼c. per pound, the average price at which the metal was marketed having been close to 12¾c. per pound.

DIVIDENDS

The Kendall Gold M. Co., Kendall, Montana, paid dividend No. 76, of $10,000, this month, making a total to date of $1,355,000. The property is in Judith basin, and is controlled by Finch & Campbell of Spokane.

The Hecla M. Co., operating the Hecla mine at Burke, Idaho, this month paid dividend No. 93, of $10,000, making $40,000 thus far in 1911, and a total to date of $2,150,000.

The Hedley Gold M. Co., a New York company, operating the Nickel Plate mine and mill at Hedley, British Columbia, paid a dividend of $60,000 on March 31, making a total amount of dividends to date of $263,986.

RECOVERY OF METALS FROM FLUE-DUST

The Copper Queen Consolidated M. Co., which is increasing and improving its facilities for treating the fine ore and flue-dust at its Douglas, Arizona, reduction works, recovered 17,716,692 lb. of copper, 185,541 oz. silver, and 2240 oz. gold from flue-dust during 1910. The dust treated equaled 7.44% of the original charge. The new equipment being constructed, which is to be ready for service by the end of this year, consists of two reverberatory furnaces, and six calcining roasters of the McDougall pattern; additional flue-dust chambers and a new converter flue, connecting the eight stands of converters with the dust-chambers, are already completed.

MARCH PRODUCTION OF BUTTE MINES.

The copper production for March by the Butte mines aggregated about 21,552,060 lb. The output of ore and the production of copper for the month were as follows:

Companies.	Tons of ore.	Pounds copper.
Anaconda	108,500	6,618,500
Butte & Boston	13,020	807,240
Parrot	9,610	605,430
Washoe	9,300	567,300
Trenton	12,400	719,200
Original	20,150	1,249,300
North Butte	26,350	1,607,350
Butte Coalition	27,900	1,897,200
Tuolumne	3,100	279,000
Boston & Montana	96,410	6,170,240
East Butte	11,780	1,001,300
Totals	338,520	21,522,060

THE COPPER PRODUCERS ASSOCIATION

The report of the Copper Producers Association for March shows a production for that month of 20,000,000 lb. in excess of that for February, which marks an increase in copper stocks on hand of 5,370,164 lb. over those of the previous month, when the gain over the January supply was 14,200,000 lb. The total consumption, domestic and foreign, for March amounted to nearly 30,000,000 lb. in excess of the February consumption. Stocks of marketable copper on hand at all points in the United States on March 1 are given at 150,637,770 lb.; and the production of marketable copper during March in the United States from all domestic and foreign sources amounted to 130,592,080 lb. The March deliveries of marketable copper for domestic consumption amounted to 66,080,789 lb.; those for export aggregated 59,081,127 lb., making total deliveries of 125,161,916 lb. Stocks of marketable copper at all points in the United States on April 1 are reported at 102,007,934 lb. The March output of copper is 3,000,000 lb. in excess of that of any previous month of which a record is given.

MINES OF WESTERN AUSTRALIA

The names of the principal producing mines of Western Australia are given in the following table, with figures showing the tonnage of ore produced in 1910, the value of the product, and the profit for the year:

Name.	Tonnage.	Yield.	Profit.
Associated	3,739	$ 25,000	.....
Associated Northern Blocks	2,453	23,000	$ 10,000
Burbank's Main Lode	1,657	22,000	.....
Chaffers	3,740	24,000	270
Golden Horse-Shoe	22,418	143,000	9,500
Golden Ridge	2,705	31,000	15,000
Great Boulder Perseverance	20,003	129,000	32,500
Great Boulder Proprietary	16,558	242,000	117,000
Great Fingall	10,185	76,000	13,000
Hainault	4,651	33,400	3,700
Ivanhoe	19,511	189,000	90,000
Kalgurli	8,450	105,000	53,000
Lake View Consols	9,440	8,000	2,000
Lake View & Star	13,316	82,000	3,400
Oroya Exploration	21,832	23,500	10,500
Oroya Black Range	4,350	43,500	11,000
Oroya Links	7,515	24,500	3,000
Sons of Gwalia	13,501	118,000	46,000
Sons of Gwalia South	2,480	23,000	8,500
South Kalgurli	9,220	60,500	12,000

The three properties from the output of which dividends were paid within the year were as follows: Associated Northern Blocks, $43,500; Ivanhoe, $250,000; Kalgurli, $185,000.

THE MT. ANDREW MINE

The mine of the Mt. Andrew Iron & Copper Mining Co., situated on the south side of Kasaan peninsula, Prince of Wales island, Alaska, is reported by our Ketchikan correspondent as having been bonded to the United States Smelting, Refining & Mining Co. The importance of this information is due to the fact that the Mt. Andrew mine contains deposits of high-grade iron and copper ore of considerable magnitude, as has been demonstrated by the operations thereon during the last three years. Approximately 80,000 tons of ore has been shipped from the property since it was first opened, and this product found a ready market at the smelters of the Northwest. According to information given out by the owners last summer, shipments of ore in 2500-ton cargoes sampled 40 to 50% iron, 4½ to 6% copper, 3½% lime, and 8 to 10% silica; there is also a gold and silver content, those metals being worth $1 to $1.25 per ton. This is a clean sulphide ore, and occurs below a gossan capping. The orebody strikes along a contact of limestone and syenite, in irregular deposits. A working level was driven from the side of the mountain, by which the orebody was opened 100 ft. below the surface; drifts were extended from this level in opposite directions and the ore was blocked out. Raises were made at various places to the surface, connecting with open pits in which the ore near the surface was blasted and passed through chutes to the main level. Later work has extended the workings considerably below the adit-level. The width of the deposit, as shown by this development, is approximately 150 ft. The ore is transported to the ore-bunkers on Kasaan bay over a 3060-ft. aerial tramway. A marked feature of Mt. Andrew ore is the uniformity of its iron and copper content. A force of over 100 men was employed at the property last season. The principal owners are Samuel Lichtenstadter and M. D. Haynes of Seattle. The property a few years ago was under lease to the Britannia Smelting Co. of British Columbia. It is understood that the mine is to be examined and sampled in the interest of those who hold the option.

Special Correspondence

GOLDFIELD, NEVADA

Record Bullion Shipment. —Deep Level Development.— Shaft-Sinking at the Florence.—A Large Orebody.—Jumbo Extension.

Another record shipment of gold bullion, estimated to be worth $480,000, was consigned to the Selby company by the Consolidated Mines company a few days ago. The bullion as now shipped is about 900 fine, a great improvement having been effected by the new refinery, which is said to make a saving of at least $5000 monthly in improved recovery and reduction of transportation charges. New processes for the treatment of concentrate and other mill products, which have been perfected by J. W. Hutchinson, superintendent of the 100-stamp mill, enable the company to treat all these products locally, eliminating the former heavy expense of shipping the concentrate to the smelters. In the final report of J. F. Thorn, the company's general superintendent, of operations in February, the recovery and profits are shown to be considerably in excess of the preliminary estimates, issued early last month. From the total production of 23,675 tons the gross recovery was $973,730 and net profits amounted to $719,325. The average value of the ore was $41.13, with an average recovery from milling of $38.59 per ton or 93.84%. Total operating costs were $8.31 per ton, a slight increase over the costs of the preceding month, due to the higher grade of ore. Development work for the month aggregated 4220 ft. No new discoveries of note are reported, but known orebodies have been extended at many points, and special mention is made of operations in the territory at the south of the Combination No. 1 claim, in and near the old Reilly lease ore-shoot and the continued opening of the Red Top vein from the Laguna workings on the 600-ft. level, where a large tonnage of $15 to $20 ore is being blocked. It is now predicted by the management that the March output will be at least equal to that of February and possibly greater. On the deeper levels, from the Clermont shaft on the 1000 and from the Grizzly Bear shaft at 1170 ft. development continues with satisfactory results and the drifts from the latter shaft are nearing the point where the downward extension of the great Clermont ore-shoot, exposed on the 750, 900, and 1000-ft. levels, should be penetrated. Two mining engineers, Albert Burch, of San Francisco, acting for the Consolidated Mines Co., and Walter E. Wiley, of Los Angeles, representing the Jumbo Extension Mining Co., have just completed the work of sampling, measuring, and appraising the orebodies of the Vinegerone Fraction which, by the terms of an agreement recently entered into between J. H. Mackenzie, managing director of the Consolidated, and Thomas G. Lockhart, president of the Jumbo Extension, will become the sole property of the Consolidated company by the purchase by the latter of the Jumbo Extension's one-half interest in the ore contained in the territory. Under the agreement the Consolidated will deduct a sum equal to $9 per ton as a total charge for mining, milling, and metallurgical losses. The Vinegerone is a narrow fraction lying between the side lines of the Red Top and Miss Jessie claims and contains one of the strongest points in the Red Top vein, which dips east through the fraction, and has been developed on its strike within the claim for 900 ft. The ore is said to be of excellent grade and of an unusual degree of uniformity in character throughout and will afford a large tonnage for immediate treatment at the hands of the Consolidated company, as it is practically blocked out by workings of the Red Top on and above the 360-ft. level and proved for a considerably greater depth by winzes. A 65-ft. raise from the 350-ft. level is said to have yielded $25,000 net and for a long distance the stopes of the Red Top mine have opened the ore along the vertical side-line on the west of the ore. It is said that there will be little delay in reaching a final agreement upon the submission of the appraisers' report and that the transaction will place a handsome cash balance in the treasury of the Jumbo Extension company.

At the Florence Goldfield mine good progress has been made in sinking the main shaft, which has passed the 700-ft. point, near which a station is being cut. It has not been possible to cut stations at exact intervals of 100 ft., owing to the condition of the ground which, in places in this mine, is known locally as 'gumbo,' and in driving frequently requires continuous piling for considerable distances and must be caught up at once by timbers to prevent its slipping and sloughing. Drifts have been started on the 670-ft. level to the south and east to reach the lower extension of ore-shoots that have been opened in the old lease workings on various levels down to the 500, and the workings at this depth will be extended far to the south to a point through and beyond the large andesite dike which, apparently from fault action, has been turned nearly at right angles with the main veins of the Florence and has been supposed to cut off the ore just south of the Florence hill and the highly productive Little-Florence and Rogers leases. A similar dike appears between the main Florence and Engineers' veins, east of the Florence shaft, and when the earlier lease workings encountered this dike the work was abandoned at this point and directed elsewhere. Later a cross-cut was driven through the dike, some 20 ft., and on the other side were found the bonanza orebodies of the Engineers' lease which produced high-grade ore to the amount of several millions within a short period. During the past two months the Florence has been developing a large body of excellent ore at the northern extremity of the Florence claim, in territory formerly included in the famous Reilly lease and adjoining the ground from which the Consolidated has been mining high-grade ore recently. This vein for some distance has its apex outside and west of the Florence boundary, but by the terms of an early agreement between the Florence and Consolidated companies a small fraction, less than 100 ft. wide and 300 ft. long, was equally divided between the two, giving the Florence a part of the vein. A peculiarity of this vein is that, after dipping to the west for less than 100 ft., it buckles back and dips east toward the centre of the Florence. This explains the failure of several lessees who have worked to a depth of over 600 ft. on the Combination No. 2 in quest of this vein. As a result of opening this vein on the 350-ft. level, nearly 100 ft. below the old lease workings, the company is recovering a good quantity of ore of better grade than that handled for many months past and mill heads have advanced correspondingly. At several other points in the mine high-grade ore is being broken and the outlook is better than for more than a year past.

Jumbo Extension has been a centre of interest, owing partly to the negotiations for the sale to Consolidated of its one-half interest in the Vinegerone Fraction and to the fact that ore of excellent grade is being shipped from the Goldfield Annex Co. lease on the Polverde claim, adjoining the Clermont on the east. This is the only work now in progress on this company's claims, but T. G. Lockhart, the president, announces that development work may be started before long, as the company has the privilege of operating from the Annex shaft. This shaft is 1060 ft. deep, the second deepest in the district. In sinking the shaft some ore was exposed at about 700 ft. and last year the lessees shipped some ore from drifts on the 800-ft. level, but the ore apparently became exhausted at this point after sinking to the present depth and failing to find the ore on the 1000-ft. level, work was resumed on the 800, with the result that the ore-shoot was found and several shipments have been sent to the sampler. Within the past week another ore-shoot of good proportions and yielding better assays than any yet found, has been exposed on the 800-ft. level to the south, the 800 drift being north of the shaft. Preparations have been made to increase the volume of shipments and the prospects for future operations are regarded as exceptionally bright. The Jumbo Extension company will probably begin work on the 1000-ft. level after the present southeast drift has progressed another 100 ft. to the boundary of the leased territory.

SPOKANE, WASHINGTON

Review of Mining in the Northwest. — Operations for 1910 Satisfactory.—Record of Production in British Columbia. — Coal Mines. —The Coeur d'Alene.

Reviewing the mining situation in the Northwest, L. K. Armstrong, secretary of the Northwest Conservation Association, says that a year ago the vitality of the industry in the Northwest was about at its lowest ebb. A period of intense activity, due to high metal prices, had been followed by the beginning of a more sane system of development and metallurgical economies not heretofore practised, with the result that the industry appeared from the outside to afford little profit in the face of the low prices of the metals, especially copper, which remained at about one-half the price it had commanded three years previously. Reports to the effect that elsewhere copper was being produced and marketed at a cost of about 7c. per pound, with large ore reserves to draw from, added to the disquieting conditions. The other side of the picture, however, is not quite so discouraging. Mining corporations and individuals, having large investments, had realized

British Columbia.

that the industry would not long continue under high pressure, and began the introduction of newer and better methods, so that by the advent of 1910 it was discovered that these plans were being carried out with success. Meanwhile development plans had been maturing, projects were undertaken which resulted in greatly increasing the ore tonnage in some of the mines. The statement of one operator that the older camps were excellent fields in which to prospect has been emphasized in the discovery and development of large orebodies in mines hitherto little known. Including the great copper camp of Butte, dividends paid by companies operating in Montana, Idaho, Washington, and southern British Columbia, exclusive of coal companies, aggregated $7,266,332. These dividends were paid by companies operating gold, lead-silver, and copper mines, and representing about 6% of the total value of the production. So the year 1910 was one of the most satisfactory in the history of mining in the Northwest.

In the British Columbia Crows Nest Pass coalfields three companies, the Crows Nest Pass Coal Co., Corbin Coal & Coke, and Hosmer Mines Ltd., mined about 25% more coal than the district produced the previous year. On the Alberta side, in which Spokane capital is largely interested, the production was equally satisfactory. Excepting the St. Eugene, and a few others less important, the argentiferous lead mines of both East and West Kootenai had an era of renewed activity, the one serious drawback being that the Kaslo & Slocan railway, connecting several of the important mines with the navigable waters of Kootenai lake, was completely wiped off the map for several miles by the forest fires which devastated the country last summer. A remedy for this disaster, however, is to be found in the early completion of the Canadian Pacific railway to the mines. Cutting the ore on the 1050-ft. level of the Rambler-Cariboo, the discovery of vast deposits of silver-lead ore in the Standard mine and the continued discoveries of zinc ore in the Lucky Jim, assure the Slocan a period of great activity. The mines about Ainsworth, as a result of the advent of several Spokane men in the field, will resume more extensive development. Nelson is properly the centre for the Toad Mountain, Forty-nine Creek, Sheep Creek, Ymir, Salmo, and Erie districts, where operation, reduction, and shipments have been kept up. Sheep creek has a high record for the amount of gold bullion shipped during the past year, the Nugget and Queen mines alone having produced over $200,000. The Yankee Girl at Ymir shipped nearly 5000 tons in course of development.

West fork of Kettle river, Princeton, and surrounding territory began to attract capital last year, the former with the assurance of all-rail connections with the outside world, and the latter because of that fact and the consequent coal shipments and metal mines developments. As a coal-producing State, Washington stands at the head of the list on the Pacific Coast. Out of a production of between four and a half and five million tons, the mines of Kittitas county produced considerably more than half. The total value of the entire production at $2.25 per ton at the mine would amount to more than $10,000,000. Building of railroads into Okanogan county has already stimulated mining, several important projects having been started or are now being projected, among which is a smelter near Oroville. At Chesaw, men friendly to the Granby company have located a number of claims upon which a large amount of money is to be expended in development. Nespelem, at the southeastern border of the county, has some remarkable deposits of copper, gold, and lead-silver ore now being developed. The First Thought mine, at Orient, soon may be provided with a cyanide plant for treating its ores. At the Napoleon mine, below Orient, a cyanide plant has been installed to treat the carbonate ores of that mine. It will take several years to mine and treat these surface ores, from which several million dollars will be extracted. Shipping operations around Northport were confined to a small tonnage of lead ore, the production of the Last Chance mine, owned by the Jupiter Lead Co. The only shipper at Chewelah was the United Copper.

Loon Lake, Germania, and Deer Park, all in Stevens county, Washington, have been active in exploiting the tungsten deposits which promise to make Washington famous. The ores of the Stevens county mines are of exceptionally high grade and can enter any market in the world in competition with other raw ores. However, it is the intention of at least one company to build a metallurgical plant near the mines, and market only the refined products. Built into the heart of the Metaline district, the I. & W. N. railway provides an outlet for the ores of that region. Several mines will revenue shipments this year under the new conditions, having an all-rail connection with smelters at Tacoma and elsewhere. But the premier mine of Bonner county, Idaho, is the Idaho-Continental, which now has an estimated lead-silver tonnage blocked out valued at about $4,000,000. Developed to the 500-ft. level, this mine has been opened laterally for several hundred feet, with the limits of the ore-shoots as yet undetermined. A railroad is to be constructed to the mine by the Great Northern company, and a 500-ton concentrating plant will be erected this year to treat the lower-grade ore. Around Lake Pend Oreille development is about normal except near Clark's Fork, where the Lawrence mine has a large body of silver-lead ore. Some tests have been made at the Webber mine in the hope of effecting a satisfactory saving by cyaniding the silver ores. These

tests are still being carried on. The Panhandle smelter remains idle. In verification of the statement made by Stanly A. Easton, manager of the Bunker Hill & Sullivan mine, to the effect that the older camps offer a splendid chance to prospect, the Jack Waite, Marsh, Caledonia, and Stewart, in the Coeur d'Alene, are now classed as new mines, which are upon a shipping basis. The Ajax is in readiness to take its place beside them. Operations at the deep levels of the Morning have disclosed the wonderful possibilities of that mine. Hecla also increases in value with depth. Hercules, Federal, Bunker Hill & Sullivan each contributed to the increased production, the last named having in contemplation the building of another 500-ton unit to its mill, bringing the capacity of the plant up to 2000 tons per day. Better ore-dressing methods are steadily being introduced.

COCHISE COUNTY, ARIZONA

Interesting Notes on Ore Occurrence and Mine Development in Johnson Camp.—A Gold Mine.

The camp of Johnson, Arizona, is more active than it has been for some time, and the results are good. The Arizona United company two years ago erected and started a small but efficient smelter, which so far as good work is concerned was all right; but sulphide ore had not been developed, and iron deposits close at hand were made use of, thus necessitating the purchase and shipping in of these materials, and the plant closed down indefinitely. This put a damper on the camp, and operations ceased, except those of the Black Prince Copper Co., a Denver corporation, and the Peacock Copper Co., an El Paso concern, each of which has worked constantly, the former on a large scale. Johnstown, Pennsylvania, people have taken over the Arizona United and are using a churn-drill, and it is believed that the property will make good. The Peacock Copper Co. owns a large acreage of ground on the southeasterly edge of the camp, in which there are many croppings of copper-silver ore. They have a 125-ft. inclined shaft on one of the faults, most of this depth in ore; but a new incline has been started and is now down about 75 ft. This work is in limestone, and is being directed by Herbert S. Wein. The opening follows the vein all the way on a clearly-defined contact. For about 45 ft. the work was in hard dolomite; but a change occurred, and the drills penetrated better ground. At 60 ft. there was ore in small quantity, but of good grade, and the body is increasing with depth. The ore on the dump consists of bornite, azurite, and malachite. As this is more in the nature of exploratory work, no equipment has been constructed. But Mr. Wein has a wooden headframe, the cable is attached to a wagon a short distance up the hill, and instead of turning on the steam he calls 'geddap,' and the bucket begins to rise; in this way at practically no expense the ore and waste are brought up. The shaft starts at the bottom of the arroyo and attains depth rapidly; and water-level will be reached soon. The indications are good here, and the work is being well done. The incline will be equipped with a hoist when 100 ft. is reached.

About three miles from Cochise are the 12 claims of the Cochise Gold Mining & Milling Co., yielding gold ore. Seth Merrill is in charge of the work. The properties have been prospected by about 800 ft. of work. There appears to be a porphyry dike, 40 to 140 ft. in width, in which the gold occurs, assaying about $3.50 per ton, and it appears to be free-milling. Both walls are well defined. The adits, 45 and 62 ft., respectively, have been driven to the foot-wall, all the way in ore. In driving a drift 35 ft. on the strike of the lode the ore sampled about $4 per ton. The porphyry crosses a deep arroyo, making an ideal site for a mill. Abundant water is to be had two miles distant, but as it is anticipated that better ore will be found at water-level, a new shaft, now down 40 ft., is being sunk with the intention of reaching the water. 'Specimen ore' is to be found at almost any point on the property, and one face in an open cut is heavily impregnated with gold, easily seen without a glass.

JOHANNESBURG, TRANSVAAL

The 1910 Output of the Rand Mines.—Interesting Data on Costs and Profits.—Testing Drills. — Mill Practice. — Centralizing Operations at Crown Mines.

The annual meeting of the Transvaal Chamber of Mines was held here on February 23. The retiring president, T. G. Hamilton, who manages the affairs of the Consolidated Mines Selection Co., in South Africa, made a noteworthy address on the progress of the industry during his year of office, and he also dealt at length with the outlook for Transvaal mining in the immediate future. Mr. Hamilton prefaced his address by stating that the mining industry had steadily continued to advance its scope, and that the annual gold output of the Witwatersrand had for the first time exceeded a value of £30,000,000, as the result of last year's work. To be precise, the gold output of the Transvaal amounted to £32,001,735, the contribution of the Rand being £30,703,912. The output figures for 1909 were £30,925,388 and £29,900,359, respectively. These figures assume additional importance when considered in relation to the gold production of the world. In 1895 the Transvaal's output was 21%, in 1905 it was 27%, and for 1910 it is estimated that the Colony produced more than 34% of the total. Analyzing the output of the Witwatersrand, it is ascertained that £19,000,000, or 62% of the output went in working costs. Dividends paid amounted to £8,876,085, or 29%, and the balance was absorbed in profits tax, interest on loans, capital expenditure, etc. For 1909 the corresponding figures were 60% working expenditure, 31% dividends, and 9% miscellaneous. Working costs 'for incidental reasons' increased from 17s. 1d. per ton in 1909 to 17s. 7d. per ton in 1910. To a large degree the increase is accounted for by pursuance of a policy in which low-working costs have not been set in the forefront of the managerial program to the extent that has obtained in other years. Working profits, it may be noted, decreased from 11s. 6d. per ton in 1909 to 10s. 6d. per ton in 1910, and the aggregate profit was, therefore, £11,216,105, as against £11,794,376 in 1909, despite the crushing of an additional 888,782 tons of ore. The stamp duty for the last year was 7.19 tons per diem. The number of Europeans employed on the gold mines during December last was 25,376, as compared with 23,126 in December 1909.

Among the many important matters dealt with in the Chamber's report, and discussed by Mr. Hamilton at the meeting, particular reference must be made to the increasing use of rock-drills in the mines of the Witwatersrand. As a result of the recent stope-drilling competition there has been a decided improvement in the types of small drills that find a market on the Witwatersrand for stoping purposes. Mr. Hamilton drew special attention to the deduction arrived at by the committee superintending the investigation, which was to the effect "that under suitable conditions, both as regards mining and efficient working, it is possible to break ground as cheaply and keep stopes as narrow as required with small machines as with hammer-boys." In addition to the data gained in the drill competition important experimental work has been in progress at the Robinson Deep mine under the auspices of the Mines Trials Committee, and has as its object the determination of the best quality of steel for drilling work and the most suitable forges and devices for sharpening drills. Valuable information has been gained from the experiments, and it is anticipated that the completed tests will have an important bearing on Rand mining economics. Mr. Hamilton referred to the improvements that have taken place in Rand metallurgical practice, and specially alluded to the removal of the amalgamating plates from the mill-house to a separate building, the use of zinc-dust as a precipitant, and the installation of vacuum filtration plants at the Crown Mines, Robinson, Bantjes, Brakpan, and Modderfontein properties.

Interesting reorganization work is being carried out at the Crown Mines property. The extent of the Crown Mines claim area from east to west on the strike of the reef is nearly three miles, and there are on the property nine main

shafts and seven crusher stations. In the past, ore has been raised through all these shafts and each of the crusher stations has been utilized. Since the amalgamation of the several properties, which now constitute the Crown Mines Ltd., it has been decided to reorganize not only the plants but the scheme of working, and, with a view to economy and efficiency, one of the first items in the new program is to be concentration of hoisting and crushing at two stations only. Two shafts, known as the No. 5 and No. 7, in future will be the main haulage pits of the property, and at each of these crushing operations will be carried out. By systems of underground chutes and haulage all rock from the Langlaagte Royal, Paarl Central, Langlaagte Deep, and western areas will be concentrated at the No. 7 shaft and hoisted there, while ore from the Robinson Central Deep, Crown Deep, Crown Reef, and eastern areas will gradually be concentrated at shaft No. 5. These two shafts will be connected on the 13th level at a vertical depth of approximately 2200 ft. by a main haulage drift 14½ ft. wide, and practically straight from one end of the property to the other. This drift will be served by electric haulage. The two shafts will have to handle between 9000 and 10,000 tons per day as the full requirements from the mine.

MEXICO

Cost of Production at Cananea. — Consolidations in Chihuahua. — Alvarado Reduction Plant.— Veta Colorada Mill. — Reorganization of Mexico Consolidated.

During the remainder of this year the Cananea Consolidated Copper Co. (Greene-Cananea) expects to produce copper at a cost of 9c. per pound. Last year the total cost was 11.19c., but this included a construction cost of 1.49c., leaving the operating cost 9.7c. per pound. The construction program, inaugurated a few years ago, has been completed at a cost of over $7,500,000, and there will be no further construction charges this year. The operating cost will cover new development. The operating profit of Greene-Cananea in 1910 is placed at $1,300,000, and construction costs at $650,000, leaving a balance of $650,000. The production in the year amounted to 45,771,925 lb. of copper, 1,187,820 oz. of silver, and 5483 oz. of gold. The ore handled in the 12 months amounted to 969,728 tons. The mines formerly owned by the Hidalgo Mining Co., in the Parral district of Chihuahua, have been taken over by the Alvarado Mining & Milling Co. at a price of $500,000. These mines, and control of the Parral & Durango railroad, were acquired a few months ago by those principally interested in the Alvarado enterprise, the deal involving, according to reports, $1,500,000. To make the purchase of the mines, and to pay off notes of the Alvarado Consolidated Mines Co., the concern that was merged with the Palmilla company in the organization of the Alvarado Mining & Milling Co., the present company has issued $1,000,000 of 5-year 6% convertible gold bonds. The new reduction plant of the Alvarado is handling from 250 to 300 tons daily, and it is hoped to increase to 400 tons daily during the present year. The dump ore at the Palmilla mine and at the mines of the Hidalgo company is sufficient to keep the plant busy for a long period. Development below the water-level in the Palmilla mine will have to await the erection of a powerful pumping plant. The company plans to develop an ore reserve sufficient for several years before enlarging the reduction plant. The new plant of the Veta Colorada Mining & Smelter Co., near Parral, is operating steadily, and bullion shipments are being made. The tanks of the Veta Colorada plant were planned by Bernard MacDonald, the Guanajuato cyanide expert, and have been given the name 'Parral tanks.' They are of unusual size, and new principles of agitation are involved. The results so far have been very satisfactory, according to report. The time for depositing securities under the latest plan for the reorganization of the Mexico Consolidated Mining & Smelting Co., of Boston, owning mines and a new reduction plant in the Guanacevi district of Durango, has been extended to April 21.

NEW YORK

Awaiting Supreme Court Decisions.—Competition of Copper Producers.—Sulphuric Acid Manufacture.—Alaskan Developments. —South Utah Mines.—Tooele, Tintic, and Pioche.

In a general way, the waiting attitude prevailing throughout the East has become intensified. There is nothing on foot in the way of bringing out new issues. It is said that the house of J. P. Morgan & Co. alone has nearly a billion dollars of consolidations and industrial promotions awaiting a construction of the Sherman law. It is hard to realize the extent to which the coming Supreme Court decisions affect Wall Street. Every Monday, if the Supreme Court at Washington is sitting, sees a busy group of customers watching the tickers. It is the rule now in the New York financial district that offices filled on Mondays are uninhabited for the remainder of the week. It is undoubtedly in the hope of securing a new and more active following among small traders that the Stock Exchange has taken in several of the leading new copper issues, such as Nevada Consolidated, Ray Consolidated, and Chino, which are soon to be followed by Miami and Inspiration.

That the copper situation is not clearing itself as rapidly as was hoped is shown by a recent move on the part of the Guggenheim coppers to compete with the Tennessee Copper in the making of sulphuric acid. Utah Copper and Nevada Consolidated are, up to the present time, the leaders in the porphyry group, and, as such, are in a class alone as large producers of cheap copper. It is significant, therefore, as an admission of the competition among these copper producers and of the gravity of the situation in view of the new properties just ready to put copper on the market, that the American Smelting & Refining Co. should begin to look forward to and prepare for the day when the net profits will be derived from by-products. The A. S. & R. Co. people have been examining phosphate beds throughout the West with a view to utilizing the phosphate in the manufacture of fertilizer, if a market can be found for the product. Experimental leaching plants are in operation at both the Nevada Consolidated and the Utah Copper properties, and if the experiments result satisfactorily an attempt will be made to recover the copper from the oxidized overburden and from the tailing dumps. Tennessee Copper's sulphuric-acid plant is making about 500 tons daily. This output is about 80% of what the plant is expected to produce when all the operating problems have been solved. It is expected to show a profit of about $3 per ton. Inasmuch as the plant was really erected as an expedient to rid the company of endless litigation over its smelter fume, it appears to have been a real turning of loss and annoyance into an actual profit. It may yet be that Butte, Bingham, Tooele, and Douglas, instead of being centres of areas devastated of vegetation, will not only overcome the fume problem, but will be the source of rejuvenation for the lands of the West which have been exhausted by unwise cultivation without rest or crop rotation. In a way, it would be a duplication of Nature's chemistry as illustrated by the finest vineyards in the world growing in the volcanic ash near the crater of Mount Vesuvius.

Undoubtedly a part of the promotions mentioned as held up in the office of J. P. Morgan & Co. is represented by the Copper River railroad and the Bonanza mines in Alaska. The railroad has just been completed, and the first shipments of copper are expected to be made in the very near future. It may have been something more than a construction of the Sherman anti-trust law which deterred the house of Morgan & Co. from making any public offering of the Alaska enterprises. In the face of the copper situation it would have been futile in any event, but it is also true that there exists in the public mind a well-defined idea that, while the Morgan-Guggenheim syndicate has been performing some great feats in Alaska, such work has not been disinterestedly for the good of the territory.

Mr. Heinze's operations in Porcupine are hailed as ex-

tremely successful. and, indeed, the first promotion of his new enterprises in that camp seems to have moved off without a hitch. In the meantime, however, it is expected that Mr. Heinze will be altogether eliminated from Ohio Copper before the next annual meeting in June. Mr. Heinze's ability to create enthusiasm in new promotions and enlist support among strangers, and his propensity for getting snarled up in litigation, is a pat illustration of the old saying that it takes a bigger man to complete an undertaking than it does to begin one.

The South Utah Mines & Smelters, which is a reorganization of the Newhouse Mines & Smelters Corporation, has settled the claim of the United Metals Selling Co., for $144,000, in full. The South Utah company ships its concentrate to the Tooele smelter, and is adding new equipment to its mill in an effort to lower production costs. The copper output is sold by E. P. Earle, who is also very largely interested in Cobalt and more recently in Porcupine.

It is expected that the erection of the new lead stack at Tooele will greatly improve the situation of the lead-silver producers in Utah. The Tintics have quite a following in New York, while the camp at Ploche has just as many followers, though the latter have been mostly heart-sick from deferred hope.

LONDON

Kolar Mines.— Decrease in Costs at Mysore. — Report for 1910 at Nundydroog.—New Properties.—Successful Year at Ooregum. — New Methods Employed.

Since writing last week of the Mysore Gold Mining Co., the most important of the Taylor group of mines in the Kolar district of India, the news is published that the decrease in costs of operation has made it possible to treat great amounts of ore that have hitherto been left in the stopes, so that it is not only the discoveries at depth that have to be followed by the shareholders. Two other mines of the same group have published their reports for 1910. The Nundydroog shows a position of high current profits and future prospects like the Mysore. The Ooregum has made its largest recorded profit, but development is not so promising for the future. Some details of these mines will be of interest.

The Nundydroog company was first formed in 1882, but no satisfactory results were obtained until 1898. Since then the output has steadily increased, with the exception of 1898-90, when a lean zone was passed through. The report for 1910 shows that 91,000 short tons was sent to the stamps and that 81,293 oz. bullion was extracted by amalgamation. In addition 84,280 tons of tailing yielded by cyanide 7436 oz. bullion. The total production of gold was worth £334,748, the working cost was £153,813, royalty to the Mysore Government £18,984, income tax £7221, depreciation £10,773, amount placed to reserve £20,000, and dividend £117,916, being at the rate of 41⅔%. This dividend is the highest yet paid, a result which is not fully appreciated until it is recollected that all expenses formerly charged to capital account are now being paid out of revenue, and also that a reserve fund is being built up. Other items of note are that the additional ground acquired from the Tank Block is proving useful in facilitating development, that the price paid for electric power to the Cauvery Falls company has been reduced, and that the ore reserve has been increased to 141,296 tons during the year. The superintendent, Charles H. Richards, gives a detailed account of development at various points and draws special attention to the valuable discoveries on the 2450, 2600, and 2750-ft. levels in Kennedy's section. Mr. Richards also reports that he has been investigating the question of treating the large accumulation of slime and that he expects to make a definite proposition in the course of the current year. Two years ago the company acquired an option on the Jibutil block in the Anantapur goldfield, Madras Presidency, and since then W. T. Stonor, the superintendent, has pushed development. His report is incorporated with the Nundydroog report, showing that the shaft has been sunk to 450 ft. and levels have been driven at 130, 250, 350, and 450 ft. The ore reserve is 21,200 tons, and in all the levels indications are good. The directors have therefore decided to complete the purchase and to float a separate company to purchase and work the property.

The other company, the Ooregum, began producing in 1888 and the first dividend was paid in 1891. It is not so large a property as the Mysore, Champion Reef, or Nundydroog, and it has passed through more vicissitudes. The last period of low-grade ore was from 1905 to 1907, but in 1909 the gold content once more rose and averaged 12½ dwt., as compared with 8¾ in 1905. The report for 1910 shows that 133,407 tons of ore was sent to the mill, and yielded 80,934 oz. bullion; in addition, 122,051 tons of tailing yielded 12,833 oz. bullion. The total production was 34,151 oz. fine gold. The extraction per ton was about 12¾ dwt., practically the same as in 1909, and the total yield was the largest in the history of the company. The income from the sale of gold was £357,119. The current expenditure was £175,157, royalty £20,270, income tax 7286, depreciation of plant £6000, allocation to cost of new shaft £9000. A reserve fund has been started with £15,000 out of the year's profits. The dividends absorbed were £129,250, being 42½% on the £120,000 preference and 32½% on the £240,772 ordinary. The working costs have been reduced during the year, being 26s. 3d. per ton, as compared with 29s. 5d. in 1909, hence the possibility of paying an increased dividend and starting a revenue fund. The amount of development work done during 1910 was 16,298 ft., and the reserve on December 31 was 164,534 tons, a slight increase during the year. The general results were not quite so good as expected, but R. H. P. Bullen, the superintendent, reports that he will be able to maintain the present yield during this year. The deepest workings are 4210 ft. on the dip. For some time the directors have discussed securing other property, and the opportunity has recently been presented of taking a three years option on claims twelve miles to the north of the Kolar district. This property contains ancient workings in which a vein has recently been discovered 60 ft. from the surface. The Ooregum company plans to spend £5000 in exploration work.

Another gold mine under the auspices of John Taylor & Sons is the Mount Boppy at Cobar, New South Wales. It has been producing gold since 1901 and yielding dividends since 1902. The metallurgical equipment contains 40 stamps that were acquired from the Gallymont company. The ore near the surface was oxidized, showing the usual secondary enrichment, and the profits to 1908 were large. During the years 1905 to 1908 the dividends were 47½% on a capital of £121,000. Subsequently the oxidized ore decreased in value and the workings penetrated sulphide, but nevertheless the dividends were 27½% in 1909 and 35% in 1910. The report for 1910 shows that 47,082 tons of oxidized and 31,608 tons of sulphide ore were sent to the stamps, and 11,199 oz. was caught by amalgamation. In addition the cyanide plant extracted 17,937 oz., and 317 tons of concentrate, sold to smelters, yielded 2314 oz. The total production was therefore 31,486 oz. (8 dwt. per ton), which sold for £132,048. The working cost was £79,685, income tax £3191, depreciation £4042, and allocation to capital expenditure £3000. The dividend distributed absorbed £42,350, bringing the total distribution to date to £395,382. The directors intend to alter the metallurgical methods, in order to obtain a higher extraction from the sulphide ore. It is proposed to adopt the all-sliming method, and a new plant, consisting of tube-mills, agitators, and filter-presses, is to be provided. Experiments show that by this means an additional pennyweight can be extracted per ton, giving on 80,000 tons per year an increased yield of £16,400. The superintendent, James Negus, reports that development at depth, toward the south end of the property, indicates that the two orebodies which at the northern end are like the two legs of an inverted saddle, have come together and partake of the nature of an ordinary fissure vein. There is therefore a prospect of an extended life for the property. The ore reserve was 234,684 tons on December 31, an increase of 9000 tons during the year.

General Mining News

ALASKA

KETCHIKAN DISTRICT

(Special Correspondence.)—The Mt. Andrew mine, one of the best producers in this district, has been bonded to the United States Smelting, Refining & Mining Co., at $2,500,000, the first payment of $1,000,000 to be made on July 1 this year, when, if the bond is taken up, that company will take full charge.

P. Heaney, in charge of the Victory, on Seal bay, reports good progress. The main tunnel is now in 1900 ft., and raising and driving is also being done on this property. Operations at the It mine have commenced again, and the ground prospected last season with the diamond-drill will be opened this year by driving an adit about 1300 ft. long. Returns from the last shipment of ore from the Rush & Brown mine showed an average of about 7% copper and $4 gold per ton. The vein of high-grade sulphide ore will be prospected on the 200-ft. level by a cross-cut now being driven from the main shaft. A number of prospectors are preparing to explore the Salmon river country, near the British Columbia boundary line, as several good-looking croppings were discovered there last season.

Ketchikan, March 30.

PRINCE WILLIAM SOUND

The Valdez *Prospector* reports that steps have been taken at that place to put a stop to the practice of staking claims on ground while it is so deeply snow-covered as to make the discovery of a vein or lode impossible. The unfairness and absence of good faith in staking a large area of country when it is covered by 10 ft. of snow serve to discourage legitimate prospecting and to restrict *bona fide* locations.

The first shipment of copper ore was made from the Bonanza mine at Kennicott last week. It amounted to 2000 tons, and was hauled to Cordova over the Copper River & Northwestern railroad, and thence by steamship to the Tacoma smelter. A shipment of 30,000 bbl. of fuel oil, produced by three wells in the Katalla field, was made for Seattle on April 5 by the Amalgamated Development Company.

THE TANANA

Winter sluicing was performed successfully in March by Peterson & Kellum, who are operating on 17 Goldstream, out from Fairbanks, having a lease on ground belonging to L. L. James and H. H. McDonald. The first clean-up, made after an 8-day run, amounted to about $5000, gold to this value having been taken from 2150 sq. ft. of bedrock. Sluicing at that season of freezing weather was made possible by covering the sluice-boxes and heating the interior by steam-pipes; the water, before being turned into the flume, was also heated by exhaust steam. This firm was employing 31 men in March, this force having been engaged in blocking out the ground, timbering, and building flumes. When the regular season opens, May 1, a force of 120 men will be employed. All the material on bedrock will be handled with cars this season instead of wheelbarrows. The pay-dirt is found on bedrock, 50 to 65 ft. below the surface, and is reached by vertical shafts through which the gravel is hoisted to the surface for sluicing.

ARIZONA

COCHISE COUNTY

The Copper Queen Con. Mining Co., operating at Bisbee, the Detroit Copper Co. at Morenci, and the Moctezuma at Nacozari, comprising the three copper companies controlled by Phelps, Dodge & Co., made net earnings of $6,190,092 in 1910, distributed as follows: Copper Queen, $4,623,856; Detroit, $1,085,545; Moctezuma, $480,690. The Copper Queen company operates at Douglas the largest copper-smelting plant in the Southwest, where ores from its Bisbee mines, concentrate from the Moctezuma mill, and a large tonnage of custom ore and concentrate are smelted. The Detroit company operates a concentrator and smelter at Morenci.

MARICOPA COUNTY

The Arizona Mines Co. has sunk a 250-ft. inclined shaft on the foot-wall of a vein said to have a width of 40 ft., containing ore of good grade, carrying copper, silver, and gold. The intention is to continue sinking till a depth on the 40° incline of 450 ft. is reached. The property is situated on Castle creek, out from Wickenburg. F. X. O'Brien has sunk a 200-ft. shaft, and has driven 500 ft. on a 20-ft. vein of sulphide ore, at his property in that vicinity. In the latter, sulphide ore has been found.

GREENLEE COUNTY

The Arizona Copper Co., the copper mines of which are in the vicinities of Metcalf, Longfellow, and Morenci, produced 32,210,000 lb. of copper during 1910, at a cost of 10.3c. per pound. Its ore is said to have yielded an average of 42.64 lb. of copper per ton. Close to 96% of the ore produced was concentrated, the remaining 4% having been smelted direct. The company has three concentrating mills at Clifton, and one at Morenci; the smelting plant, as to its original unit, was built at Clifton more than 20 years ago, although it has been enlarged and portions of it rebuilt several times. But it is now announced that a new smelter is to be built. In addition to its milling and smelting operations, this company for many years has made use of a leaching process for treating low-grade oxidized ore, using sulphuric acid that is manufactured from the sulphurous fume emitted in the roasting sulphide ore. This leaching plant has been considered a pronounced commercial success. In connection with it is a plant for the manufacture of bluestone, or copper sulphate. The home office of this company is at Edinburgh, Scotland.

YAVAPAI COUNTY

The Monte Cristo mine, near Constellation, being developed by Ezra W. Thayer of Phoenix, is attracting attention by reason of the finding of a 14-in. vein of ore assaying high in silver. The ore consists of chloride of silver and lead carbonate.

The Congress gold mine, for years one of the best producers in Arizona, is reported closed down. It has two veins, on one of which an inclined shaft was sunk on the dip of the vein to a depth of 3300 ft. The surface equipment includes two mills and a cyanide plant. The mine is believed to be nearly worked out.

(Special Correspondence.)—Lewis & Ardria are shipping 10 tons of high-grade gold and silver ore per day to the Humboldt smelter. The United Verde Copper Co. has acquired of J. S. Jones the Independence mine, at Chaparal This property is a producer of siliclous ore, much desired at the United Verde smelter. The Henrietta mine, situated near McCabe, is reported operating again. The ore is being sent to the smelter. A carload of ore was shipped recently from the Oro Belle mine, near Crown King, which sampled about $100 gold per ton; another car was shipped from the McKinley mine, situated in the same locality. The latter was of low-grade ore.

Prescott, April 4.

YUMA COUNTY

The mine belonging to W. E. Scott, on the Goodman lode, in the vicinity of Quartzsite, has been developed by a 125-ft. shaft and 175 ft. of driving on the vein. The ore mined and treated in a small Nissen stamp-mill during the last few months yielded between $9000 and $10,000 in gold. The last clean-up, which resulted from milling 25 tons of ore, amounted to about $1500. The Goodman lode croppings are traceable for 1500 ft. This lode is at the head of a gulch containing the old La Paz placer claims, where some placer mining is still in operation. A property containing cinnabar ore is being developed with a force of 10 men, directed by George Cheney, in that vicinity.

CALIFORNIA

CALAVERAS COUNTY

Ralph King, James B. Maguire, and others are preparing to work the Three B. claim on Calaveras river. This ground contains a deposit of auriferous gravel having a width of 100 ft., a depth of at least 60 ft., and of undeter-

mined length. A pit, made by excavating, is kept free of water by a water-power siphon, and a hoist is to be placed there to be used in raising the gravel to the dump-hopper, at the head of the sluices. Water for sluicing is to be obtained from the Mokelumne canal. Two gold dredges are in successful operation at Jenny Lind, and the San Andreas *Citizen* states that another dredge is to be built there. An electric-car line, which is being built from Stockton to Jenny Lind, may be in operation by July 1.

ELDORADO COUNTY

The Murdock gravel mine, situated on Nigger flat, four miles from Placerville, has passed under bond to Idaho and Washington operators, who expect to work it this season. The property is said to contain an ancient river channel, the gravel bed of which is rich in coarse gold. This stratum of auriferous gravel lies beneath a lava capping, and is so well cemented together as to require a crusher and stamps for pulverizing it, so as to free the gold before passing the material through sluice-boxes. P. K. Kelsey, of Lewiston, Idaho, who is concerned in the bond given, is now in

Map of California.

charge. The present mill has five stamps, and a larger mill may be built if operations shall prove as successful as anticipated. The drift being driven on the Helena gravel mine, near Georgetown, by Robert Waugh and Archie Goldberry, now has a length of 900 ft., and the drift heading soon is expected to reach the gold-bearing channel.

KERN COUNTY

The Randsburg *Miner* reports that the cyanide annex to the Osdick 5-stamp mill, in Stringer district, has been put in operation, with Charles Overmyer in charge. The first material to be leached consists of 2000 tons of tailing that has accumulated, and similar material from other mills of the district will then be treated. The Yellow Aster M. & M. Co. has finished the work of straightening and retimbering its Bonanza shaft, which is situated east of the big glory-hole, and has a depth of 335 ft. A cross-cut to be 600 ft. long is to be driven from this shaft toward the axis of the mountain, by which the orebody will be opened at a depth of 1000 ft. Other cross-cuts are to be driven in the opposite direction to explore ground south of the main orebody. A 2000-ft. tunnel is being driven through to the hill to serve as a haulage level for the delivery of ore to the mill. The Atolia Mining Co. is successfully operating a tungsten mine near Atolia. P. Fahey, operating the Windy mine, near Randsburg, recently sent 50 tons of ore to Red Dog mill. Half of this was taken from the 140-ft. level. The Phoenix mine, at Johannesburg, owned by C. A. Burcham of Randsburg, is equipped with a 5-stamp mill, which is in operation. An interior shaft is to be sunk to a depth of 500 feet.

NEVADA COUNTY

(Special Correspondence.)—At the Champion mines 80 men are employed, of whom 20 are on the pay-roll of the North Star Mines Co. The latter is opening new levels and sampling the various orebodies exposed. Its bond on the Champion continues for six months, and it appears to be satisfied with developments thus far conducted. The Champion Mining Co. is concentrating work in the vicinity of the 800-ft. level and running the mill on ore from this place. It is reported that operations are to be resumed at the Murchie mines, situated in a proved section of the Nevada City district, and which recently passed into new hands. The new 3-compartment shaft at the Brunswick mine has reached a depth of 450 ft., and sinking is to be continued as soon as a new 600-gal. pump has been put in place. The Brunswick has been idle for two years, pending the completion of the new shaft, which will intersect the old workings at a depth of 1000 ft. The mine lies in the same gold belt as the Idaho-Maryland group.

Nevada City, April 8.

The North Star mine, the widely known gold property at Grass Valley, mined and milled 90,110 tons of ore during 1910, of an average value of $13.68 per ton. The gross proceeds for the year amounted to $1,232,933; cost of operating and development was $555,860, leaving a profit of $677,073. The North Star Mines Co., which owns the property, paid $403,471 in dividends within the year, and placed $554,526 in the investment account. The manager for the company is A. DeW. Foote.

PLACER COUNTY

The Beaver Dredge Co., of Los Angeles, is constructing a gold dredge on the Hawk ranch, near Rocklin, to replace the one of lighter construction used last season. The new dredge is to cost $125,000. Pendleton brothers, who are driving through cemented gravel in the Laird mine, at Yankee Hill, east of Loomis, have taken out some material that runs $100 per ton.

PLUMAS COUNTY

The Rose Quartz gold mine, on Poorman's creek, which is equipped with a mill and ditches and flume for a water supply, has been leased for three years to Hattie E. Churchill of Sacramento. Operations at the property are to begin this spring, with Julia Kelley as superintendent. Some development work is to be performed to open ore-shoots, and new equipment may be provided for the mill.

SAN BERNARDINO COUNTY

The smelter of the Needles Mining & Smelting Co., which has been enlarged and improved generally, is ready to operate again. A large tonnage of ore has been accumulated. The concentrating plant has undergone some changes, and when it is started again its processes will consist of wet concentration for making a lead product, followed by drying the iron-zinc middling and separating those two metals by Huff electrostatic machines, similar to those in use at the United States company's plant at Midvale, Utah. D. R. Muir is manager for the Needles M. &. S. Company.

SIERRA COUNTY

The Gold Canyon mine is under bond to E. M. Parrish, who came into possession of the property last fall. In sinking a winze 25 ft. below the drain tunnel rich ore was found in what is believed to be the same shoot as that which yielded high-grade ore in early days. The Omega gravel mine, situated near Forest, which is leased to the Electric Separating Co. of Oakland, is being developed with a force of 24 men, who are extending drifts through the channel of blue, cemented gravel which has fine gold disseminated through it. This tight placer material is pulverized in the mill, and the gold is recovered by electro-chemical machines which were put in by L. J. Neuamont of San Francisco. W. A. Hussey of Oakland is

manager for the company, with W. W. Casserly in charge of the mine.

TUOLUMNE COUNTY

(Special Correspondence.)—T. J. Benny, superintendent of the Lone Star group of mines, situated northwest of Confidence, and owned by J. W. Watters of Santa Cruz, will put things in readiness for the resumption of operations. Several adits have been driven on the veins to determine the merit of the property, and it is now the intention to start a cross-cut at the lowest point of the mountain, where the mill is situated, to tap the veins at great depth. It is estimated that between 300 and 400 ft. of cross-cutting will have to be done. Besides the gain of several hundred feet of backs, the proposed adit will be the means of materially reducing the cost of moving the ore to the mill. The extensive improvements being made for several months at the Jumper have been completed and mining activity again prevails. The entire mill, consisting of 60 stamps, is not yet in operation, owing to some unfinished repairs, but will be in a short time. The working crew is being increased as fast as possible. The Street mine, at Tuttletown, is being unwatered, and it is expected that development work will be commenced by May 1. Underground work has been resumed at the Berkley and the new 10-stamp mill started. Between 20 and 25 men are employed. It is reported that operations are to be resumed at the Hazel Dell mine, and that the Hyde and Keltz will also be re-opened and worked. The properties are on the East lode. A new head-frame has been erected at the Mazeppa, and development work is in progress with a crew of 10 men. The development of the Hull mine, near Big Oak Flat, is to be resumed. The four 5-stamp batteries, recently purchased by the operators of the Dutch mine, have been delivered at the property and will be put in position soon. The addition will double the present capacity of the mill.

Tuolumne, April 8.

COLORADO

CLEAR CREEK COUNTY

(Special Correspondence.)—J. L. Cutting, leasing on the second level of the Gold Dirt mine, on Covode mountain, shot into a body of ore 3 ft. wide, the ore assaying 7.8 oz. gold per ton. The Columbia and Eureka mining claims, on Silver mountain, have been taken under bond and lease by J. H. Meinhart, of Denver, who has commenced work. The adit on the Sporting Times vein, Alpine mountain, is being driven to cut under the old shaft that is down 150 ft. Drifting is also in progress on the Moore vein, a 4-in. streak of galena being followed that is worth $45 per ton. A shipment of 50 tons of lead-zinc ore was sent out this week from the East Griffith mine to the Newton mill at Idaho Springs for concentration. Ericson & Co. are operating under lease. In milling 400 tons of ore from the Aetna vein, at the Capital mine, $4000 was realized. Of this sum $1900 was taken from the amalgam plates. It is reported that the Centennial mine, on Leavenworth, has been sold to W. M. Cooper, representing a syndicate of Pennsylvania men. The consideration is given at $125,000.

Georgetown, April 3.

(Special Correspondence.)—It is stated that the Gold Quartz mine at Alice will be equipped with a 25-ton mill by W. A. Maxwell of Brighton. Shipment of 700 tons of ore is being made from the Refugee mine to the Hudson mill for concentration. T. H. Rowem, who recently purchased the mine, is to develop the property thoroughly. After a temporary suspension, operations were again begun last week on the Saratoga mine, and shipments are being made to the Golden smelter. The mill at the Lombard mine, up Ute creek, will be started this month. Extensive development is in progress through adits 3 and 4, and large reserves of concentrating ore are exposed. Henry I. Seemann is manager. All of the machinery for the Kattie Emmett mill has been delivered, and W. W. Cannady, the manager, expects to have the plant in readiness to start ore-treatment this month.

Idaho Springs, April 3.

GILPIN COUNTY

(Special Correspondence.)—Work is to be resumed on the Fourth of July mine. The machinery is being overhauled and placed in good condition. R. L. Martin is owner. H. Peck has the contract to put up a shaft-house on the Gilpin-Coatey mine at Black Hawk. The machinery was ordered from Stroehle & Co. Large development is in progress at the Anchor mine, that recently passed to the North American S. & M. Co. It was announced this week that the National group of mines had been taken under bond and lease by the last-named company, the price specified being $300,000. Heavy shipments are going out from the Chase mine, operated by the Gilpado M. Co. The ore is of a smelting grade and brings from $87.80 to $280.90 per ton. A shipment of 25 tons of ore from the Egyptian mine brought a settlement of $21.50 per ton in gold and silver. Ben Anderle is operating under lease. The shaft on the Topeka mine, in Russell district, has attained a depth of 1500 ft. As soon as a sump of 40 ft. has been completed, driving will be started from the 1400 and 1500-ft. levels.

Central City, April 2.

LAKE COUNTY (LEADVILLE)

The Mt. Champion Gold M. Co., which has been doing development work all winter with a force of 16 men, has its property on Lackawana gulch opened by an 1800-ft.

Central Colorado.

cross-cut, the greater length of which is in a deposit of ore, which, according to the *Carbonate Chronicle*, is free milling, and assays $10 per ton in gold. It is claimed there is 30,000 tons of ore exposed. The company is to build a 9000-ft. tramway from the mine to the millsite. Machinery and other equipment is being hauled to the property by way of Half Moon gulch. The Sugar Loaf Con. M. Co. is continuing to drive its tunnel toward the Virginius claim, and when the objective point is reached a raise will be driven from the tunnel to the old Virginius shaft, thereby obtaining good ventilation. The old workings of the Virginius will be explored and further developed. Ore of shipping grade has been found in the tunnel where it intersects three veins. The Garbutt, on Breece hill, now has a 700-ft. working shaft. A cross-cut was driven from the No. 3 shaft of the Ibex group into Garbutt ground, and a 200-ft. raise was made to the Garbutt shaft. A large tonnage of ore has been blocked out on the different levels, the ore having been developed on four different fissures, the dips of which are bringing them closer together. The

ore now being mined is said to have an assay value of $45 per ton in gold and silver. The Empire Zinc Co., in control of the Colonel Sellers zinc mine, on California gulch, is expected to begin shipping ore from this and other mines of the district as soon as its zinc smelter in Oklahoma shall be completed, which will probably be within the next six weeks. Henifen & Reynolds, who operate the Louisville zinc mine through the Yak tunnel, are shipping 35 tons of ore daily. The Sunday mine, at the head of California gulch, is producing 500 tons of lead ore per month. This ore carries some gold. The property is in the hands of lessees. A body of ore recently found by a lessee on a block of Ibex ground is said to sample 40% zinc carbonate.

SAN JUAN COUNTY

The Peerless San Juan mine, on Minnie gulch, between Silverton and Eureka, may be operated again this season. It has been idle by reason of dissension among the directors of the company. The property has been opened by two adit-levels, the lowest of which was driven 800 ft.; by this a depth on the lode of over 2000 ft. is attained.

SAN MIGUEL COUNTY

Information received by the Telluride *Journal* is to the effect that the Ballard mine, situated on Bear creek, has been sold to those who are likely to re-open the property and operate it this season. The Ballard has a strong vein of good-grade ore, and was a profitable producer 25 years ago. It had lain idle many years by reason of litigation. Bear creek joins the San Miguel river opposite Pandora.

HINSDALE COUNTY

An ore-reduction plant, equipped for putting into practice the Rankin process, has been built at Lake City.

IDAHO

IDAHO COUNTY

The Elk City *Mining News* states that Tiedeman and Bosch, who own the Golden Rule placer property, situated five miles up-stream from Elk City, are preparing for hydraulic operations this season. Their ditch takes water from the west fork of American river, and they obtain some water from smaller streams. The necessary pipe-line is in order, and work will begin early. It is learned from the same source that the Jumbo mine, in Buffalo Hump region, is active, and that 10 stamps in the 20-stamp mill are operating; and that the other 10 stamps will be in use later. H. E. Gray sold his interest in the Jumbo lease to Bathurst and Shonecker.

SHOSHONE COUNTY

The discovery of a new ore-shoot is reported to have been made by driving a drift on the vein about 1000 ft. from the main ore-shoot, on No. 4 adit level of the Hercules mine, at Burke. The drift has been extended 75 to 100 ft. on the new orebody, disclosing ore of milling grade, and some galena of a grade that will stand shipping. Stringers of ore have been found in a 180-ft. drift, at 120 ft. depth, in the property of the Ajax M. Co., which adjoins the Hercules. The Stewart company, operating the Stewart mine, near Kellogg, is reported to have paid all of its indebtedness, and it has a surplus of $70,000. It is stated that a mill will be built. The ore being produced at this mine is being concentrated in a leased mill. John H. Nordquist, in charge of the Idora mine, is reported as stating that a 9-in. body of clear galena has been opened in an intermediate level, 60 ft. below No. 2 adit. By the side of this streak is a much larger body of ore of milling grade. There is, also, 6 ft. of milling ore opened on a second intermediate level, 180 ft. below No. 2 adit.

MONTANA

LINCOLN COUNTY

The Snowshoe mine, a lead-silver property, situated 20 miles south of Libby, which belonged partly to the Noble estate, and partly to persons of North Yakima, has been sold to E. H. Wilson, of Oakland, and his associates. The sale was due partly to the efforts of P. L. Eberhardt, of Wallace, Idaho. The Snowshoe, during the time it was operated, five to twelve years ago, produced ore of a value of about $1,000,000, but it has been idle for the last three years. The mine is opened by means of a 450-ft. vertical shaft, the levels from which, extending toward the centre of the mountain, attain a much greater depth on the vein. The surface improvement consists of hoisting facilities, shaft-house, shop, and a concentrating mill of about 200 tons capacity. The railroad of a local lumber company, which extends to a place within eight miles of the mine, is to be built five miles farther, and this will afford good transportation facilities. The Snowshoe ore contains lead, silver, gold, and iron, the concentrate making a high-grade sulphide product. It is stated that Mr. Wilson will employ a force of men later in the season and take charge of operations.

SILVER BOW COUNTY

(Special Correspondence.)—The Pilot-Butte Mining Co., controlled by Tuolumne interests, will resume operations on the property in May. The report comes from the Elm Orlu mine, owned by W. A. Clark, that the rich vein on which mining is being done in that property, has been opened to the north side-line of the Pilot. The latter is

Western Montana.

surrounded by the Butte & Superior, Elm Orlu, North Butte, and Anaconda mines. The Pilot was formerly in the hands of inexperienced men, but those now in control, including Edward Hickey and his associates, have always been successful in their mining operations. Machinery for the mine has been ordered. While the shaft is being sunk it is purposed to cross-cut the zone at a depth of 1600 ft. from the Butte & Superior workings, the latter company having given permission to work through its property; and the intention is to raise on the Pilot shaft from the 1600 at the same time that sinking is being done. Patrick Sheehan, superintendent of the Tuolumne, will have charge of the work on the Pilot.

Butte, April 8.

NEVADA

HUMBOLDT COUNTY

(Special Correspondence.)—It is stated that the new management of the National Mines Co. has decided to adopt a more liberal development policy, relative to the district, than has hitherto prevailed. This is supposed to mean that lessees will have better opportunities to operate on this remarkably rich ground. National ranks third among gold and silver camps in Nevada, principally due to the production of the National Mines Co. J. L. Currier of New York has purchased the Jersey mine for $250,000. The property is situated in Jersey valley, 90 miles south of Winnemucca, and comprises 22 claims. The ore is gold bearing. It is stated that a new company will be formed to operate the mine, and that a 50-ton concentrating plant will be built within a few months. The Adamson-Turner

mine, on the north side of Winnemucca mountain, has an orebody said to be nearly 3 ft. wide, containing rich ore. A winze is being sunk on the ore. At the Seven Troughs Coalition 75 men are employed, and the mill is operating at full capacity. On the fifth level the vein is 6 ft. wide, the ore running as high as $100 per ton. The mill is unable to handle all the ore produced. The Signal Peak, situated near the Mazuma Hills and Seven Troughs, has been operating since last December, and ore-shipments will soon commence to the Darby mill at Mazuma. The Nineteen-Ten, Barret Springs district, is shipping steadily.

Winnemucca, April 6.

LINCOLN COUNTY

The stockholders of the Prince Consolidated, the Ohio Kentucky M. Co., and the Nevada Utah Mines & Smelters Corporation have authorized the directors of their respective companies to carry out plans recently made for the merging of all the interests named, which means the consolidation of a number of the largest mines of the Pioche district, under the name of the Amalgamated Pioche Mines & Smelters Corporation. The properties included in the consolidation comprise the Nevada Utah, the holdings of the Prince Con., the Ohio Kentucky, Greenwood, and the narrow-gauge railroad which extends from Pioche to the Day mine, at Jack Rabbit.

STOREY COUNTY

The three principal north-end mines on the Comstock lode, Virginia City, had an output for the week ended March 25 as follows: The Ophir produced 487 mine-cars of ore of an average value of $26.58 per ton, amounting to a total of $12,945; the Mexican produced 129 mine-cars averaging $50 per ton, making a total of $6570; the Con. Virginia's output was 216 cars, averaging $9.87 per ton, aggregating $2132. The principal extraction from the Ophir was from the 2100-ft. stope on the Hardy vein; that from the Mexican was divided, the ore coming from the 2300 and 2500-ft. levels; the Con. Virginia ore was taken from the 1800-ft. stope, principally.

NEW MEXICO

SOCORRO COUNTY

(Special Correspondence.)—The body of milling ore, recently discovered in the winze that was sunk from the fifth level of the Enterprise mine has been opened by a cross-cut at greater depth. The mill at the Deadwood mine is being brought to higher efficiency each week. The last clean-up amounted to 2500 oz. of gold and silver bullion; there was produced, also, 15 sacks of concentrate. The mine is being unwatered, and a larger force of miners will be employed later. The clean-up made last week by the Ernestine M. Co. was 7030 oz. of gold and silver, recovered from 680 tons of ore. A company is being organized to develop property known as the Iron claims, situated close to the Gold Dust group, three miles from Mogollon.

Mogollon, April 4.

OREGON

BAKER COUNTY

The Baker ore-sampling plant, owned by the Oregon-Idaho Investment Co., which was destroyed by fire April 1, is being rebuilt.

GRANT COUNTY

The Canyon Mountain M. Co., now having control of the Jack Chambers mine, close to Canyon City, has commenced driving an adit-level on the vein in which pay-ore is exposed, and is to equip a small mill in which to treat the ore. Among those interested in the mine are C. J. Bingham, Jack Chambers, Harry Craig, F. S. Slater, and M. Stockdale, of Canyon City.

UTAH

SALT LAKE COUNTY

The ore reserves of the Utah Consolidated, locally known as the Highland Boy, are now placed at 381,000 tons. The 1910 ore production was 182,204 tons, which yielded 41.15 lb. copper, 0.84 oz. silver, and $1.63 gold per ton. Special attention is being given to the development of that part of the property heretofore little explored; to better accomplish this a 3-compartment interior shaft is being sunk from No. 7 haulage level at a point about 1500 ft. from the portal.

TOOELE COUNTY

The Galena King Mining Co., for which Duncan MacVichie is manager, is to be operated again. The work of putting the shaft in good condition is in progress. The mine is situated at Stockton, and in former years was a profitable producer of lead-silver ore. It has a 1000-ft. shaft, the workings connected with which are caved to some extent, requiring considerable work to be done before regular mine work can be carried on. The litigation that was pending between this company and the Honerine has been settled. The earliest mining operations in Utah were at Stockton, and the first lead smelter in that State was built there. It is a district in which there are a number of developed mines, and today there is evidence of a revival of activity. The Honerine has a large extent of development, including a drain and transportation tunnel over 2000 ft. in length.

WASHINGTON

FERRY COUNTY

(Special Correspondence.)—Activity in the mines of Republic district is increasing. New people are coming in with money to invest, and mining properties are changing hands. The Copper Bell, one of the earliest patented locations, said to cover the southerly extension of the San Poil vein, has been sold to E. Orr, of Spokane, who will organize a company and proceed with development. Work on the Ben Hur mine has been resumed, with seven men cleaning up and getting ready to break ore. The winze below the 285-ft. level is being unwatered. The force is to be increased to 15 men; and beginning with the first week in April the Ben Hur Leasing Co. expects to ship three carloads of ore per week. At the Hope mine, now in charge of W. W. Robbins, a small hoist has been installed at the head of the winze, for development of the Black Tail vein below the adit-level. The winze will be sunk to a depth of 300 ft. below the adit. Driving is in progress on ore on the No. 2 level of the Knob Hill mine, from which 30 tons of ore per day is being taken. The value now averages about $35 per ton. The San Poil Consolidated Mining Co. has employed ten men during the past week, and shipped two carloads of ore to the Granby smelter. The North San Poil raise is now up 80 ft., all the way in good ore. At the head the ore is 7 ft. wide between the walls. On account of bad air only one shift is at present employed. The new machinery will be installed within 30 days.

Republic, April 7.

CANADA

BRITISH COLUMBIA

The Mollie Hughes mine, a producer of silver and gold ore, situated at New Denver, has been sold by Michael Zatoni to a syndicate of Spokane men. The property comprises seven claims, and has been developed by several adits, so connected that the ore can be delivered from the lowest level to barges on Slocan lake. Considerable ore was shipped from the mine during the last two years, the smelter returns from which are said to have shown an average value of $54 per ton.

MEXICO

CHIHUAHUA

(Special Correspondence.)—J. Gordon Hardy, consulting engineer for La Republica M. Co., reports that during February 1025 tons of ore was milled, the revenue derived therefrom having amounted to ₱65,257. Operating costs and expenditures for development amounted to ₱44,037; construction expenses, ₱2542. Conditions under which operations continue are trying, and the ordinary means of transportation are practically paralyzed. The mine is at Sanz, some distance from Ocampo.

Ocampo, March 29.

Decisions Relating to Mining

Specially reported for the MINING AND SCIENTIFIC PRESS.

STATUTE MAKING MINE OWNER LIABLE FOR NEGLIGENCE OF MINE FOREMAN IS UNCONSTITUTIONAL

The section of the Pennsylvania statute of 1891, providing that for any injury occasioned by violation of the act, for failure of the mine owner to comply with its provisions, a right of action shall accrue to the party injured against such owner for any damages he may have sustained, is unconstitutional in so far as it imposes a liability upon the owner of the mine for failure of the mine foreman to comply with the statute.

Dempsey *v.* Buck Run Coal Co., (Penn.) 76 Atlantic 745. March 1910.

INJURY TO MINER—ASSUMPTION OF RISK

An experienced driller and miner was employed to enter different rooms in a coal mine and drill the face of the coal so that it could be shot and removed. After the coal had been thus drilled or cut in a particular room a number of men called 'loaders' would shoot down the coal by blasts and load the same on cars in which it was removed from the mine. When the driller had finished in one room the machine would be rolled into another room, and so on until all were cut or drilled. It was understood that he would cut or drill in the different rooms in the order in which the drilling or cutting was needed for the purpose of keeping the 'loaders' engaged in shooting and hauling out the coal. After the coal was thus drilled or cut and shot down and removed from the room it was the duty of the 'loaders' to prop the roof of the room with props furnished by the mine owner, to make it safe for the driller, who had nothing to do with the propping or protecting the roof. After each drilling or cutting and shooting and hauling out of the coal the props would be advanced to within 10 or 12 ft. of the bank or the face of the unmined coal; or if the roof was bad or dangerous the props would be placed closer to the face of the unmined coal, the idea being to regulate the location of the props by the condition of the roof of the mine, and to use as many props and in such places as the condition of the roof might demand. The driller was not directed to enter any particular room at any particular time, but the method of the work of drilling or cutting was to enter the rooms in order and as fast as the coal was shot and removed from the different rooms. While thus working in a room in which the props were placed some 12 ft. from the face of the coal the driller was injured by falling rock from the roof because of the improper propping. In an action for the injuries it was held that the driller did not assume the risk because he was not directed by the mine owner to go into the particular room, as he entered such room according to the system of work. It was held also that the mine owner owed the duty to the driller of keeping the place safe, as the driller was not charged with the duty either of making the place safe himself, or of inspecting it to see if it was safe. Neither could the mine owner escape liability as a matter of law because he had delegated the authority to the loaders to make the place safe, and their judgment that it was safe was conclusive. Nor was the driller prevented from recovery by reason of the statute of Kentucky which provides that any person employed in a mine who wilfully neglects to prop the roof of any working place under his control shall be liable to a fine, etc., as such statute was not applicable to the driller, for the reason that he was not charged with the duty of propping the roof. It was held it could not be said that the driller was injured in the work of making the place unsafe, so that the mine owner would not be liable for the injuries, since the injuries occurred from the failure to properly prop the roof, which had no connection with the work of the driller, and was done by an entirely different set of working men.

Williams Coal Co. *v.* Cooper, (Ken.) 127 Southwest. 1000. May 1910.

Personal

Professional men are invited to send news of their engagements and travels. Such news is interesting to friends.

W. P. HAMMON is in New York.

C. E. JULIEN will be in New York next week.

J. R. FINLAY was in San Francisco this week.

C. W. MERRILL has returned to San Francisco.

R. D. GEORGE was at Jackson, California, last week.

EDMUND JUESSEN was in San Francisco last Saturday.

FREDERICK H. MORLEY was in San Francisco on his way back to Denver from Honolulu.

SIMONDS & BURNS have moved their offices from 60 Wall street, New York, to 55 Liberty street.

R. S. RAINSFORD is manager at the Jumbo mine as well as for the Argonaut Mining Company.

F. A. BROWN is in the Cripple Creek district, Colorado, examining mining properties for Eastern people.

M. J. FALKENBURG, of Falkenburg & Laucks, is in the interior of British Columbia on professional business.

THOMAS G. LOCKHART, general manager for the Florence-Goldfield M. Co., Goldfield, Nevada, is at San Francisco.

WILLIAM S. MANN is building a stamp-mill and cyanide plant for the Pilones Mining Co., at La Portilla, Durango, Mexico.

ATHOLL F. MCEWEN sailed on the *Baltic* April 8 from New York for Europe; he expects to be gone about three months.

W. F. FERRIER has been appointed general manager for the Natural Resources Exploration Co., Ltd., of Canada, with headquarters at Toronto.

W. CLAYTON MILLER, general manager for the Federal Mining & Smelting Co., operating in the Coeur d'Alene district, Idaho, was at San Francisco this week.

CATALOGUES RECEIVED

HEINE SAFETY BOILER CO., St. Louis, Mo. 'Boiler-Room Tactics.' 20 pages. Illustrated. 6 by 9½ inches.

FOOS GAS ENGINE CO., Springfield, Ohio. 'Foos Horizontal Engines, Single Cylinder.' 48 pages. Illustrated. 10½ by 8½ inches.

CLEVELAND ROCK DRILL CO., Cleveland, Ohio. Bulletin No. 30, 'Cleveland Rock Drills.' 16 pages. Illustrated. 6 by 9 inches.

MARION STEAM SHOVEL CO., Marion, Ohio.. Bulletin No. 60, 'Marion Excavating Machinery.' 16 pages. Illustrated. 6 by 9 inches.

ALLIS-CHALMERS CO., Milwaukee, Wisconsin. Bulletin No. 1403 (Reprint), 'The Hancock Jig.' 16 pages. Illustrated. 8 by 10½ inches.

INDUSTRIAL INSTRUMENT CO., New York. Bulletin No. 40, 'Tachometers, Tachographs, Stroke and Revolution Counters.' 38 pages. Illustrated. 8 by 11 inches.

BOGART GAS POWER ENGINEERING CO., Buffalo, New York. Bulletins "B," "D," "E," and "O," describing the various types of engines made by this concern. 48 pages. Illustrated. 8 by 11 inches.

L. VOGELSTEIN & Co. give the following figures of German consumption of foreign copper for the months January and February, 1911:

	Tons.
Imports of copper	29,407
Exports of copper	1,271
Consumption of copper	28,136

as compared with consumption during the same period in 1910 of 28,370 tons. Of this quantity, 25,536 tons were imported from the United States.

Company Reports

PHELPS, DODGE & CO.

This report summarizes the reports for 1910 of the Copper Queen Con. Mining Co., Detroit Copper Mining Co., Moctezuma Copper Co., Burro Mountain Mining Co., and the Stag Cañon Fuel Co. The holdings in these companies amount to $48,987,640, the capital stock of Phelps, Dodge & Co. consisting of 450,000 shares of a par value of $100 each. The receipts of the company for 1910 were $9,099,-909.53, of which $252,520.99 was the expense of operation of the company; $5,399,875 was paid in dividends and $3,447,513.54 was added to the surplus. The total production of the Copper Queen Con. Mining Co. for the year was 12,430.27 oz. gold, 608,096.95 oz. silver, 76,428,908 lb. copper, and 696,118 lb. lead. The Detroit Copper Mining Co. produced 23,056,292 lb. of copper. The Moctezuma Copper Co. milled during the year 447,555 tons of ore, of an average content of 2.992% copper, and produced 107,-104.6 tons of concentrate, containing 22,603,218 lb. of copper. The Stag Cañon Fuel Co. produced 1,381,457 tons of coal in 1910.

DALY-JUDGE MINING COMPANY

During the year ended January 31, 1911, this company mined 56,108 tons of ore, of which 9106 tons of an average value of $26.14 per ton was sold in the crude state, and 47,002 tons was subjected to concentration. This produced 7787 tons of concentrate, of an average value of $28.45 per ton, 2511 tons of iron middling worth $12.94 per ton, and 10,556 tons of zinc middling worth $5.69 per ton. The total cost of operation was $7.35 per ton, of which $4.76 was the operating cost and $2.59 the cost of exploratory work. The net profit for the year was $94,177.05, and a payment of $36,000 was made for three years drainage privilege through the Ontario tunnel. The report does not convey any idea as to the worth of the property, as it makes no mention of the number of shares of stock issued, nor does it give any statement as to the amount of ore in reserve, the so-called financial statement being merely a profit and loss account. No provision is made in this for depreciation of the property and equipment.

STANDARD CONSOLIDATED MINING CO.

The report of this mine, situated at Bodie, California, for the year ended February 27, 1911, shows that during 1910, 14,010 tons of ore was mined, and 14,528 tons crushed in the stamp-mill, and $70,402 recovered in the form of amalgam, the cost of treatment being $1.63 per ton and the average extraction being 41.45%. The tailing from the mill was treated in the cyanide plant, together with 23,570 tons of old tailing, the average value being $6.21, of which 83.74% was recovered. The ore reserve is 3275 tons, of an estimated value of $50,000. The dividend for the year was $17,839.40, making a total to date of $5,211,970, corresponding to a total production of bullion of $15,900,520. The company possesses valuable water rights that are capable of being developed into a large source of revenue as soon as a satisfactory market for power has been developed. An excellent feature of this report is the detailed monthly statements of cost of operations, notably the cost of development and stoping in the different veins.

EL PASO CONSOLIDATED GOLD MINING CO.

The report of this company for the year ended December 31, 1910, shows that the receipts from ore sales and other sources amounted to $561,103 and the expense of operation was $512,486. A further payment of $37,098 was made on account of drainage and amortization. Dividends amounting to $49,000 were paid during the year, leaving a surplus of $429,691 in the treasury, but there is no statement as to the character of this surplus, except an incidental reference to the purchase of $80,000 worth of Drainage Tunnel stock. It would be well to include a full statement of this item constituting the surplus. The number of shares issued is 2,450,000 of a par value of $1 each. During the year 8262 ft. of development has been done, with an increase in the ore reserve. Twenty-four sets of lessees are at work, of whom 15 are actually producing ore. The drainage adit is draining the lower levels of the mine, opening them up for exploitation on company account, as the lessees are at work only above the fourth level. The report reflects great credit upon the president, A. L. Burris, and the management, for the energy and skill with which they have brought the mine through a critical period in its history.

WARRIOR DEVELOPMENT COMPANY

During the year this company mined and sold 31,450 tons of copper ore of an average copper content of 9.65%. This was sold to the El Paso smelting works during the first half of the year, and to the old Dominion Copper M. & S. Co. for the latter half of the year, on the basis of 90% of its copper content. The average cost of production was 8.74c. per pound of copper, of which 4c. was the smelting cost. This corresponds to a profit of $2.69 per ton of ore smelted. The company is capitalized at 50,000 shares of $10 each; 5000 fully paid shares are outstanding, and $4 each has been paid on 40,150 shares. The property consists of three groups of 275.5 acres of patented claims, 41.2 acres on which patent is proceeding, and 841.57 acres of unpatented claims. Of the purchase price of the property, $124,940 has already been paid; $30,880 is to be paid from earnings during 1911 and 1912, at the end of which period a further $1,120,000 is to be paid, either $850,000 or $350,000 of this sum being payable in bonds at the option of the purchaser. The report says that there has been an increase in the amount of ore blocked out ready for stoping, but the amount is not given. A contract for smelting the ore on more advantageous terms has been made, and the shipments will be increased to 125 tons per day. The company is operating the property under a bond and lease.

The Prospector

This department makes a charge of 25 cents to subscribers not in arrears and $3 to non-subscribers for each determination. To ensure promptness in publication of the determinations, payment must be forwarded with specimens.

S. L., Oasis, California: Clay shale.

J. M. D., Atwater, California: Gypsum in a clay limestone.

M. J. O., Denio, Oregon: The specimen is molybdenite with quartz.

E. E. N., Nogales, Arizona: No. 1, olivine basalt; No. 2, amygdaloidal basic lava.

O. F. W., Robinson, Utah: One specimen is quartz and the other an indurated clay.

R. H. B., Takilma, Oregon: No. 1, psilomelane pebbles: No. 2, chromite; No. 3, red hematite; No. 4, earthy limonite or ocher.

T. C. C., Nogales, Arizona: No. 1, cleavage pieces of rhodochrosite with quartz; No. 2, pyrite in chlorite schist; No. 3, pyrrhotite in quartz diorite: No. 4, hornstone; No. 5, manganese dioxide, pseudomorph after rhodochrosite.

W. J. W., Parsons, New Mexico: Most of the samples are too much altered to make definite determinations possible. They appear to be alterations of similar kinds of rock, probably syenite or monzonite. No. 1, highly kaolinized volcanic; No. 2, weathered surface piece of syenite; No. 3, fine grained syenite, showing pink feldspar, magnetite, and chloritized hornblende; No. 4, kaolinized syenite with chalcedony seams; No. 5, altered syenite; No. 6, a weathered piece of the rock which is suggestive of phonolite.

Market Reports

LOCAL METAL PRICES.

San Francisco, April 13.

Antimony	12—12¾c	Quicksilver (flask)	61½
Electrolytic Copper	14—15¼c	Tin	45—46½c
Pig Lead	4.75—5.70c	Spelter	7—7¾c

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

METAL PRICES.

By wire from New York.
Average daily prices in cents per pound.

Date.	Electrolyt'c Copper.	Lead.	Spelter.	Silver, per oz.
Apr. 6	12.03	4.41	5.40	53
" 7	12.03	4.41	5.40	53
" 8	12.00	4.41	5.40	53⅛
" 9	Sunday.	No market.		
" 10	12.00	4.41	5.40	53⅛
" 11	12.00	4.41	5.40	53⅛
" 12	12.00	4.41	5.40	53¼

ANGLO-AMERICAN SHARES.

Cabled from London.

	Apr. 6. £ s. d.	Apr. 13. £ s. d.	
Camp Bird	1 13 4½	1 12 3	
El Oro	1 4 0	1 4 6	
Esperanza	1 14 4½	1 14 4½	
Dolores	1 5 0	1 5 0	
Oroville Dredging	0 5 9	0 5 9	
Mexico Mines	7 12 6	7 11 3	ex div.
Tomboy	0 15 0	0 15 0	

(By courtesy of W. P. Bonbright & Co., 24 Broad St., N. Y

MINING STOCK QUOTATIONS—NEW YORK.

(By wire from Catlin & Powell Co., New York.)

	Closing prices, Apr 13.		Closing prices Apr. 13
Amalgamated Copper	$ 62¾	Mason Valley	$ 8¼
Arizona-Cananea	3	Miami Copper	18⅝
A. S. & R. Co.	73⅞	Mines Co. of America	4⅞
Braden Copper	4⅛	Nevada Con	17¼
B. C. Copper Co.	5¾	Nevada Utah	¾
Butte Coalition	17⅜	Nipissing	10¾
Chino	22½	Ohio Copper	1⅛
Davis Daly	1⅞	Ray Central	1⅝
Dolores	5½	Ray Con	15¼
First National	1⅞	South Utah	¾
Giroux	5¼	Superior & Pittsburg	13⅝
Goldfield Con	6⅛	Tenn. Copper	36½
Greene-Cananea	6⅝	Trinity	4
Guanajuato Con	⅛	Tuolumne Copper	4⅞
Inspiration	7	United Copper	3¼
Kerr Lake	6¼	Utah Copper	43⅞
La Rose	4⅛	Yukon Gold	8⅞

COPPER SHARES—BOSTON.

	Closing prices, Apr. 13.		Closing prices Apr. 13
Adventure	$ 5¼	Mohawk	$ 36½
Allouez	32	North Butte	27⅞
Atlantic	3	Old Dominion	37
Calumet & Arizona	49½	Osceola	100
Calumet & Hecla	485	Parrot	11½
Centennial	11½	Santa Fe	1
Copper Range	60½	Shannon	10
Daly West	4½	Superior & Pittsburg	13¾
Franklin	9¼	Tamarack	36
Granby	30½	Trinity	4
Greene Cananea, ctf.	6¼	Utah Con	13½
Isle-Royale	12¼	Victoria	19/16
La Salle	4	Winona	6½
Mass Copper	6	Wolverine	106

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

SOUTHERN NEVADA STOCKS.

San Francisco, April 13.

Atlanta	$ 10	Mayflower	$ 4
Belmont	5.90	Midway	21
Booth	10	Montana Tonopah	78
Columbia Mtn	3	Nevada Hills	3.15
Combination Fraction	11	Pittsburg Silver Peak	70
Fairview Eagle	50	Rawhide Coalition	3
Florence	1.52	Round Mountain	54
Goldfield Con	5.95	Sandstorm Kendall	9
Gold Kewenas	6	Silver Pick	5
Great Bend	1	St. Ives	—
Jim Butler	23	Tonopah Extension	1.00
Jumbo Extension	30	Tonopah of Nevada	8.00
MacNamara	11	West End	78

(By courtesy of San Francisco Stock Exchange.)

COMMERCIAL PARAGRAPHS

THE AMERICAN METAL CO., LTD., announces the removal of its Denver office to the A. C. Foster building, Sixteenth and Champa streets.

FALKENBURG & LAUCKS, chemists and metallurgists at Seattle, have established an ore-testing plant which contains such equipment as is necessary in making tests by all standard processes.

The AMERICAN LOCOMOTIVE CO. announces that on April 8, 1911, its Chicago office was moved from Railway Exchange building to suite 907-912 McCormick building, Michigan boulevard and Van Buren street.

THE PACIFIC TANK & PIPE CO., of Los Angeles, reports that its San Francisco office has just sold the Rawhide Queen mill a complete cyanide plant for a ten-stamp mill in Rawhide. It is expected that the entire plant will be delivered on the ground within thirty days and will be in complete running order by June 1.

J. W. SWAREN has opened offices in the Shawmut building as advertising consultant, handling engineering advertising only. Mr. Swaren had a broad engineering experience before taking up sales work, and has been advertising manager for several San Francisco manufacturers. There is a broad field for this work in San Francisco.

Jesse Scobey has purchased an interest in the HENRY E. WOOD ORE TESTING CO., of Denver, and is now vice-president and secretary of the company, associated with Henry E. Wood, president. In connection with their regular assaying, chemical, and ore testing work, they will act as consulting engineers in the design and equipment of milling plants and as managers and agents of mining properties for foreign investors.

The DORR CYANIDE MACHINERY CO. reports among recent sales three thickeners and one classifier sold to the Portland Mining Co., of Colorado Springs, Colorado. The Dorr Mines Syndicate of the Porcupine district, Ontario, is installing four Dorr classifiers and seven Dorr thickeners in its new mill. The Vulture Mines Co., of Wickenburg, Arizona, reports that the Dorr continuous thickening process in use there is operating with little or no personal attention.

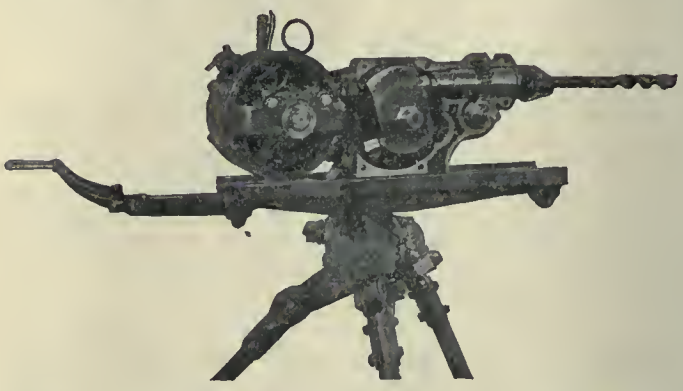
THE HAMMOND IRON WORKS has recently taken over the business of the Hydraulic Cyanide Agitation Co. of Warren, Pennsylvania. The patents for the Paterson agitation tanks have been assigend to the Hammond Iron Works for the United States, Mexico, and Canada. This company has recently received an order and shipped to the Exploration company of England and Mexico for its Santa Rosa mines in the State of Zacatecas, four Paterson agitation tanks. The Paterson tanks have been put on a working scale in London and are showing some wonderful results.

The revival in mining due to the use of improved metallurgical equipment is well reflected in the large number of installations made by the OLIVER CONTINUOUS FILTER CO. of San Francisco. Filters have recently been placed in operation at the following plants: Two at the Trinity Gold Mining & Reduction Co., Carrville, California, handling an exceptionally impervious oxidized slime; two at the Empire Mines Co., Grass Valley, California, operating on classified slime; one at the Pittsburg Liberty Mine, Masonic, near Bodie, California, handling a re-ground product; one filter has just been installed at the Treasure Mining & Reduction Co., Clear Creek, New Mexico. The installation of this filter was a record breaker for prompt delivery, being shipped seven days after the order was placed, and ready for operation twelve days after arrival on the ground. Filters for the following companies are now being built: Nevada Wonder Mining Co., Wonder, Nevada; Candalaria Con. Mexican Mining Co., San Dimas, Durango, Mexico; Maricopa Mines Co., Austin, Nevada; Cia. Minera Jesus Maria y Anexas, San Jose de Gracia, Sinaloa, Mexico. The last named is a repeat order, this company having had two Oliver filters in operation for two years.

THE FORT WAYNE ROCK-DRILL

The great advantages of electrical power as a means for driving rock-drills has caused many efforts to be made to develop an electrical drill of a type suited to actual working conditions. Many devices have been tried, but failed to accomplish successfully and economically the desired approximation to the combined striking and rotating action of hand-drilling; the problem of converting the rotation of the electric motor into the reciprocation of the drill proving too difficult of solution. A simple and ingenious method of solving the problem has been devised and employed in the construction of the Fort Wayne rock-drill, which has recently been placed upon the market.

This drill is of the rotary-hammer type, operated by an electric motor which is mounted on the frame of the drill proper. The mechanism of the drill consists of two parts, a revolving helve containing the hammers, and the chuck mechanism for holding and rotating the drill steel. An idler is conveniently arranged in connection with the flexible belt between motor and drill, which provides a means of regulating the speed of the drill. Thus all the advantages of hand-drilling are obtained without the disadvantages usually incident to machine drilling.



The drill steel is held in the chuck by means of several spring-steel plates. When not striking rock, the blow from the hammer is absorbed by these buffer plates, and they also retain the steel in the chuck while 'backing out' of deep holes or in broken and uneven ground. The drill casing, striking mechanism, chuck, and buffer plates are all simple and very substantial. The floating hammers in the helve are of special steel and are completely cushioned by air chambers so that the jar of the impact is reduced to a minimum. The drill steel cannot be jammed into a fissure or cleavage crack for two reasons. Should a fissure be encountered the buffer head prevents the drill steel from being plunged forward. The drill steel is not reciprocating, and before it can be fed far enough into a fissure to wedge, it has hammered for itself a square shoulder or face, due to the rapidity of the blows on the constantly rotating drill steel. The resultant effect approaches that of boring.

Another point of excellence in the Fort Wayne drill is the simple method employed for the removal of cuttings from the hole being drilled. A specially designed steel, illustrated in the figure above, removes the cuttings by boring action and does away with the use of hollow drills or water under pressure. Thus the large expense of pressure systems, including tanks, hose, water lines, etc., is eliminated, as well as the cost of maintenance and inconvenience incident to such systems. While these drills are ordinarily used in a horizontal position, they may be used in any position and will drill holes at any angle. The ease with which power can be transmitted throughout the workings by wire and the rapidity with which the lines can be changed enables the operator to advance his work more rapidly than could be done when using other types of drills.

A comparison of tests of the Fort Wayne drill and air-drills shows that the former requires about 1½ to 2 hp., including transmission loss, while an average air-drill requires from 15 to 20 hp. for the same work. This is due to the design of the drill, the much greater efficiency of the electric motor, and the small loss in transmitting power to the drill. The simplicity and strength of design of this drill is a guarantee that the cost of maintenance will be exceedingly low. Owing to the saving in power, the low cost of maintenance, and the high efficiency of the Fort Wayne drill, from 50 to 70% can readily be made, under ordinary conditions, upon the investment. The drill can be operated with either an A. C. or D. C. motor, and since the motor is entirely independent of the drill the change from one to the other may be easily made. An 8-page bulletin describing the machine in more detail can be obtained from the Rock Drill Department of the Fort Wayne Electric Works, Madison, Wisconsin.

MAYO MEAN EFFECTIVE PRESSURE TABLES

The calculation of the mean effective pressure of Corliss engines, both single cylinder and compound, operating under condensing and non-condensing service, has always been a tedious mechanical process. While any one may calculate this mean effective pressure by means of standard formulas, engineers have usually avoided this work, with the result that the figures have never become thoroughly standardized. It often happens at a contract-letting where from eight to ten engine-builders are represented, that each builder offers an engine of a different size, which is not only inconvenient for the engine-builder, but results in delays and confusion to the purchaser as well.

The Hooven-Owens-Rentschler Co., of Hamilton, Ohio, has recently issued two tables neatly gotten up with celluloid covers, by means of which the mean effective pressures for the different types of Corliss engines, and therefore their horse-power can easily be obtained. The object of these folders was to get some uniformity in ratings among engine-builders. They will be found of much interest to engineers and others connected with the generation of steam-power by reciprocating engines.

Each set of tables consists of a celluloid casing with a transverse slot near the end, at the side of which the various gauge pressures are printed. Within this casing is a scale upon which the number of expansions or points of cut-off are marked, together with a table of mean effective pressures. It is readily seen that by sliding the scale until the desired number of expansions or percentage of stroke at cut-off is immediately under the opening provided for it, there will be found adjacent to the steam pressure the correct value for the mean effective pressure.

One table gives the results for single cylinder engines, both condensing and non-condensing; the other for compound condensing and non-condensing engines. For condensing operation a vacuum of 26 in. is assumed, but a constant is given which can be added or deducted for variations from this vacuum. Gauge pressures of from 50 to 200 lb. are tabulated. The compound engine table shows results of any number of expansions between 5 and 27.

These tables will be furnished to anyone interested by applying to Chas. C. Moore & Co., Engineers, San Francisco.

A. LESCHEN & SONS ROPE CO.

In a paragraph published in our issue of March 25, relating to the building of an 8500-ft. aerial tramway for the Standard Silver-Lead M. Co., at Silverton, B. C., it was stated that the contract to build the tramway had been let to B. C. Riblet, while as a matter of fact it had been let to A. Leschen & Sons Rope Co., of St. Louis, through the Leschen representative, W. S. Riblet, of Nelson, B. C. The error arose from the fact that Mr. Riblet was formerly in the business of building tramways, and the fact that the Riblet patents and other property were purchased a number of years ago by A. Leschen & Sons Rope Co. had been overlooked.

The Chicago office of the Atlantic Equipment Co. was on April 8, 1911, moved from the Railway Exchange building to suite 907-912 McCormick building, Michigan boulevard and Van Buren street.

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EDITORIAL

GOLD, literally by the ton, is being produced by the Goldfield Consolidated Mines Company, a recent shipment having weighed 2138 pounds.

DISPUTES relative to the proper form of entry for phosphate claims on the public land seem not likely to be determined soon, since the cases in controversy at Salt Lake have been settled out of court.

THE MIAMI MILL began operations upon unusually low-grade ore, so that the poor results in 'warming up' the mill might be upon poor ore. Since Mr. J. Parke Channing has begun with so sensible a refinement, we may continue to look forward with interest to many useful lessons to be learned from ore-dressing practice at the mill under his direction.

SAN FRANCISCO members of the American Institute of Mining Engineers met at luncheon at the Palace Hotel last Wednesday to plan for the meeting of the Institute that is to be held in that city in October. An executive committee with Mr. W. C. Ralston, chairman, and Messrs. H. F. Bain, F. W. Bradley, E. H. Benjamin, S. B. Christy, and M. L. Requa as fellow members, was selected. Mr. Bradley will act as chairman of the sub-committee on session, Mr. Benjamin on excursions, Mr. Requa on finances, while Mr. Christy will be chairman of the reception committee, and Mr. Bain will be local secretary. Excursions probably will be arranged to the oilfields, to the dredging fields at Folsom, and to the Bohemian grove. It was also resolved, upon motion of Mr. Luther Wagoner, that the local members should effect a permanent organization and provide for meetings annually or oftener as might prove feasible. The matter was placed in the hands of the executive committee and no doubt a strong local organization will result. This will, we are sure, be helpful to the community and the parent society.

SALE of a half interest in the Vinegorone fraction to the Goldfield Consolidated Mines Company for $195,000 has led to quiet discussion of the methods of valuing such ground. Last year Mr. C. S. Herzig examined the property for the Jumbo Extension Company and estimated the reserve at 73,000 tons of ore worth approximately $3,000,000. His estimates were widely criticized as excessive. Later Mr. G. F. Lewis made an estimate of 87,000 tons at $41 per ton. The sale was finally made on the basis of an appraisal, Mr. Albert Burch acting for the buyer and Mr. Walter Wiley for the seller. Allowing $5000 for development and $9 per ton for treat-

ment and metallurgical losses, the amount agreed upon is still startlingly less than the previous estimates led the public to expect. It is evident that there is a marked difference of judgment as to what is properly to be regarded as constituting an ore reserve. The difficulties of measuring and valuing deposits where the ore is high in grade and irregular in occurrence are admittedly great, but there should be no such discrepancy as noted. The burden of proof would seem to rest on the engineers making the larger estimate.

"ITALY," says a keen American engineer now traveling on the peninsula, "is a very different country from that depicted by the ordinary tourist with his nose in a Baedeker. The cities are modern, have clean streets, good trams, and steam roads; the hotels are clean and comfortable, with steam heat, electric lights, elevators, and all conveniences. The people are courteous, good-looking, well dressed, and well 'set up'. They show every sign of prosperity, and, while taxes are high and living not at all cheap, they are cheerful and proud of the progress made by United Italy—now just celebrating its semi-centennial. The country has a fine army and navy—every officer looks as if he were a picked man. Machine-shops and foundries are new, well designed, and well equipped. This nation is bound to realize its great future, and American engineers would do well to study European methods more than they do. By joining the best things here to what they have at home, an irresistible combination would be effected." It is a pleasure to quote this cheerful tribute to modern Italy, and at the same time to express the best of good wishes for the future of a country of which every American schoolboy learns the history, but whose present position in the industrial world is too little appreciated.

CHOICE through popular election is a poor way to select State mine inspectors. Mr. J. A. Holmes, director of the United States Bureau of Mines, put the matter nicely when he said in a recent address: "The State mine inspectors should have greater permanence in office and freedom from political and other outside influences. Their selection and continuance in office should depend upon their training and experience. They should be examined by a non-political board of mining men. They should be appointed upon the recommendation of such a board from the applicants that have shown the highest skill and best experience. Under no circumstances should they be selected by popular vote. In other words, politics should have nothing whatever to do with their selection or their continuance in office. The inspectors should have better support in the way of compensation. In fact, the salary and other conditions should be such as to enable the State to secure the best possible type of men for this important work." Inspectors should be impartial public officials, favoring neither the men nor the operators. We are glad to see that the Mining and Metallurgical Society of America has been agitating the matter of securing better and more independent inspectors.

TONOPAH has given geologists and engineers much to think over. The relations of the complex of igneous rocks in which the rich ores occur have led to dispute, the question being whether certain of the formations represented surface flows or intrusive sheets. If the former, it should be possible to follow the veins down into them; if the latter, the orebodies might be expected to be terminated by eruptive contacts. Repeated faulting has complicated the situation, already made sufficiently difficult by the close resemblance of the rocks of the different formations. Mr. J. E. Spurr, in his work for the United States Geological Survey, favored the thesis of the intrusive character of the disputed rocks. Mr. J. A. Burgess, as a result of his long work for the Tonopah Mining Company, developed the alternative hypothesis. During the last year Mr. Spurr has been re-studying the district at the instance of the various companies concerned, and his scientific results have now been made public. We print this week an abstract for which we are indebted to the courtesy of Mr. Edgar A. Collins, general manager for the Montana-Tonopah Mining Company. It will be seen that in the main Mr. Spurr continues to hold to his original hypothesis, and, while in the printed report the matter is not discussed, it is evident that following his conclusions, development must in the main continue to be directed to searching for faulted and floated masses of the 'earlier andesite' or 'Mizpah trachyte,' to use the new name. Perhaps the most interesting phase of the whole matter is the uniting of a number of independent companies to support such an unusually technical and scientific study.

Re-Location of Mining Claims

Our correspondents have taken decided exception to our former editorial comment on the question as to whether or not a locator has a right to re-locate his own claim after having failed to perform the annual assessment work required by law. The subject is of sufficient importance to merit further discussion. The Federal statute provides as a condition of the ownership of an unpatented mining claim that "not less than one hundred dollars worth of labor shall be performed or improvements made during each year," and that "upon a failure to comply with these conditions the claim or mine upon which such failure occurred shall be open to re-location in the same manner as if no location of the same had ever been made." The same statute also provides that if the original locator shall have "resumed work upon the claim" after failure and before re-location, an attempted re-location by another is ineffectual. We have, then, in the very statute prescribing the necessity of performing annual labor, a remedy provided by means of which a delinquent locator can atone for his failure to comply with the law. The question at once arises, is this method exclusive, or has the delinquent locator the same right possessed by third parties of making a new location and initiating a new title? It must be admitted that there is some authority supporting this idea, but a critical examination of the reason-

ing upon which the doctrine is based, leads to the conclusion that it is erroneous. It proceeds upon the theory that the original locator's title is terminated by the failure to perform the required annual labor. This premise is incorrect. The courts have repeatedly held that a failure on the part of a locator to perform his annual labor does not terminate his title. The Supreme Court of California has said: "The sole effect of such failure is to throw the land open to location *by others* and in the absence of such other location the original claimant's right to resume and hold his claim remains." If this doctrine is true and the location remains alive until an adverse locator steps in and takes advantage of the forfeiture (and there is but little question on this point), how can it be contended that the original locator possesses the right to re-enter his own claim, which still is in existence, to oust himself, as it were, in order to defeat the plain provisions of a salutary law intended to make every locator give evidence of good faith? This would allow a man to forfeit his own property in his own favor for the express purpose of evading the law. It has been contended that by making the new location the locator virtually abandons his original location. The very statement of this proposition answers itself. The attempt to make the new location is evidence of the strongest character that no real abandonment is intended.

Such eminent authorities on mining law as Lindley, Morrison, and Costigan, all favor the view that a delinquent locator should not be permitted to take advantage of his own delinquency by being allowed to re-locate. The Act of 1907, prescribing annual labor for mining claims in Alaska, specifically provides that a failure to perform annual labor renders a claim open to re-location "by others." The Supreme Court of the United States has said that the object of the law is to require every person who asserts an exclusive right to a mining claim "to expend something of labor or value on it as evidence of his good faith and to show that he was not acting on the principle of the dog in the manger." There are practical reasons why a man should not be permitted to re-locate his own claim and thus avoid the reasonable requirements of the law. He has the advantage of the situation, for he alone knows whether he is going to perform his assessment work or not, and can plan accordingly. By being in possession of the property at the expiration of the year he can resist the attempt of others to re-locate, for the law will not ordinarily permit any one to initiate a right by force as against a party in possession, and he can manage matters so that it is impossible for any one else to re-locate before he does. The law requiring the performance of annual labor is a wise one. Through all the ages mining laws have invariably required the performance of certain work as a condition of the retention of title. In some instances practically continuous mining was required. Many think that the existing Federal requirements should be increased, and it is certain that they should not be diminished. In any event they should be rigidly enforced, and the recent tendency of the courts seems to be in this direction.

Samuel Franklin Emmons

That geology is a young science, we are constantly reminded. S. F. Emmons, who died at his home in Washington, D. C., March 28, was born less than a dozen years after Lyell's 'Principles' had been given to the world; he graduated at Harvard in 1861, two years before Dana's 'Manual of Geology' was published; he studied, in 1862 to 1864, at the Ecole des Mines under Elie de Beaumont, one of the very founders of geology; he served on the first of the great National Geological Surveys; he was at one time or another the contemporary of practically every working geologist America has produced; and with it all he was the intimate personal friend of more than half of the young men in the profession. Literally hundreds came under his influence and owe something to him for direct inspiration or criticism. Beyond that, in the widening circle touched through common friends and printed page, his influence reached wherever economic geology is practised. In certain ways Emmons was the most influential geologist America has produced. With the possible exception of his chief, Clarence King, to whom he was always devoted, he came closest to mining engineers and mine operators of any of the men who have served the nation through work on the Geological Survey.

A trained mining engineer, with the best that Harvard, Paris, and Freiberg could give, he returned to America at the close of the Civil War, a young man of twenty-four, anxious to practise a profession then nearly unknown in America. His first commission took him to Missouri, where, amid the red clay and dolomite boulders, residual masses of galena were mined by most primitive methods; the forerunner of Missouri's present great lead industry. Other calls took him West, and his great opportunity came when he became one of the geologists of the Fortieth Parallel Survey. He entered upon his duties with enthusiasm and displayed ability of high order, so that at the close of the work he and J. D. Hague were King's principal assistants.

When the work of the Fortieth Parallel Survey was finally completed and the corps disbanded, Emmons started out to make a fortune. Adding to his savings funds advanced by personal friends, he bought cattle and herded them on the open range of Wyoming. It was a profitable business, but involved much hard work of which Emmons took his full share. It was difficult for those who knew him later to realize that the eminent and rather reticent scientist had once been a 'cowboy' and could ride, rope, and brand with the best of them, but in Wyoming there are stories yet of his life on the range. When, in 1879, the United States Geological Survey was organized and Clarence King was made director, almost his first act was to telegraph to Emmons the offer of a position. The lure of the old work was strong, and as soon as the cattle business could be sold to advantage, Emmons rejoined his chief. He was immediately placed in charge of the headquarters established at Denver, Colorado, and remained there up to the time the branch offices were abol-

ished, when he, with others, was transferred to Washington.

While living in Denver, Emmons accomplished three things, in particular, which have profoundly influenced the course of development of economic geology in America: (1) He planned and carried through a geological examination of the Leadville district; (2) he organized and directed the investigation of the precious-metal deposits for the Tenth Census; (3) through the Colorado Scientific Society and other agencies he brought about close personal relations between the scientific men employed by the Government and the mining engineers and mining men who were opening and operating mines. The result was to bring about an immensely stimulating and helpful set of reactions between science and practice. Geology was made practical and mining men were made to see that it was so. This, as much as any other one thing, has made possible the firm support that economic geology now has in the United States. At Leadville, Emmons and his associates centred their attention on structural studies. The fascinating problems of ore genesis were held to be subordinate to the practical problem of finding orebodies, and painstaking plotting of contacts and faults made it possible to accomplish results that, to many of the men then getting their first experience in following orebodies, were uncanny. Nowadays such work is common, and it is easy to overlook the marvel of it then. Emmons' less well-developed studies of the genesis of the Leadville deposits have been criticized; but the maps that accompany the Leadville monograph are standard today. Leadville in the early eighties was the great mining camp of the United States. Many of the present graybeards of the profession were then smooth-faced youths gaining experience there and laying the foundations of success and fortune. From Leadville they scattered to the ends of the earth and everywhere took with them the respect for accurate geologic work that Emmons had inspired. Through his work of the Tenth Census, too, Emmons exerted a wide influence. That Census is commonly considered the best that the United States ever has taken, and the number of men who began their professional work by digging up the exact facts that give it value, is surprising. All these men in the West came in contact with Emmons and he was ever a man to influence his fellows. He liked men and they reciprocated by liking him. So long as he remained at Denver, the office of the Geological Survey was the familiar meeting-place of geologists and engineers interested in developing the West. He was one of the three men, Mr. C. R. Van Hise and Mr. W. H. Weed being the others, who discovered and simultaneously announced the laws of secondary enrichment of ore deposits, and in 1894, at a time when gold mining was much depressed, he predicted the revival that so shortly followed. The roll of men who have served as his assistants includes most of the active men of the profession, and the list of papers he wrote, and of societies he honored and was honored by, is long. He remained active to a few days before his death, and as recently as March 18 we had the pleasure of publishing a notable discussion of the Cobalt deposits written by him. His fame was world-wide, and deserved.

Emmons gave freely of his services and advice and there is no question that had he cared to leave the Government service and undertake general consulting work he could have had for the asking an extremely remunerative practice. He, however, lived close to his ideals, and aside from the modest competence with which fortune favored him, had no apparent desire for money. He devoted his life to his profession, and it is appropriate that his fellow-engineers and geologists should erect some permanent memorial to him. To that end we have pleasure in quoting the following from a personal letter from Mr. T. A. Rickard:

"As you can imagine, the news of the death of Emmons means much to me. Apart from the loss of a personal friend, I appreciate keenly the tremendous service he performed throughout his life in applying geology intelligently to mining, and more especially in deciphering the structural geology of metal-mining districts in the interest not only of science but of industry. What Lyell did for geology as a whole, Emmons did for economic geology. Others have done splendid service, and are still doing it, but his Leadville monograph and the numerous papers he contributed to the Colorado Scientific Society, the American Institute of Mining Engineers, and to various technical journals, undoubtedly were the first publications to impress practical men with the value of geological research as applied to the making of money in mining. As a former resident in Colorado and as a mining engineer keenly interested in the geological side of our professional work, I was one of a great many to feel the stimulus of his writings. He did a public service, and it ought to be publicly acknowledged. Therefore I write to suggest that you, as editor of a paper devoted to the serious side of mining, should start a movement to perpetuate his memory by some useful benefaction. What form this should take may be left for future consideration. The endowment of a chair of economic geology at Harvard, his alma mater, or at the School of Mines in Colorado, the State in which he did his best work, might be appropriate. This may well be left to a committee, which should consist of men representing the intimate relation between mining and geology; for example, R. W. Raymond, James Douglas, James F. Kemp, F. W. Bradley, J. Parke Channing, Ben. B. Lawrence, Seeley W. Mudd (who knew him so well in his Leadville days), H. L. Smyth (of Harvard), David W. Brunton (as representing Colorado mining), George Otis Smith, director of the Geological Survey with which he so long served, J. A. Holmes, director of the new Bureau of Mines, and yourself. Of course, I would like to help in any way possible. Emmons had many friends on this side and they also are sure to be willing to subscribe toward a proper proposal to honor his memory and to perpetuate his good work."

We believe Mr. Rickard voices the feelings of many in what he writes, and, adopting his suggestion, we are asking the gentlemen named to join in forming a provisional committee to investigate the feasibility of carrying out the plan suggested.

The Development of Ore-Dressing Systems

By Frank E. Shepard

*In the quest for minerals there appear to be several phases of development, one leading into the other. The discovery of many of our large mining districts has resulted from placer workings in which the gold is found in gravels on or near the surface. The primitive methods with pick, shovel, and hand-rocker often served to develop rich deposits, then followed the more highly developed hydraulic mining systems involving greater expenditure of capital, but bringing greatly increased returns. This trail leads to a source and the patient prospector often reaches an outcrop or vein which requires deeper working with a more elaborate plant. The search is first for high-grade ores, for the difficulties of mine development, transportation, and treatment are great, and expenses proportionally high. Bonanzas, however, are rare, and afterward comes the patient search for ways and means of developing better methods of mining, milling, and smelting for making a profit from lower-grade ores. Refractory ores are found which call for more advanced methods of smelting, or the grade of ore is such that milling systems must be devised for concentrating sufficiently to permit shipment to smelting or refining points.

While the general trend of the value of an ore is from high grade to lower grade, there has also been an accompanying decrease of market price for the metals, which has called for serious study in all metallurgical systems. Ten years ago manufacturers of machinery for ore-reduction processes in the Rocky Mountain section, were devoting much attention to the details of smelting machinery for the treatment of high-grade ores. Today there is less call for smelting systems, and the demand appears for improved ore-dressing machinery for effecting recovery from lower and lower grade ores. This change from higher to lower-grade ore conditions has taken place generally throughout the fields of gold, silver, lead, zinc, and copper mining. The stamp-mill, with its amalgamating plates and bumping tables for the recovery of 50 to 70% of the gold and silver in the earlier period, is being succeeded by the concentration and cyanidation plants producing recoveries of 90% and over.

Lead-iron-zinc ores are presenting more and more difficult problems, and with the mining of lower-grade ores of these metals has come the demand for better methods of crushing, screening, hydraulic classification, and concentration, and great development in electrical processes for mineral separation has appeared in this particular line of ore treatment. The successful mining and milling of the great porphyry copper-ore deposits of a grade as low as 2% and under has brought about radical changes in milling methods, and concentrating mills of 10,000 tons daily capacity have been successfully developed. The tremendous growth of modern steel production has produced such demands on the iron ore supply that commercial possibilities have been found in the lower-grade iron-ore deposits of Michigan, and concentration plants have been installed for the treatment of 20,000 tons of ore per day. The call for economy in the Cripple Creek district has resulted in treating the dumps formed by the discarded ores of a former period, by means of modern concentration and cyanidation methods at the remarkably low cost of $1.50 per ton.

Those investing in mining enterprises have found that it pays to be guided by specialists in this line of work. Many mistakes are made by mining companies through hurrying the building of a mill before the mine is sufficiently developed. The professional fees of a competent geologist and mining engineer are well earned and thorough examination and sampling of the mine should be completed to furnish sufficient data from which to design and develop a suitable mill system. Having secured a representative sample of the ore to be treated, there are laboratories throughout the country where tests and experiments may be conducted and results obtained from which an economical system of ore treatment may be planned. The various manufacturers of mining and milling machinery offer engineering advice in the development of systems of ore treatment, and while this may be competent and the result of good practical experience, such advice depends upon data furnished by the mining company. Large mining companies appreciate the value of preliminary investigations of ore conditions in a mine and furnish the manufacturer reliable data from which to design and construct suitable machinery and equipment for the ore-dressing system: but in the smaller mining organizations, the building of a mill oftentimes appears to be more important than the development of orebodies, and the manufacturer is called upon to furnish machinery to treat ores which may change radically with further development of the mine. In extensive mining operations the plan is sometimes followed of erecting small mills to test the practical application of the mill system determined upon, and this proves of great value in solving difficult problems of ore treatment.

In the smaller mining companies, often composed of business men without any experience in mining or milling methods, it is seldom found that sufficient funds have been devoted to these important preliminary tests, and instead of employing competent technical advice some one of the directors of the company who 'has a liking for machinery' assumes charge of affairs, and the resulting mining and milling composition ends in minor chords. However small the proposed mining or milling installation, it is always advisable to secure the advice of a mining or metallurgical engineer who, after studying the entire field of operation and the economic conditions relating to mine and mill, making a suitable examination of the mine, and the necessary preliminary tests, submits general plans and specifications for a suitable mill system. While the manu-

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facturers of mining and milling machinery are by custom expected to prepare plans for milling systems, on account of the stress of business competition, this is not a wise plan, and it is better practice to have one engineer thoroughly familiar with all technical matters from inception to the completion of the milling plant. The manufacturer has the very important part to perform of attending to the many details of mill installation, and it is his affair to keep up to the minute in all the improvements which aid in reducing costs and increasing the recovery from the ores.

Mill designing is a profession in itself. It is not necessary for the consulting, mining, or metallurgical engineer of the mining company to be an expert in the details of mill construction, as the machinery manufacturers make a study of these problems. The detailed drawings of the mill should be entrusted to an engineer who has not only a very thorough knowledge of mill-machinery details, but an intimate knowledge of mill-men and practice. In the selection of mill machinery the new, inexperienced mining company usually buys the cheapest grade, while the mill superintendent of long experience buys the best machinery that can be built. In a small mill treating 50 tons in 24 hours of an ore having a value of $15 per ton and assuming that the mill recovers 80% of the value, a delay in operation of but one hour means a loss of $25. It is manifestly poor economy to save a few hundred dollars in the original investment at the expense of several thousand dollars for delays and repairs.

Ore-crushers were formerly equipped with hard cast-iron jaw-plates which had to be removed every few weeks, whereas now these crushers are provided with the best crucible-steel jaw-plates which last for several months. Crushing-rolls were formerly equipped with cast-iron shells which gave short service and soon became grooved; now the best forged-steel, machine-finished shells are used with longer service and better product as a result. Elevating and conveying apparatus has reached a high state of development, all tending to greatly reduce the cost of handling materials. By means of these excellent modern devices the entire mill system is made automatic from beginning to end, excepting the adjustment of machinery.

One of the greatest, if not the greatest, improvement in the wet concentration of ores has been the important development in the preparation of ore previous to jigging and table-work as a result of the investigation of Robert H. Richards. Mr. Richards' devices for hydraulic classification of ore pulps, previous to table concentration, have produced savings over former methods amounting to hundreds of thousands of dollars annually. In the case of the small mill before mentioned having 50 tons capacity daily and recovering 80% of the value in $15 ore, an improvement in recovery of only 5% will mean an additional saving of over $12,000. Such improvements have actually been accomplished in practical mill systems using Richards' system of hydraulic classification.

The tube-mill is an important element in modern mill systems and was adapted from cement mill practice. It takes the place of the more complicated crushing machines involving the frequent renewal of shoes, dies, screens, and various parts in roller or Chilean mills and presents a simpler and more economical means for the fine crushing of ores. The development of the tube-mill in connection with the stamp-mill in South African practice is extraordinary; the combination effecting an increase in tons crushed per stamp from five tons, before the tube-mill was introduced, to twenty tons per stamp when assisted by the tube-mill. The better understanding of the preparation of ore previous to treatment on tables as well as the better understanding of the concentrating tables themselves has brought about great improvement in mill recoveries.

The development of magnetic and static concentrating machinery has allowed a practical separation of iron and zinc minerals which before was most difficult or impossible. Use has been made of the property of surface tension in liquids for the purpose of separating minerals from the attending gangue. In general, the sulphides of the metal may be floated on the liquid, while the gangue sinks. While the system is limited to certain conditions, it opens an interesting field, and one which may develop great possibilities. Even greater progress could be accomplished were it possible to obtain the earnest cooperation of mill operators. In some cases splendid triumphs have been accomplished because new devices have been given the 'square deal' by intelligent and progressive mill operators. On the other hand, many a mill system is undeveloped on account of personal prejudice and lack of initiative.

Failures in mill systems are too often due to the neglect to make tests to determine the points where losses occur or the costs of various operations. Changes suddenly occur in the ore, and if not promptly followed up with required changes in the mill system, will result in serious losses. One of the modern requirements is thorough sampling, and the best mills make use of automatic sampling throughout. It is most important to have the right spirit prevail among the members of the mill crew. Good team work tells here as well as in games, and a fair attitude and attention to improved methods of milling means thousands of dollars to the mining company.

We often see machinery advertised as 'fool-proof.' If the mill system is to be run by fools then we need fool-proof machinery, but if we can not advance beyond the stage of fool-proof machinery then we might as well give up our ideal of greater recovery. For the economical treatment of low-grade ores we must expect greater complication in the mill system, but if we can save $25,000 by the addition of some machine, even though not classified as 'fool-proof,' is not the expenditure warranted of $2500 in wages to some mill-man who will be friendly to the machine?

The man who stands by the machine has the opportunity of discovering many points, possibly improvements, regarding the operation or results of that machine. If the personal equation of that man is plus and he receives proper recognition by the man-

agement, the result is a substantial increment to mill development. Mills are usually built in remote sites, difficult of access, and in many cases at altitudes of 10,000 and 12,000 ft. above sea-level. It requires some financial incentive to induce good men to work constantly under these conditions, and liberal wages must be offered to obtain a high order of intelligence in the mill crew. The study of mill systems has in some cases shown a high order of inventive ability among mill superintendents in the development of devices for increasing the recovery of ore values, or reducing the expense of operation. There is, however, a great amount of blind prejudice to overcome when an attempt is made to introduce improved methods in the milling systems. This is a strange condition, for one would think that any millman would be favorable to any device which would show improved results even at the expense of some extra attention, but the fact remains that it requires a bitter fight to establish new systems.

A very interesting psychological fact exists in mill conditions. If a new device or system be introduced by some one of the mill attendants and he has the care of the device, that device is certain to work successfully. Should a system be introduced by the manufacturer, even though such system may have proved a success, all manner of prejudice and resistance appears, and often a good system is classed as a failure. If our graduates of technical schools could be induced to serve a few years of apprenticeship in a mill, and devote their technical training to assisting in the development of improved devices, good progress would be made for securing better ore-dressing systems. With the successful treatment of low-grade ores there must be better study of conditions, better skill in operation, and a constant effort for improvement. The modern mill calls for a higher order of materials of construction; concrete and steel are now being used where a few years ago their use was designated as an extravagance. Better machinery is being used and the use of higher-grade materials throughout the mill construction is considered a necessity.

The opportunity for improved results in ore-dressing systems is great. When it is known that in the operation of 10,000-ton copper-ore concentrators, the loss on every ton of ore treated is from 30 to 40%; that in precious metal wet-concentrating mills the loss is from 20 to 30%, the time is at hand when the data from long lines of investigation in assisting the engineer and the builder, added to the practical application of the honest mill-man, should produce some telling results.

Keeping a defective tool in operation does not pay; nor is it to the interest of the employee, particularly if he is paid by the job, to use imperfect apparatus which reduces his possible earnings. On the other hand, it is by no means seldom that workmen are found who have their choice of the best materials and apparatus and who possess the intelligence to apply these correctly, showing a striking disregard for their own safety and that of others, especially in framing structures of a temporary nature.

Magnesite in California

By Charles G. Yale

*The production from the magnesite deposits of California in 1909 was 9465 short tons crude, valued at $37,860, as compared with 6587 tons crude, valued at $19,761, in 1908. Aside from the increase in quantity in 1909, it is to be noted that there was an advance of 33⅓% in price of the crude ore, the average having risen from $3 per ton in 1908 to $4 per ton in 1909. The cost of producing magnesite differs considerably in different counties, owing to the diverse character of the deposits and the differences in the cost of carrying it to the nearest railroad. In some localities the ore is valued as low as $2.35 per ton at the mines; in others as high as $9 per ton. Where the merchantable ore occurs in small stringers, instead of in heavy homogeneous deposits, the cost of production is much increased. Moreover, where considerable development work is combined with that involving the extraction of ore, the cost increases, and it is not always feasible so to segregate the two factors of cost as to fix an exact valuation on the ore mined ready for sale. The price given is that at the railroad station nearest the respective mines.

Only seven mines in California were productive in 1909, and all but two of these are small, yielding a few hundred tons each. These mines are in Fresno, Napa, Riverside, Santa Clara, and Tulare counties, the most productive one being in Tulare county. The sale of the product of these mines is virtually limited to localities on the Pacific Coast, the cost of transportation to points of consumption east of the Rocky Mountains being prohibitive. The California magnesite can not compete in price at Eastern points with that imported from Greece and Hungary, whence shipments are made by sea and where cheap labor conditions prevail. Most of the magnesite produced in California is used in the manufacture of paper from wood pulp in the paper mills of California and Oregon. The quantity used for making artificial stone, tile, flooring, and building material is increasing each year. For these purposes and in paper manufacturing, only calcined magnesite is used. Crude magnesite is used only in manufacturing carbonic-acid gas, in the course of which process the magnesite is calcined and then is sold in that form. This calcined magnesite is sold generally at from $16 to $20 per ton, and it takes about 2 tons of crude ore to make 1 ton of the calcined material.

The few mines opened in 1909 were small, none of great importance having been developed to a producing stage. The county most productive in magnesite is Tulare, which has three mines, one of them the most important in the State. On this property calcining furnaces have been in operation for some time, and the entire output is calcined before shipment. The other two mines in the county are not equipped for calcining the crude ore.

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*Min. Res. U. S., 1909.

The World's Greatest Silver Mine—Broken Hill

By John L. Cowan

Few of the world's 'big bonanzas' have given a better account of themselves than Broken Hill, in New South Wales, where silver-lead ores are quarried in open-cuts, like sandstone is in America; and where one remarkable mine (the Consols) has yielded incredible quantities of ore that ran 95% pure silver. And although silver mining on 'the Barrier' is greatly depressed, and the Cobalt mines have monopolized the attention of that part of the mining world interested in silver for several years past, the Broken Hill Proprietary is the largest silver producer in the world today. In the twenty-seven years that have elapsed since the discovery of 'the Barrier' (as the vein is called), its mines have paid more than $100,000,000 in dividends. They have yielded silver of a value of $300,000,000, to say nothing of shiploads of lead and zinc, and no inconsiderable quantity of gold and copper. Yet the Broken Hill mines are rarely

Main Shaft, Broken Hill Proprietary.

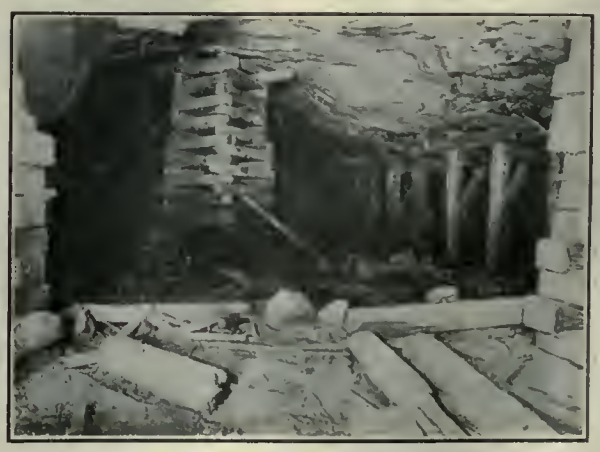
mentioned in the journals, and the average American, unless well informed, probably does not even know the name of the great silver-producing lode to which New South Wales owes its prosperity and the commanding position it occupies in the world's metal markets.

Like most of the world's great mines, those of Broken Hill were discovered by accident. In 1869, Charles Rasp left his home in Germany to seek his fortune in Australia. Apparently he did not find it quickly, for in 1884 he was only a 'boundary rider' (a bush-country euphemism for sheep-herder) killing time and strangling ambition on one of the dreariest stretches of saltbush and mulga-bush that even New South Wales afforded. The country round about had been prospected before, and was universally believed to be devoid of valuable minerals. Patrick Green, a storekeeper of Menindie, with a party of experienced miners and prospectors, had hunted for copper on the very spot where the city of Broken Hill now stands, but found nothing that looked good or afforded the slightest hope of something better deeper down in the earth. Then in 1883, Charles Nicholls went in search of whatever the fickle goddess of the mines might see fit to bestow, walked over the spot where now is located the main shaft of the mine that yields one-sixteenth of the world's annual output of silver, 'pegged a block,' and worked for a few weeks, finding nothing, and then gave up in disgust. He was willing to take a solemn oath to the effect that there was nothing worth digging for in that part of the saltbush country.

Whether Charles Rasp, the boundary rider, knew

Great Open-Cut, Broken Hill.

of these past failures or not does not matter. He noticed the peculiar appearance of the country that he traversed day after day. Odd-looking outcrops of 'ironstone' were distinguishable through the growth of saltbush that covered the half-desert; queer-shaped hills gave to certain sections an appearance that bordered upon the uncanny. It was after Broken Hill had grown into a great mining camp that the discovery was made that the despised ironstone was a rich sulphide ore. Although Rasp did not suspect that the ironstone was worth anything, he did think that so strange looking a coun-



Method of Timbering, Underground.

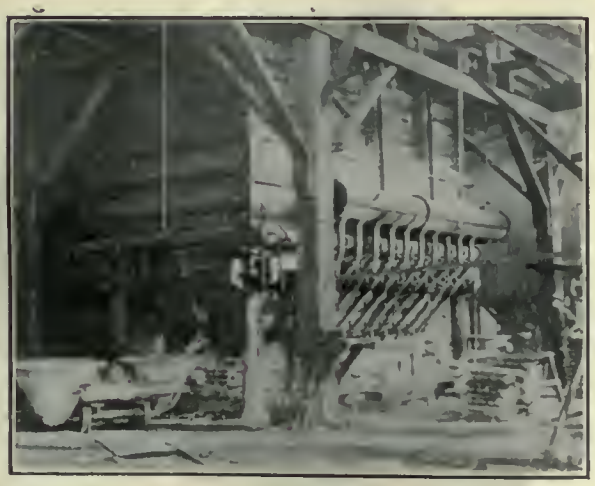
try must contain something of more value than the scanty desert vegetation that had grown, withered, and grown again for unealculated ages. He was not a geologist, nor even a mineralogist, and had not the remotest idea what that something might be. He made a wild guess that it might be tin. So he 'pegged a block' (for no one 'stakes a claim' in Australia), and sought for help to develop his problematical tin mine.

Rasp must have been a persuasive talker, for he

soon succeeded in getting together a syndicate, composed of himself and six other employees of the sheep ranch. That made seven members, constituting the syndicate, each one owning one share. The maximum assessment that could be levied was fixed at ten shillings per share per week, or a total of about $35 per week available for development work. Seven claims were located, and the parent of the Broken Hill Proprietary Mining Co., embarked in mine development, with less real working capital than would suffice to pay the office rent and postage bill of any up-to-the-minute American 'mining syndicate' trying to float a Nevada prospect showing 'free gold' or 'virgin silver' from 'the grass roots.'

Lead Bars on Wharf, Port Pirie.

Interior of Refinery, Port Pirie.



Blast-Furnace at Port Pirie.

Molding Market Lead, Port Pirie.

It was not long until some of the future silver kings of New South Wales began to feel the weekly drain of ten shillings each upon their meagre wages. So they were compelled to sell fourteenth and even twenty-eighth interests in the mine. Sometimes 'the boys' were careless, when going to or returning from the mine, breaking down the fences and permitting the sheep to stray; and that got them into serious difficulties with the overseer, who would have regarded as a fool anyone who tried to tell him that the hole in the ground into which 'the boys' were sinking their money meant more for the future development of New South Wales than all the sheep in Australia were worth.

One day a boundary rider, named Philip Charley, who had purchased a fourteenth interest in the mine, went to camp in great excitement. "Look at that, boys," said he; "we're in luck at last." They looked at the specimens he exhibited, but couldn't see anything to get excited about; and one of them remarked, disgustedly, that it was "nothin' but bloomin' carbonate of iron." "No," said Charley, "don't you see the speeks of chloride?" That seemed to the 'boys' to be really funny. "Hold on to your share, Charley," said one; "you may make a thousand out of it." "I wouldn't sell out for that," the boundary rider replied. "Ho, ho," jeered another, "then if I hold on to mine a year or two I may make five thousand out of it." That was considered the wildest possible flight of the imagination. Yet within three years after that a fourteenth interest in that mine was worth, on the open market, more than fifty thousand pounds sterling. In ten years it was worth half a million pounds.

By 1884, it began to be apparent to everyone that there really was silver in paying quantities in the Broken Hill Barrier, and a little cluster of tents sprang up on the site of the future mining metropolis. One day a man from an older mining camp drifted that way and offered the members of the syndicate a dozen eggs for a monopoly of the restaurant privileges on their lease. Eggs were scarce, in fact almost unknown, in that part of the bush country, and the proposition was hungrily accepted. Thus was the commercial life of Broken Hill inaugurated, and the first business enterprise launched.

It was a bad beginning. Nine of the eggs proved to be hopeless, and the other three were open to grave suspicion, so that they were regarded 'only fit for custards.' Thus it happened that the municipality of Broken Hill, with a present population of 20,000, was hatched from a dozen stale eggs. In 1884, chlorides were discovered in large amounts, and then the boom began. In a few months there were 5000 people on the ground, notwithstanding the fact that the law regarded every individual as a trespasser. The land was all reserved from settlement and occupation. However, the Colonial Land Department had no desire to engage in wholesale prosecutions, and allowed matters to drift until late in 1887, when a proclamation was issued canceling the reserve and permitting settlement. Then came a fight for land. The occupants had no shadow of legal title, and every claim of any possible value was hotly disputed by a dozen or more contestants. Claim jumping, rioting, gun fighting, and assassination for a time made Broken Hill one of the wildest and most lawless of the world's mining camps.

This period of lawlessness is known in the history of New South Wales as the 'Battle of the Barriers.' As soon as it had been fought to a finish, the great Broken Hill mining boom rose to its highest pitch. It was just like all other mining booms—like the 'Kaffir circus' of Johannesburg, or the more recent Goldfield and Cobalt frenzies. Promoters traded upon the credulity of the people, rather than upon the riches of the mines—and the amount of credulity available passed human power of estimation. It was all converted into cash by the crafty. Everything within a radius of miles was 'pegged,' and shares in worthless saltbush claims were sold at figures that would have been regarded as fabulous for dividend-paying mines in old and well established districts. One man wanted badly to enter the gamble, but had not a one-pound note to his name. So he wired to a Melbourne broker to buy for his account 1000 shares in block No. 10, in which it was expected that the mineral lode would be cut at any minute. The broker had unlimited faith in anything bearing the Broken Hill label, so he executed the order, allotting the penniless speculator a thousand shares at the market price, which was then three pounds six shillings. In less than a week the lode was cut, proving to be of phenomenal richness, and shares soared to £20 each. The man with plenty of nerve, although with only enough cash to pay for a telegram, cleared £15,000 on the transaction.

In twenty-seven years, the little $35-a-week syndicate developed into the world's greatest silver-lead mining corporation, employing 6000 men in its mines at Broken Hill and its reduction works at Port Pirie; and the municipality hatched from a dozen stale eggs has become the wealthiest city of its size in Australia, the creator of a hundred colossal fortunes. Ten or twelve years ago, experienced mining men regarded the camp as rapidly declining, because the carbonate and oxidized ores that had been the making of the camp seemed to be verging toward exhaustion. Then it was found that down below the carbonate ores were sulphides extending to great depths, and that the 'ironstone' outcrop that scarred the face of the entire country round about was rich in silver, lead, and zinc. To extract the silver alone from the 'ironstone' did not pay; but to smelt the ore for the saving of the silver, lead, and zinc proved like rubbing the lamp of Aladdin.

As a result of the discovery of sulphide ores, and of practicable and economical methods of treating them, a railroad was built connecting Broken Hill with the ocean at Port Pirie, where one of the largest silver-lead reduction works in the world has been built. Pig lead is shipped to Europe literally by the shipload, and silver bullion by the ton. Most of the zinc concentrates are exported to Europe for treatment, but it is planned in the near future to build reduction works at Port Pirie for the treatment of these also. Small quantities of gold, copper, and tin are produced, and great expectations are entertained of the eventual finding of important tin-producing deposits somewhere in the neighborhood. Although the Broken Hill Proprietary is the greatest of the Barrier mines, with an output more than equal to that of all the others combined, still the Broken Hill Central, producing 1,500,000 oz. of silver annually, is something of a mine, too; and numerous others justify their existence by paying dividends with unfailing regularity. But when Broken Hill is spoken of, one's thoughts naturally revert to the Broken Hill Proprietary, which for years has held its position as the greatest silver producer in the world.

Gypsum produced in the United States as well as in foreign countries is mainly manufactured by grinding and partial or complete calcination into the various plasters, such as plaster of paris, stucco, cement plaster, flooring plaster, and hard-finish plaster. A steadily increasing quantity is being used as a retarder in portland cement. Refined grades of plaster are used in dental work, also as cement for plate glass during grinding, and as an ingredient in various patent cements. Considerable quantities are ground without burning and used as land plaster or fertilizer, while smaller quantities are used in the manufacture of paint, crayons, and paper, imitation meerschaum and ivory, and as an adulterant. The pure white massive form, known as alabaster, is much used by sculptors for interior ornamentation.

Sand-lime products may be put to numerous uses. It is claimed by the manufacturers that the bricks are suitable for use in superstructures and foundations and for all underground work, especially for sewers; that they improve with age, have great crushing strength, are low in porosity, are poor conductors of heat, and are unaffected by acids. It is also claimed that they are sanitary, and that they will not disintegrate under extreme climatic changes. On account of their uniform size, shape, and color it is said that they can be economically laid and can be made to produce a like face on both sides of an 8-in. wall. The bricks can be tinted any shade or color desired.

Some Surveying Problems

By E. R. Rice

A scheme that is quite useful in field work, and especially in stadia work where it is neeessary to sacrifice accuracy to speed, is shown in the sketches, Fig. 1. In the ideal case, shown at (1), where the instrument is set up at A and the rodman is at C, across a river or deep valley, too far to read the rod, the transit-man turns off an angle of 5° 42′ 30″ (theoretically 5° 42′ 38″), and lines the rodman in at B, at right angles to A C.

Then when the transit is moved to C, C B is measured either by tape or stadia, and A C = 10 C B. In ordinary country and ordinary work, it is sufficient for the rodman to guess at a right angle to A C. A right-angle prism can be used to advantage. Sometimes, as in (2), in sighting from one ridge to another, the rodman cannot go at right angles

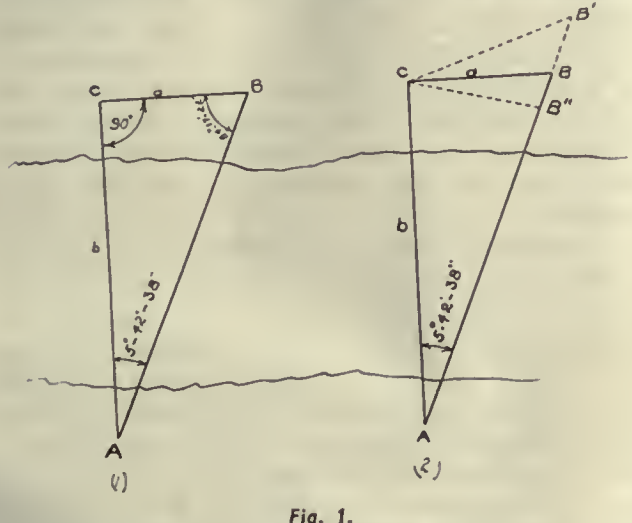


Fig. 1.

to C A, but has to walk along the right to C B′ or C B″.

When the transit is moved to C, then C B′ or C B″ is measured, the angle B C B′ or B C B″ measured, and C B solved for by $C B = \frac{C B' \sin C B' B}{\sin 84° 17' 22''}$. This method should be resorted to, also, when higher accuracy than is obtainable by the first method is desired.

I might mention here that the accuracy of stadia measurements, a solar attachment, and a 10-inch slide-rule graduated as close as a 20-inch, are all about the same, averaging in the neighborhood of 1:1000, and can be used in conjunction to advantage. The above formula can be solved at one setting of the slide-rule. In long stretches of country, A C can be made two miles or over, if the rodman has a field-glass with which to watch the transit-man's signals.

The sketches in Fig. 2 show three possible cases of the 'three-point problem', which may be solved in the following way:

$\eta = \Theta + \Phi$ in all three figures.

In (1), $\eta = C - A - B$

In (2), $\eta = 360° - A - B - C$

In (3), $\eta = 360° - A - B - C$

$\text{Cot } \Theta = \frac{a \sin B}{b \sin A \sin \eta} + \text{Cot } \eta$

The triangle U V W has all its sides and angles known, as would be the case in any triangulation system. S is any station occupied by the instrument, not on the circumference of a circle passing through the points U V W.

The instrument is set up at S, and the angles A and B read, and Θ solved for by the formula. With Θ known, we have a triangle S U V in which all the angles and one side are known, and hence the bearing and length of S U or S V can be found, and the total latitude and departure of the station S computed. This method is quite useful in a hilly country where triangulation stations are established on the tops of hills and one does not care to spend five or six hours tying in work by an ordinary traverse.

It is to be noted that in cases (1) and (3) it is impossible to place S on the circumference of a

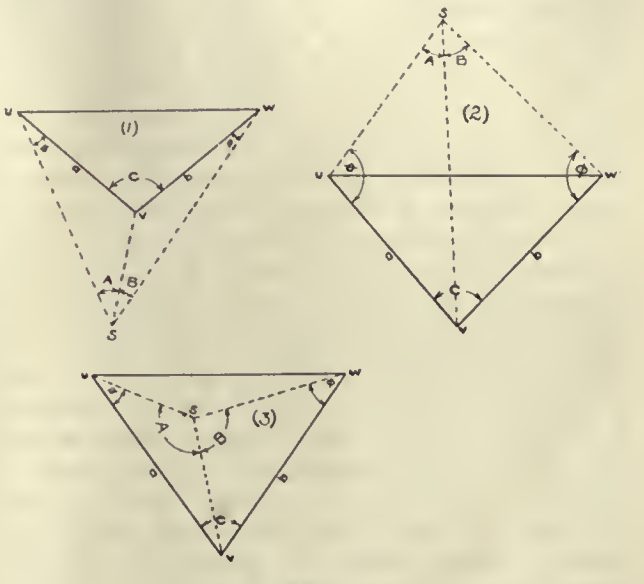


Fig. 2.

circle passing through U V W. Also, in solving case (2), attention has to be paid to signs, for when η is between 90° and 180° Cot η is negative, and when between 180° and 270° it is positive. It is therefore best to use case (1) or (3) whenever possible.

Carborundum is manufactured by fusing a mixture of pure granulated coke, very pure glass sand, and sawdust. The coke is the carbonaceous residue from the distillation of petroleum; the sand used is the purest glass sand. The sawdust is added mainly to make the mixture porous and thus to avoid explosions of the carbon monoxide produced during the reaction. The fundamental reaction takes place between the sand (silica) and the coke (carbon), resulting in the production of carbide of silicon, or carborundum. The carborundum crystals are crushed under manganese steel rollers in a circular pan of the same material. The crushed product is then treated in a bath of sulphuric acid to dissolve the minute particles of steel that have been cut from the rolls and the pan. This method of removing the steel has been found more satisfactory than the method of removing it by magnets. After the carborundum has been washed to free it from acid it is screened into different grades and is then ready for manufacture.

Tonopah Geology

By J. E. Spurr

***Conclusions in 1902.**—When I made my study of the mines of Tonopah, in the summer of 1902, I identified the highly altered and variable-appearing rock in which the principal veins were found as andesitic; and found that this rock was frequently covered by another andesite, later than the principal ore deposition, and therefore barren of ore and forming a 'cap-rock' to the ore-bearing veins. The formation which enclosed the veins I called the 'earlier andesite' (although my investigation shows the rock to be really a trachyte); the younger rock the 'later andesite.' Still younger than the 'later andesite' I found a variety of volcanic rocks, largely extrusive surface formations including tuffs, explosive breccias, and flows, but also partly intrusive. These younger rocks were chiefly rhyolitic in composition. One of the most conspicuous of these rhyolitic rocks was a rock with a glassy ground mass, usually packed full of angular inclusions of similar glassy rhyolite, so that the whole had usually the structure of a breccia. This rock occurred chiefly as surface flows in the district south of the town of Tonopah; to the north of the town, however, it was found to outcrop abundantly in the guise of an intrusive rock, younger than the 'later andesite.' To this rock the name 'Tonopah rhyolite-daeite' was given; it appeared to be plainly an autoclastic volcanic breccia. The origin seemed to be due to periods of quiescence and of partial congelations in a volcanic vent, alternating with periods of upward propulsion of the viscous lava, so that the hardened glassy exterior crusts were shattered and carried along in the upwelling still fluid portion of the same lava; and these incidents repeated a number of times produced the peculiar and characteristic structure of the finally solidified rock as we find it. Also later than the ores, and roughly contemporaneous with the Tonopah rhyolite-daeite eruptions and related intrusions (the span of the period of activity of this lava was considerable), I found a series of waterlaid tuffs formed in a lake of vast extent. Later than these tuffs, I found a number of volcanic necks, formed of distinct but closely related lavas of rhyolitic composition merging toward daeitic composition. In sum, it appeared that the productive veins had formed after the eruption of the 'earlier andesite' (which was and is still believed to be in a large measure at least a surface flow) and before the advent of the numerous other volcanic and volcanic-detrital mentioned. The whole volcanic history, including the formation of the ore deposits, was found to belong to the Tertiary, probably Miocene-Pliocene.

New Information Obtained in 1903.—Returning to Tonopah in the summer of 1903 for a brief examination of recent developments before the publication of my report, I found that a number of shafts had, after passing down through the 'earlier andesite,' penetrated, at a depth of a few hundred feet, a dense greenish glassy rock, highly altered, and essentially aphanitic, but evidently of rhyolitic nature. This rock is characterized by numerous angular light-colored or white inclusions, apparently of altered rhyolitic glass of much the same nature as the matrix, so that the whole rock appears to be an autoclastic glassy rhyolite. The most important veins seemed to be cut off by this rhyolite, whence it was concluded that the rhyolite was an intrusive sheet, younger than the 'earlier andesite' and the principal ore deposition; and this view, after recent exhaustive investigation, is still held. Since this rock was closely similar to the outcropping intrusive Tonopah rhyolite-daeite in the vicinity, it was correlated with this formation. This correlation has now been definitely abandoned, as subsequent extensive development work has proved this underground rhyolite to be of distinctly greater age than the Tonopah rhyolite-daeite (or Tonopah rhyolite, as it may be called with more simplicity and as much accuracy) and to outcrop at the surface nowhere in the surveyed and mapped district. Thus it constitutes a new formation, unexposed at the time of the original investigation. It is commonly referred to in Tonopah as the 'Upper rhyolite,' but will be here more conveniently designated as the West End rhyolite.

I observed, in the summer of 1903, that there was evidence of a second period of vein-formation, later than the extrusion of the West End rhyolite. The description of these later veins still holds. They are less definite and persistent than the veins of the first period, contain great quantities of low-grade or barren quartz, and the pay-ore, where it does occur, is spotty and usually of low grade.

The developments observed in the summer of 1903 also showed that several shafts had passed through the sheet of West End rhyolite into andesite, having apparently the general composition of the 'earlier andesite' above the sheet, and highly altered by hot-water action. No development work whatever had been done on the lower andesite body, but it was especially remarked that the alteration of this rock was entirely of the sort sometimes designated as 'propylitic,' that is, to calcite, chlorite, and pyrite, so that the rock took on a characteristic dark-green color; while the 'earlier andesite' above the West End rhyolite sheet was mainly altered to quartz, sericite, and adularia. Evidences of this propylitic alteration in this original 'earlier andesite' mass were, however, abundant in many places, so that this lower andesite was correlated with the 'earlier andesite,' although it was pointed out that this 'calcitic phase of the earlier andesite' was not associated with the ores.† At the time of this second examination in 1903 a vertical drill-hole downward from the bottom of the Mizpah shaft had penetrated a rock which I identified as rhyolite, and correlated it with the Tonopah rhyolite, and on this basis interpreted it as a barren formation, in which no pay-ore would be found. This correlation and interpretation have been confirmed by the recent exhaustive investiga-

*Abstract of report on the Geology of the Property of the Montana-Tonopah Mining Co., Tonopah, Nevada.

†Professional Paper No. 42, U. S. Geol. Surv., p. 32.

tion. In the Mizpah Extension shaft part of probably the same underground rhyolitic body was observed, and, as it still appears, correctly correlated. This deep-seated sheet became subsequently locally known as the 'lower rhyolite.'

Progress of Development Work and Modifications of Geological Views.—The extensive underground development of the succeeding years emphasized the distinction between the lower andesite body, or the 'calcitic phase of the earlier andesite,' and the upper or original 'earlier andesite' mass. The first-named rock, whose designation became usually locally abbreviated to 'calcite andesite,' was found to have a considerable lateral extent, with the general form of a sheet underlying the West End rhyolite sheet, and overlying the deeper Tonopah rhyolite (usually called locally the 'lower rhyolite') mass, which was also found to have considerable lateral extent. The green color, due to the type of alteration of the 'calcitic andesite,' was found to be quite uniform, and the scarcity of silicification or veins in this rock became increasingly apparent. Therefore there was an increasing tendency on the part of the local Tonopah geologists, who were watching the development, to question the correlation of the 'calcitic andesite' with the 'earlier andesite,' and this increasing doubt was shared by myself. These doubts took more definite form in my mind in the summer of 1908, when I returned to Tonopah for an examination of the West End and MacNamara mines. At that time I determined the fact that the West End rhyolite sheet could not be correlated with the Tonopah rhyolite, but was distinctly older. One of the strong arguments for the intrusive nature of the West End rhyolite sheet was therefore withdrawn, and a review of the whole argument became necessary, for if the rhyolite sheet were not intrusive, the main argument for the correlation of the underlying 'calcitic andesite' with the overlying original 'earlier andesite' was also withdrawn. The now more clearly exhibited (on account of new development work) uniform points of distinction between the two andesitic rocks led finally to the conclusion that the two andesitic sheets were indeed distinct and independent rock-formations. In this new light, a probable explanation appeared to be that the different formations were merely a series of regularly successive surface flows. This explanation was regarded with some favor, although it by no means explained the peculiar relations of the rocks to the mineral veins, as it still appeared that the most important veins in the 'earlier andesite' were cut off by the West End rhyolite sheet; and that the large but relatively low-grade veins of the second period, found in the West End rhyolite, did not penetrate the 'calcitic andesite' and, apparently, had not been found in the Tonopah rhyolite beneath.

In December 1909, the thesis that the different rock formations at Tonopah were a series of successive surface flows was brought out in a publication by J. A. Burgess, geologist for the Tonopah Mining Co. As a strong point in favor of this view, mention was made of the discovery, in the Mizpah mine and in the uppermost portion of the 'lower rhyolite,' of white dense banded rocks having the appearance of stratified tuffs, alternating with the coarser breccia such as is more common in this formation. Further specimens were found in cores obtained by deep drilling which could be easily interpreted, on account of their definitely banded character, as stratified. Microscopic examinations made by E. S. Larsen, of the Carnegie Institute, showed these rocks to have an essentially fragmental character, and this led to their designation as well-bedded tuffs. These considerations made the thesis that the rocks of the district were a series of successive surface formations, occurring in their normal order, with the oldest at the bottom and the youngest on top, a plausible one, which I had no difficulty in believing might prove to be correct.

Outline of Results of Recent Study.—In the early part of 1910 arrangements were made with the principal mining companies of Tonopah for a thorough geological investigation, to supplement my original report published by the Geological Survey, and to investigate the import of data subsequently exposed by development, with its bearing upon the future methods of development work in the camp. Accordingly I have spent a number of months in close detailed underground studies and mapping, and have already investigated in detail the mines of the Tonopah Mining Co., the Montana Tonopah, the Belmont, and the Midway, all adjacent and forming as a group a unit. The results of this arduous work have been finally to fix definitely and beyond doubt most of the geological relations. As is so often the case, it is the unexpected which has finally proved to be the true solution. The 'earlier andesite' still remains the oldest of the rocks, but turns out to be a true trachyte instead of an andesite, and will henceforth be called the Mizpah trachyte. In its lower portion it passes by transition into a dense banded glassy basal phase, called in this report the 'glassy trachyte.' This 'glassy trachyte' was at least several hundred feet thick, but where the exact base was, or on what older formation this flow rested, is not known. The West End rhyolite has been determined to be an intrusive sheet, mainly inserted along the zone between the 'glassy trachyte' and the Mizpah trachyte proper, although showing considerable irregularity. The 'calcitic andesite' is a distinctively intrusive sheet of considerable irregularity, younger than the West End rhyolite, and sometimes underlying this rock, directly, sometimes separated from this rock by a variable thickness of the 'glassy trachyte.' It appears to be of essentially the same age and composition as the 'later andesite,' is correlated with it, and is probably directly connected with the main later andesite mass, which appears to be essentially a surface flow. The 'lower rhyolite' is shown to be younger than the 'later andesite,' is correlated with the Tonopah rhyolite, as was done at the time of my original investigation, and is younger than the 'calcitic andesite' sheet, which it underlies and is locally known to intrude. This 'lower rhyolite' is evidently the flatly downward-pitching extension of the great mass of intrusive Tonopah rhyolite exposed on the surface

half a mile or so to the north of the main producing mines. The thickness of this Tonopah rhyolite is unknown, as it has never been bottomed; in the Mizpah mine a vertical thickness of over 1900 ft. has been demonstrated by drilling. Thus is demonstrated by the well-substantiated and extraordinary condition of a series of four successive sheet-like formations of distinct characteristics, of which the oldest lies at the surface, and the youngest at the bottom, and the whole order of superposition is the reverse of the order of age. This inversion, striking as it is, is not so regular as an elementary review of the situation indicates; the impression of great regularity arises from the limited field of development underground, which has a major horizontal axis hardly more than a mile in length, and from the fact that the geological conditions in this developed area are so complex that the area appears to the conception much more important in size than it actually is. Development carried outside of this limited area would doubtless show a great irregularity of relation; and, indeed, this is already exhibited on the borders of the developed area.

The veins have finally been divided into three groups according to their age, which groups correspond essentially with those originally made. The formation of the first group followed the advent of the Mizpah trachyte and preceded the advent of the West End rhyolite. This group comprises those rich veins which have made Tonopah famous. The second group followed the intrusion of the West End rhyolite, and preceded the advent of the later andesite (including in this term the 'calcitic andesite'). It includes frequently large veins, usually low grade or barren, and locally profitable. The third group followed the intrusion of the Tonopah rhyolite and comprises rare, essentially barren veins, never profitable.

Synopsis of Final General Results.—At Tonopah the oldest rock is a trachyte flow highly altered to quartz, sericite, and adularia. The lower part of this flow is a fine flow-banded glassy trachyte. The main body of the trachyte contains the oldest and by far the most important group of mineral veins; the glassy trachyte appears practically barren. Stresses subsequent to the trachytic extrusion produced horizontal faulting near the zone of transition between the main body of trachyte and its glassy lower portion; and along here a glassy trachy-alaskitic intrusion, very full of inclusions, took place. Subsequent movement reopened this line of weakness, and a second trachy-alaskitic intrusion came in—the West End rhyolite sheet. At a subsequent epoch came an eruption of andesite (Midway andesite), largely as a surface flow, but largely also as an intrusive sheet along the old zone of weakness, but typically below the West End rhyolite sheet; at a still later epoch there was a series of rhyolitic and alaskitic surface flows and intrusive mass called the Tonopah rhyolite.

The principal veins were formed after the trachyte eruption and before the Montana breccia-West End rhyolite intrusions. They are quartz veins carrying silver and gold. A second set of veins was formed after the West End rhyolite intrusion and before the Midway andesite eruption. This second set is divided into four successive groups—**A**, large typically barren quartz veins; **B**, tungsten-bearing veins; **C**, mixed quartz and adularia veins, typically barren; **D**, small productive veins like those of the first set, following the trachyte. A third set of veins was formed after the Tonopah rhyolite intrusion. They are quartz veins containing occasional lead, zinc, and copper sulphides. All of these veins formed at shallow depths, and the different types represent various stages of temperature. The first period veins represent the normal shallow-seated type, and followed the trachyte eruption: the second period **B** veins represent an abnormally intense shortly-sustained temperature, following the trachy-alaskitic intrusion; the second period **D** veins a directly subsequent briefly-sustained stage of temperature more normal to shallow depths; the third period a relatively high but briefly-sustained temperature, following the alaskitic (Tonopah rhyolite) intrusion. No vein-formation followed the andesite eruption.

The history of faulting is long and complex; important movements have taken place at every stage of the geologic history. These movements accompanied and were due to the volcanic paroxysms; and were so intense that locally the rocks are ground almost to a powder.

Before magnetic separation can be applied, it is necessary to free, or break apart by crushing, all the constituent minerals forming the crude ore. Theoretically the point to which comminution should be carried is that at which every particle of mineral is free to be attracted or rejected according to its permeability; this is, of course, the ideal situation, but can not be carried out in practice. Nevertheless, this theoretical point should be the aim. The practical rule is to carry the crushing far enough to free the maximum number of valuable mineral particles, having due regard to the cost of crushing, and the saving effected. There is no ironclad rule to be followed for the solution of this problem; the process, as a whole, requires an intimate co-relation of the crushing and separation factors. Different ores require widely different treatment; for one ore, moderately coarse crushing will suffice; for another, excessive pulverization is required to liberate the particles of magnetite, with the consequent added cost of comminution.

New abrasives recently placed on the market are aloxite, a product for steel grinding which is successfully used in machine-shops, as it does not heat the tool or draw the temper; samite, an abrasive for cutting aluminum which does not glaze or fill when used on aluminum or other fibrous metals; and carborundum fire sand, a chemical compound of carbon and silicon which is mixed with a binding material, silicate of soda, of 52° B., which is dissolved in water before being added to the fire sand. The mixture is made plastic and is molded to the interior of a furnace for a lining. It is understood that this lining will withstand very severe conditions.

The Panama Canal and Commerce

By E. M. Lawton

That the opening of the Panama Canal will bring the western coast of the American continent very much to the fore, is acknowledged by all, but the extent to which this great stretch of seaboard and contiguous territory will enter into the business markets of the world involves questions too large to answer, which have, indeed, not been fully appreciated by people in general. Probably the greatest development which can reasonably be expected from this new tide of commerce will be that of the mining industry.

Latin America offers the greatest possibilities, for already California, Oregon, Washington, and Alaska have demonstrated their resources and possible products, and the Pacific ports found in this stretch are destined to be the rivals of the greatest of the Eastern cities. But take a map of the two continents and contemplate the remaining stretch of country, and recall to mind what part the countries there shown have played in the world's history. Where is to be found a land of romance more brilliant and full of stories of pursuit of wealth? Such has been the lure of the stories of all ages surrounding Latin America that even today are abortive attempts by soldiers of fortune in Mexico and Central America to secure by adventure a portion of the wealth of these wonderful places.

Will the Canal separate the two continents? Physically it will, but at the same time will unite them by the stronger ties of commerce. Peru, Ecuador, and the west coast of Mexico will be thousands of miles nearer to New York. There are many persons in our own United States who do not know that Lima and Quito and the whole west coast of South America, lie to the east of the eastern shores of the United States. With the ship canal, vessels will sail south in almost a direct line from New York to Peru, or, if anything, to the east of south. The Panama Canal itself has its Pacific outlet, southeast of the Atlantic inlet. The merchandise destined for Buenos Aires can be transhipped at Valparaiso on the Pacific and still save twenty-five hundred miles of a detour in getting around the capes of Brazil. Much has been said of the probable influence of the Canal on commerce. It is safe to assume that the ten per cent of imports now supplied to South American countries by the United States will be materially increased. The development of the natural resources of the western coast will be so favored that great strides in advance may reasonably be expected.

Unquestionably the first of the countries to be largely influenced by the completion of the Canal will be Mexico. To the great mass of the Mexican people its southwestern coast is an unknown land, a most natural condition, because it is cut off from the east by the same chain of mountains that kept California practically unknown until the railroads conquered the Rockies. Already a coast-line railroad is built from the northern frontier for more than half the total distance to Tehuantepec, with the Pan-American also in operation from the Isthmus to the Guatemala frontier and beyond, while the gaps are rapidly being filled in. This is the result of the work of the latest times because financiers foresee the part this immense stretch of country will play in the new setting of the world's stage, with the Canal as the central figure. This is not the fever-laden coast which rumor would have it, but a veritable garden, whose climatic and agricultural character is but a continuation of the known salubriousness and fertility of southern California. Cane (sugar), cotton, tobacco, corn, pineapples, oranges, melons, onions, and like products are already grown

Position of Panama Canal.

on a mammoth scale; in brief, the combined possibilities of Texas and California are found all along the west coast of Mexico. And as for transportation, aside from the railroads building, Manzanillo has a deep-water harbor just completed at an approximate cost of ₱8,000,000, Salina Cruz, with unexcelled harbor and dock facilities, and with the Mexican Government planning to spend millions of pesos on harbor improvements in Mazatlan, the district shows preparation at every point for the expected increase of commerce which the Canal will bring.

There will also be opened to the world a wealth of minerals. There may come a time, and probably will, when the headwaters of the Amazon will develop the world's greatest placer ground, but in Mexico alone, it is easy to believe that the west slopes of the Sierra Madre will prove a treasure-house far exceeding the well known propheey of Cecil Rhodes.

It is much easier to describe the non-mineralized

sections of Mexico than those producing abundantly. Mining men, with years of experience in other parts of the world, after looking over Mexico, invariably make the statement that they have never seen such an abundance of mineral signs. From Sonora to the Isthmus, there are few districts which do not show evidences of gold, silver, lead, copper, zinc, iron, graphite, and saltpetre, in evidently paying quantities, with smaller amounts of asbestos, mercury, mica, and even rarer metals and precious and semi-precious stones. Beginning at the north and referring only to the western shores, the State of Sonora has already developed mineral resources in such districts as that of Cananea, besides which there are a half dozen well known districts now producing, despite the troubles which have existed until recently with the Yaquis. The State of Sinaloa is next to the south, and minerals are known to exist there, though the records of former times when the Jesuits were the miners, are not to be had, doubtless because they were not anxious for governmental espionage. The geographic position of this State as well as the territory of Tepic adjoining to the south, is such that they must needs wait for some such increased activity as the opening of the Canal will bring. They are wholly to the west of the mountain ranges and dependent entirely on the railroads now building and on ocean traffic, for the solution of the freight question. However, at least eight well defined districts are now developed in this section, waiting for the attention which capital is beginning to give.

The State of Jalisco, having but a small amount of coast line, and the rest well traversed by railroads, has already come into great prominence. There are many millions of foreign capital invested in this State, but the coast part is still undeveloped. In the State of Michoacan, in such districts as Tlalpujahua and Inguaran, the latter being the site of the famous copper mines belonging to the Rothschilds of Paris, there are many good prospects known. The State of Guerrero is perhaps the greatest in its mining possibilities. It is known as 'the land set on edge,' of box canyons and difficulties of transportation almost insurmountable. This is one of the largest States in the Republic, as well as one of the least populous. It is the sort of mineral country commonly known as 'a poor man's country,' although, until today, transportation and distrust of foreigners, in most of the wilder sections, has detracted from the value of the rich finds which hundreds of prospectors have made. The capitol of the State has no communication by railroad with the outside world. It is the centre of seismographic disturbances in the south end of the Republic, and in general the country has the reputation of being wild but rich in minerals and waiting for some general invasion of capital which will pacify the people, solve the transportation problem, and by 'community of interest' bring about the prophesied future.

Oaxaca has been called by President Diaz, the 'Pennsylvania of Mexico,' on account of the undeveloped iron and coal deposits which are found there, and reaching into Guerrero. The iron has been smelted for centuries, but not mined, simply taken off the surface. At one small charcoal furnace on the west coast of Oaxaca, which has been worked from almost pre-historic times, a grade of iron is manufactured which has been pronounced by iron experts to be equal to the best Norway iron, if not its superior. To furnace foundrymen, a visit to this little adobe furnace, turning out about 400 lb. of iron every 24 hours, would alone be worth the trip to Mexico in order to study the primitive methods employed. The State of Chiapas next to the Guatemala border and the peninsula of Lower California, are but little known as to their mineral possibilities, but without doubt these large territories, with a combined area more than half as large as California, entirely dependent on the development of the west coast, will furnish their proportionate quota to the interest which will be found manifested toward the great Canal and its attendant results.

MINING IN HONDURAS.

Mining claims may be taken by any person in Honduras, upon payment of the Government fees, foreigners having the same rights as citizens of that country. The mining laws are much like those of Mexico. Claims are 'denounced', which is equivalent to the American word 'located'. The discoverer goes to the proper Government agent, usually to be found in the nearest good-sized town, states where he wishes to prospect or mine, and at the stated time pays the fees, whatever they may be—never large—and goes to work. A claim may be taken to the extent of 1000 hectares, equivalent to 2470 acres (the maximum). Within six months the tract is surveyed by a Government engineer and the tax paid, which amounts to 50 cents silver per hectare. Of course, a smaller claim may be taken. The principal placer region is in the Department of Olancho, near the centre of the Republic. In that region are large areas of placer ground, cut by good-sized streams, among them the Guayape, Panal, and Jutiape. There are also gold placers south of Olancho and extending into Nicaragua. It is probable that these are on the same mineral belt which runs in a northwest-southeast direction through the Central American Republics. The climate of Honduras, in the Mountain region, is salubrious, even delightful, and one can live there in comfort; but that of the lowlands adjacent to the coast is hot, and malarial fevers are prevalent. Mosquitoes abound and transmit the various contagious diseases to which residents of the tropics are subject. For this reason those from northern climes should get away from the low coastal plains and into the highlands as quickly as possible. The real extent of the mineral resources of Honduras has never been adequately proved, because of the difficulties of transportation, there being but one short railroad, which runs a few miles into the interior from Puerto Cortez, in the northwest corner of the Republic. A gold dredge is at work near San Pedro, near the southern end of this railroad. There are no wagon-roads in the country, with the exception of one from the west coast of Tegucigalpa.

Discussion

Readers of the MINING AND SCIENTIFIC PRESS are invited to use this department for the discussion of technical and other matters pertaining to mining and metallurgy. The Editor welcomes the expression of views contrary to his own, believing that careful criticism is more valuable than casual its probable interest to the readers of this journal.

Weight and Volume of Ore

The Editor:

Sir—In your issue of February 18, in an article by L. S. Austin entitled 'Weight and Volume of Ore,' the writer gives, among other things, an account of a short practical method of determining the weight of ore per cubic foot as found in stopes, using wheat as a medium to give displacement of the ore in question. This method is, briefly, filling a box with ore and wheat and afterward filling the box with the same wheat without the ore, and thus determining the displacement or volume of the ore. It seems that a far better and quicker way would be to first weigh the ore, and have a tank or water-tight box handy with water to a known depth. Place the ore in the water and take a reading on the water after submersion of the ore; data is then available for calculating the volume of the ore. Unless the ore were extremely soluble, it would make no practical difference if the reading of the depth of water were taken quickly. At any rate, if a large quantity of ore were used (400 lb. being mentioned in Mr. Austin's article) it would have no practical effect on the determination if the reading of depth of water were taken immediately after submersion of the ore.

A. L. GERRY.

Hibbing, Michigan, March 8.

Re-location v. Resumption

The Editor:

Sir—In an editorial under the above headline which appeared in the *Mining and Scientific Press* of January 14, I find the following statement:

"The original locator having failed to comply with the law's requirements has forfeited his right and the claim is then open to location by any person willing to comply with the law, *except the original locator.*" (The italics are mine.) That may be true in California under the law of 1909, but to the best of my knowledge it is not true in any other Western mining State. It certainly is not in accordance with the practice in those States. Under the United States mining law, any claim that is forfeited by failure to do the required assessment work reverts to the Government and becomes a portion of the public domain. Under that law any citizen of the United States, of legal age, is competent to locate any vacant mineral lands on the public domain. In that law there is no bar, either expressed or implied, against any citizen. The prospector who has owned a claim and forfeited it has the same rights of re-location that any other citizen possesses. Absurd? Of course it is. And, so far as I am aware, California is the only mining State which has even attempted to wipe out that absurdity—and California has not been successful. The three-year penalty, to be effective, should begin with the date of the forfeiture instead of beginning with the date of the original location. If three or more years should elapse between the date of location and the date of forfeiture, is there anything in the California law to prevent the original owner from relocating his claim at once? The clause which pretends to do so seems to have been inserted merely to make business for the lawyer and trouble for the other fellow.

J. W. BUSH.

Lower Lake, California, February 12.

The Editor:

Sir—It is rather presumptious for one not a lawyer to doubt your exposition of the right to relocate a claim, in your editorial of January 14. There is no limit to the number of times a citizen, or one declaring himself as intending to become such, may locate vacant mining ground, and his own claim again becoming vacant mining ground, what is there in the Federal laws to prevent his again using his right on the same ground he had before? And doesn't the State law imply that he did have the right previous to its passage, and that he may again re-locate after three years? True, it may be the poorest kind of policy to permit this re-location, but an amendment of the Federal laws limiting a locator to some definite number of times he may use his right in any one camp, would seem to be about the surest way to stop this practice.

While writing you, another matter may be noticed. Just how are claim holders going to be compelled to record their proof of labor? The State law says, *shall*, etc., but provides no penalty for a failure to do so. Why not make it optional, as the Montana statutes do? As this question was thoroughly thrashed out in personal conversation with one of the assemblymen responsible for the passage of the bill, the point is mentioned more with a desire to call attention to the matter than for personal information. There is one matter that seems to be overlooked by most claim holders, particularly in California. A good share of the foothill country has been surveyed for many years, and much of it returned as 'barren and worthless,' 'bushy,' 'thinly timbered,' etc. Until there is an application for patent, the Land Office has no official knowledge that there is a mineral location. If now some one comes along and uses any one of the numerous filings other than mineral, after a short time of advertising, the title may pass to the later applicant, though the ground may in fact be mineral-bearing, providing the mineral claim holders do not see the advertisement and file a protest. A remedy for this would seem to be to have location notices made in duplicate, both sent to the county or district recorder, one to be returned to the locator, the other sent to the local Land Office to be there placed on file as an official record.

E. L. BALLOU.

Igo, California, February 25.

Concentrates

Most of these are in reply to questions received by mail. Our readers are invited to ask questions and give information dealing with the practice of mining, milling, and smelting.

Heat has a tendency to demagnetize magnets, and a red heat will remove the magnetism completely.

Muntz metal is an alloy consisting of 3 parts of copper and 2 parts of zinc. Brass, as commonly made, contains 2 parts of copper to 1 of zinc.

Silver that contains lead that is to be treated by amalgamation should first be concentrated as thoroughly as possible to remove the lead, for the latter in any form is detrimental to amalgamation.

California oil is frequently used for fuel in generating oil. The duty usually is figured at 140 kilowatt hours per barrel of oil. At the Redondo plant, 250 kw. hr. per barrel was obtained, which earned a substantial bonus for the builders.

Electric power has been sold in California as low as 70 cents per hundred kilowatt hours. The cost of electric power is peculiarly subject to the influence of quantity, and prices necessarily and properly vary widely with the amount contracted to one user.

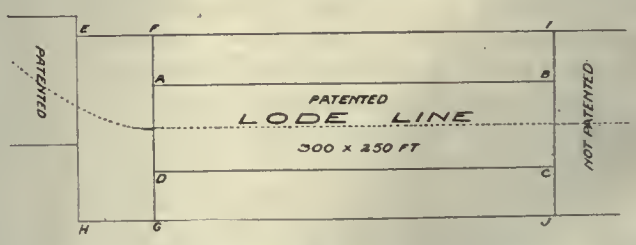
Sand when wet occupies about 10% more space than when dry, while broken rock does not change materially in volume when wet. Portland cement, when loose, occupies from 20 to 30% more space than when packed in barrels. A barrel weighs 376 to 380 lb. net, or 400 lb. gross, and occupies from 3 to 3.65 cu. ft. Four bags of portland cement go to a barrel, while natural cement takes 3 bags to a barrel. An average sand averages about 40% voids, while broken stone between the sizes of 1½ to 2½ in. contains about 54% voids.

Mantles for incandescent gas-lamps may be prepared as follows: Make a knitted or woven tube of cotton and soak in the following solution: lanthanum oxide, 30 parts; yttrium oxide, 20 parts; burnt magnesia, 50 parts; acetic acid, 50 parts; distilled water, 100 parts. To this solution 150 parts of water is added. When the mantle is first used the vegetable fibre burns off, leaving a skeleton of ash and salts. This will not stand rough handling or jarring. Another salt much used in the making of such mantles is thoria. The principal source of the oxides of thorium, cerium, and lanthanum is the mineral monazite. Monazite is chiefly obtained from Brazil, but about $150,000 worth of it was obtained from deposits in North and South Carolina in 1909.

Foaming in cyanide solutions is due to a variety of causes. In new mills particularly, oil may get into the alkaline solutions and form soap. High alkalinity, even in the absence of oil, is a common cause of foaming. Formation of calcium sulphate in the solutions is also given as a disturbing cause, and in certain instances the presence of copper and of lime compounds in the form of a fine powder seems to develop foaming. Probably the most common cause is the formation in the solutions of gelatinous hydrates, alumina being especially troublesome. The remedies to be applied are: (1) be sure no oil gets into the solutions; (2) reduce the alkalinity as much as possible; (3) clarify the solutions by use of a separate press. It must be confessed, however, that the whole matter is but imperfectly understood, and each case demands a special study.

Sulphuric acid was formerly manufactured by the chamber process. The acid so made was dilute, and where concentrated acid was desired it was necessary to evaporate. This was difficult, as the acid would attack ordinary metal, evaporating-pans of glass or porcelain were likely to break, and if made of platinum or gold were much too expensive. Recently the contact process has been devised whereby SO_2 and air are made to pass over heated platinized asbestos; the SO_3 thus formed is caused to unite with any desired quantity of water, and so acid of any desired strength can be made. A further advantage of the contact process is that it can be installed on a comparatively small scale; a single unit for burning 8000 lb. of pyrite per day, yielding 8000 lb. of H_2SO_4 may be erected for about $40,000. One of the most important points in the manufacture of H_2SO_4 is to be certain that the pyrite used is free from arsenic and other volatile metals.

Where a lode location *E H J I* is made so as to embrace a narrower patented lode location *A B C D*, which patented claim includes within its surface boundaries the apex of the lode for the entire length of the patented claim, and thus leaving on either side of the patented claim two long, narrow strips of ground, *A B I F* and *C D G J*, without any apex of any vein in either of these strips, it is extremely doubtful whether these strips can lawfully be held as a part of the larger junior location. As



a rule, a lode location should be predicated on a lode, and surface ground extending beyond the lode, where it is apparent that nothing but non-mineral surface ground is sought to be obtained, will hardly be recognized as a valid appropriation of such surface territory within the intent of the statute. Of course, junior locators are permitted to extend the lines of their locations over on patented senior claims in order to parallel end-lines and secure more complete extralateral rights, but this privilege has never been extended to a case where the junior locator's intention is palpably only to secure additional surface territory beyond the linear extent of free apex existing within the junior claim. Without doubt, the junior location would be valid as far as the parallelogram *E F G H* is concerned.

EL ORO MINING & RAILWAY COMPANY

The report of this company for March shows that the mill ran for 29 days and crushed 28,910 tons of ore, yielding bullion worth $207,410, at a total working cost of $129,050 ($19,850 being developed), with a resulting profit of $78,360. The railway yielded a further profit of $9000.

TIN PRODUCTION, STRAITS SETTLEMENT

The world's production of tin for 1910 was about 100,000 tons, and the average price was £155 5s. 3d., approximately $753 per ton. The mines of the Federated Malay States of the Malay Peninsula are the chief source of supply. *In Tinland*, a weekly journal, published at Kuala Lumpur, gives the following figures showing the output of tin for eleven months of 1910 of the several States: Perak, 387,931 piculs; Selangor, 218,922; N. Sembilan, 32,105; Pahang, 37,030; making a total of 675,989 piculs, equivalent to 44,953 tons. This represents the products of about forty mines. The smelting works at which the ore is treated are situated at Singapore and Penang, and these are in control of Europeans. The United States consumes over 35% of the world's output of metallic tin.

THE LENA GOLD INDUSTRIAL COMPANY

The report of the Lena Gold Industrial Co. for the fiscal year ended October 14, 1910, as published in the *Irkutsk Daily Sibir* of February 15, 1911, gives the following interesting facts: The property includes 43 placers of an average area of 250 acres each. The record of operations shows the handling of 0.38 cu. yd. of gravel per man per shift, the working of 1,884,710 shifts, and an aggregate of 724,573 cu. yd. of gravel washed during the year. The recovery of gold resulting from the company's own work amounted to 765.6 poods, equivalent to 403,195.6 base ounces troy; there was recovered by tributers, 18.4 poods, or 9690.2 base ounces; gold purchased, for the most part paid for in trade, 33 poods, or 17,379.1 base ounces, making a total of gold delivered to the Government assay officer at Irkutsk of 817 poods, or 430,264.9 base ounces troy. While the average value of the gold is not given, it is commonly reported at $17.75 per ounce, or $9360 per pood. Taking this average as a basis, the season's output of gold, including the small amount purchased, amounted to $7,637,200; and the average tenor recovered from 724,573 cu. yd. of material mined and sluiced was $9.87 per cubic yard. The cost per cubic yard is not given, but it has been sufficiently commented on in the reports of the Lena Goldfields Ltd., which holds the bulk of the shares. The low duty per man, less than $^2/_5$ of a cubic yard per shift, goes far toward accounting for the excessive cost known to have been incurred. The mines are situated near Chita, East Siberia.

TRANSVAAL MINERAL PRODUCTION

The total mineral output of the Transvaal for the month of January is returned by the Mines Department as of the value of £2,892,217, an increase of £17,986, as compared with the previous month. This total does not include diamonds, otherwise the total value of the mineral output would just about reach three millions sterling in value. Gold, of course, accounts for the largest portions of the output, which was valued at £2,753,543, of which no less than £2,647,808 was contributed by the Rand alone. The value of the diamond output may be estimated at £110,000. Despite the growing use of electricity at the gold mines on the Rand the tonnage of coal sold by the Transvaal collieries increased to 339,162 tons, but the average price realized at the collieries was only 4s. 10d. per ton, as against 4s. 11d. per ton in the month of December. Perhaps February may see a further decline in the average selling price of coal, as several low-priced contracts started upon that date. The total labor employed in the mining industry of the Transvaal was 27,190 Europeans and 215,867 negroes in December, but in January it had increased to 27,382 Europeans and 220,365 negroes. There were 105 fatal accidents in January, 15 Europeans and 90 negroes, as compared with 78 in the month of December.

The gold output of the Transvaal for February has been declared at 610,828 oz. of fine gold, in value £2,594,634. In comparison with the previous month the decrease amounts to 30,119 oz. or £170,752. The output of the Witwatersrand was worth £2,488,589, and that of the outlying districts £106,045. The stamps at work numbered 9627 and the tube-mills 201. On the Witwatersrand 9080 stamps were in operation. The February return is really better in point of production and profit than were the results obtained in January, if the statistics for both months are analyzed on the daily basis. On this basis there should be a shortage of £257,259 in the Rand production alone, whereas in reality it is less than £170,000. The profit should be £81,627 less, whereas actually there is only a decrease of £51,859. The following were the principal producers on the Witwatersrand:

	Stamps at work.	Tube-mills at work.	Output.
East Rand Proprietary	820	25	£228,103
Crown Mines	620	19	202,120
Randfontein S.	400	11	125,168
Robinson	250	6	111,639
Geldenhuis Deep	420	7	89,317
Simmer & Jack	320	6	86,237

INSPIRATION COPPER COMPANY

The report of Henry Krumb, consulting engineer for the Inspiration Copper Co., dated February 20, has recently been made public. Mr. Krumb describes the ore as occurring in small seams and veinlets, and also as minute grains of copper minerals, disseminated throughout a gangue consisting generally of silicified schist, but also, occasionally of granite porphyry. It was formed by secondary enrichment, through leaching and re-deposition at a lower horizon, of the primary copper contents of the mineral belt. The leached capping averages 367 ft. in depth. It lies above the enriched sulphide zone which forms the commercial orebody and which averages 155.5 ft. in thickness. This orebody has been developed by drill-holes and underground workings for a length of 3400 ft. and a maximum width of 1400 ft. As in previous reports, the ore reserves have been divided into two classes, namely 'developed' and 'partly developed.' Ore is considered as developed when bounded by either drill-holes or underground workings not in excess of 200 ft. apart. In blocks with drill-holes more than 200 ft. apart the ore has been classed as partly developed; but no ore has been allowed where the drill-holes were more than 400 ft. apart, nor has any ore been allowed beyond the lines connecting either drill-holes or underground workings. Values have been calculated for each block by averaging all samples taken within the block in proportion to the length of drift or drill-hole represented by the samples. On February 15, 1911, he estimated that there were developed 17,173,000 tons of ore, assaying 2.02% copper, and 4,029,000 tons of ore assaying 1.90% copper, making a total of 21,202,000 tons, averaging 2% copper. The above ore is all developed on 39.8 acres out of a total of 581 acres owned by the company. The number of tons of ore per acre, developed and partly developed, is 543,000 tons. To date 81 holes, with a total footage of 45,433 ft., have been drilled, and underground development work aggregating 27,526 ft. has been done. A small experimental mill has been erected, in which tests are being conducted to determine the method of concentration which will give the best results on ore, and also the kind of machines to be selected for the purpose. Tests so far conducted have given satisfactory results, and when they are completed the design of a mill to treat 5000 tons of ore per day will be commenced. To this W. B. Thompson, president, adds that a telegram from the manager, T. R. Drummond, states that on March 1 the ore reserves had been increased to 18,738,000 tons of developed, and 3,490,000 tons of partly developed ore.

Special Correspondence

BUTTE, MONTANA

Mr. Thayer's Report. — Reconstruction at Great Falls. — Centrifugal Separator.—Excellent Conditions of Mines.—Retimbering Mines. —High Ore Mine.—Probable Increase of Output.

Benjamin B. Thayer, president of the Anaconda Copper Mining Co., has completed his inspection of the properties of the company and returned to New York. Previous to his departure he stated that he had found all mines and smelters in fine condition. In regard to the numerous reports touching extensive improvements to the smelters at Anaconda and Great Falls, Mr. Thayer says that they are without foundation. No new work was being done at the Great Falls plant, and none was in contemplation. A short time ago Hancock jigs were tested and they had been found so satisfactory that they have been substituted for the others in use. The Hancock jigs have greatly increased the capacity of the concentrator.

Some reports sent out in the past few weeks would make it appear that the Washoe smelter at Anaconda was going to undergo very extensive improvements and that it would be necessary to close down the plant for a time. Mr. Thayer said that nothing of the kind is under consideration. "We are always carrying on certain tests in an effort to improve methods, but there is no reason whatever why the smelter should be closed down in consequence or any further curtailment made in the output." Mr. Thayer added that the tests being conducted at present had to do with improved methods of concentration. A new system of centrifugal concentration is being tested and may lead to a revolution of ore concentration. A machine with a capacity of 250 tons of material per day has been made and is soon to be shipped from New York to the Washoe smelter. It is expected that within 90 days it will be demonstrated whether the new system is a success. On test runs in the East the machine is said to have worked perfectly. The method of concentration by this machine is to throw the material out from the centre, separating the different particles and casting the heavy ones farther off. The system is entirely new, and has not been tested elsewhere.

In talking about this new machine, Mr. Thayer said that this was only one of many things the Anaconda company was constantly testing and experimenting with in order to keep ahead of the times and avail itself of the best machinery and methods. He said that another important test that is being carried on now at the Washoe is in sizing ores. Asked about the condition of the mines, Mr. Thayer replied that they never looked so good as at the present time. "The most gratifying thing to me," he said, "is the condition of the Anaconda mines at depth. Every new level that is being opened seems to be better than the one above." He added that the company intends to maintain the present output until there is a general improvement in business conditions. "Improvements tending toward reduction in costs are being made in all departments and it is only a question of a month or more until a number of the large hoists on the hill will be operated by compressed air generated by electricity at the new power plant at the High Ore mine. I do not think that there has ever been a year in the history of the company's mines when as much ore has been developed and the ore was of such an excellent grade."

Mr. Thayer said that in his opinion business conditions would improve when the Supreme Court decisions were all disposed of and the Canadian reciprocity question settled. He said that just as soon as conditions warranted it the Butte mines could nearly double the present output. During the curtailment period advantage has been taken to do a lot of re-timbering and other work. The work of re-timbering the St. Lawrence shaft is about completed and operations will be resumed in part just as soon as the work is completed. The re-timbering of the Anaconda mine will take several months more. In the mines formerly owned by the Boston & Montana company, the Butte & Boston, the Washoe, and Butte Coalition, conditions are better than they have been for some years, and the ordinary amount of development work is being kept up. He said that in the High Ore mine where the fire made its appearance some time ago, there was not a sign of gas and all appearance of the fire had disappeared, but for the purpose of making sure that all danger was passed, the mine would not be operated for some time yet.

CORDOVA, ALASKA

Opening of Copper River & N. W. R.R. — First Shipment of Copper Ore.—Lower Freight Rates.—Chicken Creek. —Opening of Nome Route.—Heavy Rush of Prospectors.

Saturday, April 8, 1911, was 'Copper Day' at Cordova. Early in the morning, to the accompaniment of every bell and steam whistle within a mile of Cordova, the first freight train on the Copper River & Northwestern railway loaded with 1100 tons of high-grade copper ore from the Bonanza mine, pulled through town. The Chambers of Commerce of Seattle and Tacoma were prepared to receive the shipment on Friday morning, April 14, with an appropriate celebration commemorative of the opening of Alaska's first through trunk line and the initial shipment of this remarkably rich copper ore from the interior.

The Copper River & Northwestern railway has now been turned over to the company by the contractors, and regular train service has been inaugurated between Cordova, the seaport, and Kennicott, 197 miles into the interior. Coincident with the opening of the railway, its officials have voluntarily reduced the rates on ore and concentrate from all points on the railroad to the smelter at Tacoma. In line with the plan adopted by Western railroads, this new tariff is based upon the value of the ore, so that the smaller shipper, the owner of low-grade ores, and the prospector who is trying to develop the country, gets the advantage of the lowest rates. The rates run from $5.75 per ton on the lowest grade ore to $33.70 per ton on ore which shows high value. The announcement being publicly made on the day of the opening of the railroad, created most favorable comment, as it indicates the determined effort of the railroad company to develop the interior of Alaska, in giving to the small shipper every opportunity and advantage in prospecting and developing. It is also acting as an incentive to prospectors to go into the country. The rates quoted include railroad transportation to Cordova, wharfage and handling at Cordova, and steamship transportation to the Tacoma smelter.

Word has just been received of a disastrous fire which destroyed a large portion of the business district of Iditarod on Sunday, April 9. The loss has been estimated at $75,000. This place is the centre of activity for the Iditarod district, which promises to be one of the good producers during the year. Chicken creek, in the Iditarod district, is coming to the front and prospecting carried on throughout the winter has demonstrated it to be as rich as the famous Flat creek. Several finds are reported from this district.

The competing steamship lines have announced the opening of the Nome route, commencing June 4, and continuing through the summer. This will be the signal for one of the heaviest movements to the Northland known since the early days of Nome, owing to the remarkably rich discoveries made last year at Squirrel River, Kuskokwim, Iditarod, and other points which are reached from the Nome route. As usual, the stampeders have been rushing into the country weeks ahead of time, and as a result Valdez, Seward, and Cordova have been filled with men for the last month. They have gained nothing at all by rushing into the country so early, as it has been impossible to leave the towns owing to the fact that the country has been covered with snow. But now, and until well into June, is the time to leave for the North. The service is regularly maintained to southeastern and southwestern Alaska, while the route to Nome, Kuskokwim, and Iditarod will not be opened until June.

TORONTO, CANADA

Decline of Porcupine Boom. — Hollinger Milling Plans. — Progress Notes of the District.—Diamonds at Tulameen.—Temiskaming & Northern Railway.—Keekeek Goldfield.

The Porcupine boom on the stock market is experiencing a decided reaction, Hollinger, the leading stock, having dropped, accompanied by a depression of the whole list of lower-priced issues. Investment in these has been mainly speculative, as is clearly shown by the rush to take profits whenever an advance of a few points is made. In view of this tendency it is hardly likely that any very decided or permanent upward movement will occur, at least until a dividend-paying era sets in and convinces the public that some of the mines have a substantial basis. Despite the professions of the Government of its anxiety to protect the public from the snares of the wild-cat promoter, it does not seem to be anybody's business to enforce the stringent legislation relative to advertising and prospectuses, which is little regarded in some of the announcements now being made.

The Hollinger has modified its plans for milling ore. It is said that the 30-stamp custom mill, to be controlled by the Timmins-McMartin-Dunlap syndicate, is to be supplemented by a cyanide plant supplied by the Merrill Metallurgical Co. of San Francisco. Tube-mills probably will be introduced to supplement the work of the stamps, but exact details have not yet been settled. A diamond-drill is being installed to test the orebody in depth. On the Standard a boiler and hoist have been installed, and two shafts are down over 40 ft. A rich find of free gold has been made at the bottom of one shaft. The Foley-O'Brien mine, in which high-grade ore was recently struck at 68 ft., and driving has been carried on with good results, has passed into the hands of a newly organized company known as the Foley-O'Brien. Operations are in charge of Mowry Bates, an experienced mining man. A vein recently struck on the Crown Chartered in the drift at the 50-ft. level, has proved to be 3 ft. in width and carries an average of $32 per ton. At the Vipond a 30-hp. boiler has been put in to operate a 2-drill compressor plant. One shaft is down 100 ft. with a crosscut 46 ft. to the vein, which is yielding good ore. The Callinan claim, adjoining the West Dome, has been sold to American capitalists for a figure stated at $225,000. The two Shillington-Richardson claims, north of the Armstrong-McGibbon holdings at the east end of Pearl lake, have been taken over by the Porcupine Gold Trust for $150,000, and a force of 20 men has been put to work on the property. A syndicate, headed by S. R. Clark, has secured the properties of the Success Gold Mines, consisting of four Tisdale claims, adjoining a portion of the Bewick-Moreing holding on the north. The new company will be capitalized at $2,000,000.

The mining industry of Cobalt is still languishing on account of the shortage of power, and shipments have greatly decreased, those for March being only 1819 tons as compared with 2516 tons for last March. The Right of Way, as was generally anticipated, has passed its dividend. The list of dividend-payers has been increased by the addition of the Beaver, which has declared an interim dividend of 2½%. The Beaver has good ore on the 200, 250, and 300-ft. levels. The new vein on the 300-ft. level is 8 in. wide and carries 2900 oz. per ton. The Eric Cobalt Co. which has liabilities of $33,000, is being wound up. The Nova Scotia's statement of profit and loss as of October 31 shows a deficit of $64,268 for the year and a total deficit of $235,-064. Later operations have been more profitable, shipments of bullion up to March 1 yielding a net profit of about $38,000. The Wettlaufer of South Lorrain has been transferred to the Mines Finance Co. of America. The Ophir Cobalt has struck rich ore on the 100-ft. level.

The news of the finding of diamonds in the Tulameen district, British Columbia, has awakened considerable interest, and the Canadian Geological Survey has received numerous enquiries concerning it. Some prospectors have gone to the district, though Charles Camsell of the Survey states that it will be impossible to stake claims for some time on account of the depth of snow. He will re-visit the area during the summer and make further investigations.

The Ontario Government declines at present to extend the Temiskaming & Northern railway to Gowganda. They will, however, grant a charter to any private corporation that is prepared to undertake the enterprise. There is a rush of prospectors to a new goldfield, known as Keekeek, situated in Quebec province some 60 miles northeast of Haileybury, where some 6000 claims have been recorded. The area is about 20 miles wide, extending from Lake Opasatika to Lake Missinable. The Quebec mining regulations are very favorable to prospectors.

JOHANNESBURG, TRANSVAAL

Enforcement of Mining Regulations.—Round v. Rectangular Shafts.—Natal Coal Mines.—Arbuckle Process. — Decrease in Grade. — Klerksdorp Strike.

A question of some importance to mine managers on the Rand is dealt with in the Government Mining Engineer's annual report, namely, that of making the manager directly responsible for carrying out the mining regulations instead of as in the past leaving that duty entirely in the hands of the mines inspectors. There are few mining fields in the world where such an excellent set of mining regulations exists as that in the Transvaal, but probably there is no other mining field in the world where they are broken with so much impunity, especially on the part of the employed. The regulations with regard to

Map of South Africa.

the laying of dust so as to reduce the risk of miners' phthisis to a minimum are generally disregarded by the men for whose benefit they are drawn up, and when the workmen will not take the necessary steps for the preservation of their health it is easy to understand that those regulations framed for the prevention of accidents and the men's personal safety are broken to a much larger extent. The explanation is that hitherto the mine officials have not been held responsible for the due observance of regulations in and about the mines, but that duty has devolved upon the inspector, who manifestly cannot be always in the mine, and whose occasional presence is announced all over the mine within a short time after his arrival. It would clearly require an army of inspectors to enforce the regulations under these circumstances, and the wonder is that the mine manager was not called upon to see that the regulations were properly enforced when they were first brought into use many years ago. In England a mine manager finds it necessary to prosecute all offenders against the regulations, and to send in a report of every such prosecution to the mines inspector for his own protection.

The old controversy regarding the best shape of shafts suited to the requirements of the Rand has been revived by the sinking of a circular shaft at the New Modderfon-

tein mines. With the exception of a few circular shafts, put down by Laurie Hamilton many years ago, all the shafts at the gold mines are rectangular in shape, but at the present time, when shafts are being sunk through the dolomite formation, carrying large feeders of water, the advisability of sinking them circular in shape is being seriously considered, as that shape admits of the water being shut out by iron or steel segments and pumping is thus lessened. At the Western Rand Estates beyond Randfontein, circular shafts are being sunk through the dolomite, and the water shut out permanently; this being the first instance where work of this kind has been taken in hand at the gold mines on the Rand. Had circular shafts been sunk at Grootvlei the shafts would never have been stopped through inability to deal with the water, and the Springs mines, had they adopted circular shafts, would also have made better progress where it is announced they have only just succeeded in passing through the dolomite. Probably at the New Modderfontein mine the same reasons for using a circular shaft do not apply, but the consulting engineer, having been trained at collieries in South Wales where circular shafts prevail, it is easy to understand why preference should be given to that cross-section. The Witwatersrand goldfields, as the mines increase in depth, are more approaching coal-mining conditions than metalliferous mines in other parts of the world. The need for good ventilation in the deep mines of the Rand is also becoming as well recognized as in a coal mine. The greater area of a circular shaft as compared with a similar rectangular shaft would also conduce to less interference with the air currents and make for better ventilation all around. The best shape of shafts to adopt must naturally depend upon the conditions, and on the Rand no hard and fast rule can be laid down, as circumstances may exist making either circular or rectangular shafts almost imperative.

The prospects of the Natal coal trade are causing some uneasiness to shareholders as owing to increasing competition, shortage of railway stock, loss of Cape railways locomotive contract, and the stoppage by the Indian Government of further recruiting of laborers for the Union of South Africa, there seems to be quite a crop of troubles ahead. Last year's output of coal in Natal was 2,296,447 tons as compared with 1,786,568 tons in 1909; a record output, but it seems doubtful at present whether this year's will be as satisfactory. The first month of the year has resulted in an output of 191,661 tons, of which 100,024 tons was disposed of for bunkering purposes and 31,055 tons was exported, but, seeing that the railway has refused to lower the railway rate on carriage of export coal, the question of bidding for the contract on the Indian railways has been considered and found impracticable. There will therefore be nothing to make up for the loss of the Cape railway contract; one colliery has already closed down, and it is not at all unlikely that before the year is out others may feel compelled to take a similar step.

At the East Rand Proprietary Mines, after somewhat lengthened tests, it has been decided to abandon the Arbuckle process of treatment of sand and slime; it is said that a Butters vacuum system may be installed. At Benoni the Arbuckle method of treatment, with some slight modifications, is being adopted and the results will be awaited with some interest.

Despite all that has been said lately about keeping up the grade on the Rand, the average recovery, according to the Chamber of Mines returns for the month of January, was 28s. per ton as compared with 28s. 1d. for the previous month. The decline is not much, but it follows a continued decline for many months and accompanies a rise in the working costs of from 17s. 9d. in December to 17s. 11d. in January, so that altogether the profits per ton are about three pence less. For the month of January the tonnage milled was 1,855,232 tons as against 1,827,423 tons in December, so that the lessened profits per ton were not due to a smaller tonnage being handled. Moreover, in spite of the increased tonnage treated, the working profit for January was only £954,536, being £22,406 less than during December when a smaller tonnage was treated. There can be no doubt that this continued fall in grade is due to the exhaustion of some of the richer rock near the outcrop and the milling of increased quantities of deep-level ore of lower grade than formerly. Taken in view of other indications, it raises a very interesting question regarding the future of some of the deep-level mines, particularly where they are of unusually low grade. One of these, the Simmer & Jack East, is said to be looking better in its lower levels and it is to be hoped that a corresponding change for the better will soon be seen among its neighbors.

The rich Cyferfontein bore-hole strike of 39 dwt. over twelve inches has been confirmed in another bore-hole about three miles farther to the southeast, the reef having been struck by the drill after passing through troublesome ground. The core looks well and should the results turn out anything like those in the first hole, Klerksdorp should do well again, while the possibilities of that section of the Rand beyond Randfontein so long dead will re-command attention.

DOUGLAS, ARIZONA

Electric Transmission Line From Douglas to El Tigre. — Information Concerning the El Tigre Mine.—Notes on Cochise County Properties.

The transmission line which will carry electricity generated at the Copper Queen smelter power-plant at Douglas, Arizona, to the Lucky Tiger Gold Mining Co.'s camp at El Tigre, Sonora, will be completed and ready for operation by April 15, and for the first time in the history of the border electricity generated on the American side of the international line will be used in the operation of machinery at a Mexican mining camp. The power will be used to operate the stamp-mill, new cyanide plant, and hoisting machinery at the El Tigre mine and to light the camp. The route of the transmission line is from the smelter over the international line to a point a little south of Frontera, 55 kilometres south of Douglas; thence over the mountains to the El Tigre stage line, with which it connects at a point six miles east of Yzabal, the El Tigre shipping station on the Nacozari railroad; thence along the stage road to the camp, a total distance of 65 miles. A telephone line has been strung on the poles carrying the heavier transmission wires. The latter are of No. 4 copper, single circuit, three-phase, 60-cycle, carrying 45,000 volts. The poles are of Texas pine, treated by the Burnettized system, with creosoted butts. This treatment not only preserves the wood against the elements, but also saves it from the borings of woodpeckers and other fowls that are pleased to make nests in the poles.

To supply the power for the El Tigre camp the Copper Queen smelter has installed two new 750-kw., General Electric, low-pressure turbine generators, generating at 2200 volts. These have been placed in the west end of the big power plant, and will transmit the equivalent of about 900 horse-power. A concession was granted by the Mexican Government for the route of the transmission line, and also for the passage of the electric power from the American side to Mexico. The power will be used for all purposes at the El Tigre camp. The Lucky Tiger mine has become one of the most notable silver mines in the world. Just why it lay so long undenounced while at the same time so close to the American boundary is one of the mysteries of Sonora. For years the Indians and Mexicans had spoken of a wonderful lode of silver ore rising from the mountain tops to the south of where Douglas is situated. Many prospectors searched for this vein, and finally, when the Cinco de Mayo mine was discovered, only six miles north of the El Tigre, it was thought that the bonanza long heralded had been found. When A. J. King, in partnership with the owner of the Cinco de Mayo, Francisco Garcia, took from the Cinco de Mayo $680,000 worth of silver ore in fourteen months this impression grew to conviction. Then came James Taylor and his dog Tige of Douglas. The dog is given credit for discovering the mine, at least to the extent that it was named The Lucky Tiger. Follow-

ing big development and the shipment of high-grade ore and concentrate valued at millions, out of which the company has paid to date over $1,000,000 gold in dividends, the company decided upon an increase of production. While working the high-grade gold and silver ores enough low-grade ore, averaging $30 per ton, had been uncovered to run the new cyanide plant for five years. The cyanide plant will have a capacity of 250 tons per day. The Pachuca tank system formed a part of the improvements. Instead of zinc shavings the Merrill system of zinc-dust precipitation will be used, with the Kelly filtration presses. The stamp-mill capacity will be doubled, and the heaviest stamps made have been installed, together with rolls. Engineers who have recently examined the El Tigre property declare that the mine has blocked out and partly stoped the largest tonnage of low-grade silver and gold ore ever uncovered in any silver mine. The main El Tigre vein has been developed for many thousands of feet, and the company has also opened up much high-grade ore on what is termed the Sooy and the Seitz veins. The Lucky Tiger Mining Co. is owned by Kansas City capitalists, who purchased the property for $350,000. The capital stock is now $8,000,000, and the report for 1910 showed that the mine had produced $927,000 worth of gold and silver. J. W. Malcolmson, as consulting engineer, has charge of the property.

The Arizona United has a Standard drilling rig, capable of reaching 1000-ft. depth. E. W. Walters is manager of the property, J. M. Libbey superintendent. They are making 20 to 30 ft. per day, which is good work in the hard dolomite. The sludge does not yet show many signs of copper, but this was not expected at less than 300 ft. The work is being done at the lowest point on the property, and below where a large amount of surface ore was taken out during the time the smelter was operating; thus making it possible to cut with the drill the contact in which the ore was found at a depth of about 300 ft. There is here a 400-ft. incline, from which a large tonnage of ore was taken, but which is now filled with water. A good body of sulphide ore was found in this incline, and it is believed a larger body of sulphide occurs at greater depth, and to open it would supply the character of ore required to operate the smelter. There are on this property a number of houses for workmen, office buildings, and a fine hoisting plant. The smelter is about a quarter of a mile from the railroad tracks, but a spur will be put in if the plant is again operated. The Keystone property, 1½ miles from the Arizona United, is owned in Wichita, Kansas. Some work is being done, and the vertical shaft has cut several good veins, one of which was partly explored last summer. There is also on this property a deposit of iron ore, suitable for flux. The Copper Chief properties, now idle, are operated by a vertical shaft, in dolomite, 300 ft. in depth. Last fall several shipments of ore were made, but these did not prove satisfactory, as the ore contained a good deal of zinc, which was shipped under a misapprehension. There has been some good work done on these properties, and considerable ore has been shipped from time to time, mostly high grade. Dissension in the company has hindered operations, but now that a partial reorganization has been effected, matters may improve. The properties lie on the great contact running through the camp, and orebodies of sufficient size and value to be profitable should be discovered. The Black Prince has been worked during the last four years, with R. N. Bell, of Denver, as manager. There is a vertical shaft 935 ft. deep, reaching water-level. This shaft passes through successive strata of limestone, but from the 850-ft. level the material is bluish and shows copper. Several good veins were crossed by the shaft. A Temple-Ingersoll machine drill is in use, and there is a generator for lighting the premises. This is the only deep work in the camp, and the fact that it goes a little below water-level is of great importance. Now the veins crossed may be explored with probability of good results, and sufficient water for all purposes is at hand. The work now in progress consists of exploring the vein on the 650-ft. level, and to some extent the one at 900 feet.

NEW YORK

American Electrochemical Society Meeting. — Hard Times in Wall Street.—Dullness of Porcupine.—Copper Situation Unchanged.—Debut of Miami in Exchange. — Elimination of Heinze. — Goldfield Consolidated.—Nevada-Utah Merger.

The American Electrochemical Society met here this week. On Thursday the Society visited the Laurel Hill works of the Nichols Copper Co. and on Saturday the Perth Amboy plant of the A. S. & R. Co. The meeting was full of interest, and a large membership, including those most prominent in this field, were in attendance. A number of papers were read dealing with the electric furnace and its application to commercial work, and the paper by J. C. Clancy on his new cyanide process was brought up for further discussion. The meeting as a whole was productive of great interest.

This is one of the hardest seasons Wall Street has ever endured. It is not so much the fact that there is no business doing, as it is that Wall Street as a whole is just like a factory owner with a big plant. Operation under present conditions means a desperate loss; to close down is impossible. There has been no comment made upon the men thrown out of employment or the branch offices discontinued, but many men of long employment in the Street are being forced to seek new fields, and the retrenchment all along the line has been drastic and is becoming even more so.

The market in the mining issues has had its centre of interest in the Porcupine stocks, though this week the trading has been strictly pre-holiday in character. . The new Canadian shares have elicited a great deal of public interest, but the handling of the market has not been above criticism. In nearly every case the offerings have suffered sharp recessions from the subscription prices, with the result that traders have felt safe in taking the bear side. The attitude for the present seems to be a waiting one, and Porcupine will evidently have to show cause in full measure before its boom can be launched. The argument heard on all sides is that foreign capital, Englishmen proverbially 'cold-nosed' are going in; this is important to the property owners, the fact remains that the share market in New York has had a decided reaction and will undoubtedly have further recessions in the absence of good news from the camp.

The copper situation remains bad. The increase as shown by the figures of the Producers Association for last month practically put an end to all talk of curtailment policy, and while no producer would be radical enough to admit that he would like to see a further lowering of prices such as would eliminate a large part of the high-cost copper produced by those who can make no money at present market, but who are working rather than face the cost entailed by closing down, yet it is undoubtedly true that such action would clear the atmosphere. There is no question that there is a great deal of copper coming to the market now that shows little or no margin of profit; to revert to the doctrine of the survival of the fittest would be primitive but radical and effective.

It has always been a matter of comment that the New York Stock Exchange never made any particular effort to cut into the business of the Boston Stock Exchange, but allowed the latter to monopolize so largely the trading in high-class copper stocks. Evidently, the acute conditions prevailing are to bring about a change in this regard. This week Miami Copper joined the small but growing group of copper-mining issues on the 'big board'. The statement made by the Miami, in application for trading privileges, shows 663,938 shares issued of a total of $800,000 (par value $5) authorized; 1122 acres of land owned, of which 58 are prospected and developed. Ore reserves are given as 18,000,000 tons of an average copper content of 2.58%. Equipment consists of hoisting plant of 6000 tons daily capacity with crusher plant and conveyor system of same capacity, concentrator of six units with a total rated capacity of 2000 tons. Cash on hand is $351,059. Of the bond issue put out by the company some months ago, there is now out-

standing $1,433,000. It is said that the Consolidated Arizona Mining & Smelting Co., which controls the old smelter at Humboldt, Arizona, in addition to having rebuilt that plant is to erect a custom smelter near Tucson, for the purpose of taking care of the ores from the smaller properties which need a custom plant. F. Augustus Heinze is said to contemplate complete retirement from the field of copper mining. To be sure, there is a hint that such retirement is not wholly voluntary. Mr. Heinze has relinquished control of the Davis Daly to the New England interests, and the contemplated rejuvenation of Ohio Copper is dependent upon the elimination of Heinze.

The Eastern market in Goldfield Consolidated has been something of a disappointment during the current year. There is no sign of decrease in the dividend, the showing in earnings is as strong as it has been at any time since the quarterly disbursement of 50c. was begun, but recently it has seemed impossible for the shares to make any advance. It is quite plain that there is a steady liquidation from some source, the shares being fed out as fast as the market will absorb them. The merger of the Nevada-Utah, Ohio-Kentucky, and the Prince Consolidated seems for some unknown reason to have 'bogged down'. The merger was evidently originally planned with the idea that the Nevada-Utah interests should be dominant in the new company which was to have been known as the Amalgamated Pioche Mines & Smelters Corporation. The Prince and the Ohio-Kentucky are now demanding that the deal be completed by May 1 or be definitely abandoned. Announcement of the completion of the merger has been made several times, but in each instance some hitch seems to have interfered with projected plans.

LONDON

Murex Process. — North Broken Hill and Broken Hill South Silver.—Satisfactory Development.—Stocks on Hand.—North Broken Hill.—New Concentrator.

Progress at Broken Hill is a source of continual interest. A new departure of promise is the acquiring of an interest in the Murex magnetic concentration process by Bewick, Moreing & Co., who will become managers of the Murex company for Australia. W. J. Loring will join the board. I have followed the process with keen interest and have always considered that the management hitherto has been rather lacking in engineering qualifications. The new departure will therefore introduce an important element into the method of carrying out the metallurgical idea. South Blocks Extended is to adopt the process.

On several occasions recently I have referred to the exceedingly sound positions at the North Broken Hill and the Broken Hill South Silver. These are the two brightest spots on the Barrier range, and not only are the developments in the mines excellent, but the metallurgical plants are perfect models in their way. At the Broken Hill South Silver the new concentrating plant was completed at the beginning of 1909, but was not at once put into commission, as the directors had not been able to conclude a satisfactory contract for the sale of the lead concentrate. After the settlement of this question later in that year, another period of inactivity was caused by the Australian coal strike. Some of the zinc tailing used to be sold to the Zinc Corporation, but since March 1910 the whole has gone to the De Bavay company to be treated on joint account. The Zinc Corporation and the De Bavay company are still treating old dumps. The company is in prosperous condition and nothing is now hindering the continuous working of the mine and plant. The amount of ore raised during the latter half of 1910 was 179,117 tons averaging 14.9% lead, 12.9% zinc, and 6 oz. silver. The concentrating plant produced 28,162 tons of lead concentrate averaging 70.4% lead, 5.5% zinc, and 21 oz. silver; and 84,428 tons of zinc tailing averaging 4.1% lead, 18.2% zinc, and 3.7 oz. silver. In addition 22,866 tons of slime was produced averaging 10.7% lead, 12.1% zinc, and 4.9 oz. silver, stored for future consideration, and 43,760 tons of useless tailing averaging 2.2% lead, 7.7% zinc, and 1.4 oz. silver. The zinc tailing was all despatched to the De Bavay company's plant, together with 11,548 tons of dump material; 11,420 tons of dump material was also taken by the Zinc Corporation. The developments in the mine during the half-year have been most satisfactory and the reserve on December 31 was estimated at 3,000,000 tons. It is known in addition that there are large amounts of ore not yet blocked out in the mine between the 970 and 1070-ft. levels. The company also has 1,199,000 tons of dump material on hand, averaging 5.8% lead, 16.8% zinc, and 3.6 oz. silver, together with 238,675 tons of accumulated slime, averaging 11.8% lead, 14.7% zinc, and 5.8 oz. silver. The cost of mining, filling stopes, and development was 12s. 8d. and of concentrating 3s. 6d. The income from the sale of lead concentrate was £212,591, and the receipts on account of zinc tailing £32,089. The net profit was £67,800, out of which £60,000 has been distributed as dividend.

Map Showing Position of Broken Hill.

At the North Broken Hill mine the first part of the new concentrating plant was put into commission in September 1909, and the remainder about midsummer, 1910. The present capacity is 6000 tons per week, but this level has not yet been reached owing to scarcity of mine labor. During the half-year ended December 31 there was a continued increase in the output and profit, and, what is equally important, most satisfactory development. During the six months in question 132,626 tons of ore was raised, of which the largest proportion, 56,690 tons, came from the 950-ft. level; the remainder coming from the 500-ft., 600-ft., 700-ft., 800-ft., and 1100-ft. levels. The amount treated in the concentration plant was 136,044 tons, averaging 15.8% lead, 13.3% zinc, and 6.3 oz. silver, and 23,011 tons of lead concentrate was produced, assaying 70.8% lead, 6.6% zinc, and 20.2 oz. silver. The amount of zinc tailing produced was 67,757 tons, averaging 3.6% lead, 17% zinc, and 3.2 oz. silver. This was sent to the De Bavay company's plant which is situated just to the north of the mine. In addition 15,445 tons of slime was produced, assaying 12.5% lead, 16.3% zinc, and 7.6 oz. silver, together with 29,831 tons of useless tailing. It is of interest to note that a small plant has been built for the treatment of the slime, and that the results so far obtained are promising. As regards ore reserve it is estimated that there are 1,500,000 tons available above the 1100-ft. level. At two points on this level the orebody is over 70 ft. wide.

General Mining News

ALASKA

KENAI PENINSULA

The Kenai-Alaska Gold M. Co., the property of which is at mile 24 on the Alaska Northern railroad, which extends from Seward northerly 75 miles, has driven a 400-ft. adit, by which bodies of free-milling ore have been opened. It is said this ore samples about $30 per ton. Some additional equipment has been ordered that will be in place in a few weeks. Seattle capitalists have secured the controlling interest in the Alaska Gold Quartz Mining Co., embracing five claims on Willow creek, back of Knik. The quartz is reported as being very rich and the three-stamp mill which is now on the property will be increased to a seven-stamp during the coming summer.

The Canadian interests behind the Alaska Northern are planning to extensively develop the tributary territory, and with the opening of the summer season expect to play a most important part in the quartz development of that portion of Alaska. Many experienced quartz miners are making up parties for a thorough study of the Alaska situation; these parties being largely drawn from Butte, Montana, and the Nevada camps.

A party of Salt Lake mining men has been formed to operate a large number of claims in the Lake McKinley district, another section which is making a favorable showing and which is just coming into life on account of the fact that it is tributary to the Copper River road.

THE KOYUKUK

George Gregson, who mushed out to Gibbon from the Koyukuk in February, reports much development on Sheep creek where pay-dirt was found on the benches, and he predicts a good clean-up there this season. Good pay was found, also, on Nolan creek, where several claims will be worked this year. A Keystone drill is to be taken in this spring for prospecting on South Fork. Work continued through the winter in the Koyukuk camps, getting out pay-dirt for summer sluicing.

PRINCE WILLIAM SOUND

Charles Crawford is building a stamp-mill at Valdez for treating custom ores. The Valdez M. Co. is having an adit-level driven alongside the vein in one of the walls. The ore disclosed contains gold, galena, and iron. The Biglow brothers, with W. D. Nutley, are outfitting at Chitina for extensive prospecting and development work in placer operations on Slate creek, which is 190 miles from the new town of Chitina. They are making ready to leave for the interior with a most complete outfit, and as this country has not been extensively explored in the past, the results are awaited with interest.

ARIZONA

COCHISE COUNTY

It is reported that plans have been made for the construction of a new smelter by the Calumet & Arizona Mining Co., consisting of McDougall roasters, two 60-ft. blast-furnaces, and five reverberatories. A definite announcement is expected after the annual meeting.——It is understood that final plans have been made for re-opening the Tombstone Consolidated Mining Co.'s properties. Arrangements have been made for retiring the indebtedness of the company, and the probable re-opening of the mines has greatly encouraged the district as a whole. The Hershall is working a full force and the Bisbee Extension has five men at work. The 300-ft. brick stack for the reverberatory furnaces and McDougall roasters at the Copper Queen smelter is in course of construction. The base is more than 35 ft. in diameter, the walls being 3 ft. thick. The first 40 ft. is of red pressed brick and the rest is of tiling. It is expected to complete the work early in July.

GREENLEE COUNTY

The Shannon (formerly known as the Copper Belle) is shipping a car of ore a day to the smelter at Clifton to be used for smelting purposes.

MOHAVE COUNTY

The U. S. S. R. & M. Co. has made a substantial cash offer for the Gold Road mine, after a thorough investigation by Jennings and Holden. The ore averages about $8 per ton and is suited to cyanidation.

PIMA COUNTY

(Special Correspondence.) — The announcement in the *Tucson Star* of an enormously rich strike in the Arivaca district is entirely unfounded. The Arivaca district is as yet undeveloped and while the surface showings are good and encouraging results are being obtained from prospecting, no tellurium ore has ever been discovered and no development work has been done in any other than the

Central Arizona.

Oceanic mine, which is an old, well known property, at present shut down, pending a sale. The visit of Mr. Wiseman to the district was not connected with business matters. The lease referred to in the newspaper account had only a two-inch streak of ore, and after sinking on it for 23 ft. the lessees abandoned it.

Arivaca, April 8.

PINAL COUNTY

Good vanadinite ore has been found in the Shamrock mine in the Casa Grande district, and Mr. Meehan says that he has a 16-ft. vein. The ore carries $5 per ton in gold, 460 lb. of lead, and 216 lb. of vanadium pentoxide. Vanadium ore also occurs in the Orizaba mine, a mile west of the Shamrock.

CALIFORNIA

BUTTE COUNTY

(Special Correspondence.)—Within a short time a comprehensive test will be made of a new type of dry-land dredge in this district. The dredge, which is being constructed for L. N. Hearn and associates, will be provided with a steam-shovel in place of the customary bucket line, and will be mounted on rails, instead of floating on water. It is expected that the new type of dredge will facilitate the profitable dredging of shallow ground, and also allow the working of small acreages, where it would not be possible to economically operate an ordinary dredge. The new dredge will be given its try-out on land owned by the firm of Rideout, Smith & Co. It is expected to have the dredge in commission within a few weeks. Natomas Consolidated is pushing work on its 15-cu. ft. dredge, recently delivered at Thermalito. The completion of this monster will be the first advent of the 15-cu. ft. type in this district, although the Natomas is operating a similar boat at Folsom with success. J. C. Boyd, of Sacramento, has been delegated by the Anti-Débris Association to make another examination of dredging conditions at Oroville. Mr. Boyd recently completed an investigation, but the anti-débrisites do not appear to be wholly satisfied. In the Magalia district much work is going on. Eastern people recently took a bond on the Eureka and are pushing development. At the Robbers Roost mine, E. H. Young

and associates of New York are finding gravel of fair grade.

Oroville, April 15.

INYO COUNTY

There is great activity at Keeler, following the discoveries which have been made in the leases on the Sam Kee and Whittier properties, and a promotion club has been organized to forward the development of the district. It is reported that a 12-ft. vein of shipping ore has been uncovered in the Sam Kee. Many leases are being let; the first team-load of ore went over the new road on April 3, and a 6-horse load of ore came in from the Shively on Sunday. L. D. Gordon has taken a lease on the Cerro Gordo and has about 500 tons of zinc ore ready for shipping; work being confined to the 400-ft. level. A new rate of $8.50 per ton from Keeler to Oklahoma has been secured. It is expected to ship a 20-ton car every day in the future.

KERN COUNTY

The Guaranty Oil Co. has made an alliance with the American Oil Fields Co. by which the former receives 120 acres of patented land in the Midway field, while the latter secures 25% of the carrying capacity of the pipe-line to be built to the coast by the Guaranty Oil Co. There is great activity in the mines of the Rand district; the Atolia has 100 men at work and more than 50 miners have found work in new enterprises and old ones that are increasing their forces. Edwin Higgins has been appointed manager of the La Crosse mine. The Ajax is finding good ore, and the Sunshine has good ore on the 200-ft. level. The stamp-mill at the latter will soon be started again.

NEVADA COUNTY

Eighty men are at work in the Champion mines on Deer creek, 20 of them exploring on the account of the North Star Mines, which has an option on the property. It is expected that the Morning Star and Siberia mines will soon be re-opened. These promising properties have been closed down for some time.

PLACER COUNTY

The Beaver Dredging Co.'s dredge on Dry creek is making rapid progress, and the necessary surface buildings are being constructed. H. B. Morse is retimbering the old Pioneer mine on which he has a bond. The stamp-mill at the Herman will be increased to 30 stamps. The sawmill will be started as soon as the roads are open. The Last Chance mines are working 100 men and maintaining a steady production. R. H. Young has struck some rich ore in the Annie Laurie, and the clean-up from the crushing of 18 tons at the Malmberg mill gave big results. A shaft will be sunk at the Crandall mine and drifts driven to cross-cut the ore which Mr. Norten, the superintendent, has found.

PLUMAS COUNTY

Samuel Alebuster, of San Francisco, according to the *Plumas Independent*, has taken a lease on an area covered with tailing from the Crescent and Green Mountain mills, and will proceed to cyanide it. Bids have been invited for furnishing 1000 cords of wood and for hauling 57½ tons of freight, consisting of engines, boilers, and other material from Keddie station to Crescent Mills.

(Special Correspondence.)—The Engels Copper Co. is proceeding with the erection of a 50-ton smelting plant at Light's canyon; 20 men being employed in installing the machinery. Towers for a tramway, 7500 ft. long, have been erected, and construction work on the tramway will be resumed early in June. At the mine two shifts are employed in development, and it is stated that an excellent reserve of high-grade copper ore has been opened. The blowing-in of this smelter marks the first effort at copper smelting in this county, and it is expected that the close of the year will find the company an important producer. The company is controlled by the Engels brothers of San Francisco. Several Eastern companies have also become interested in the copper deposits in the Genesee and Copper Hill sections, and exploration has been productive of satisfactory results. The Engels company has purchased a 60-hp. automobile truck to facilitate the shipment of supplies from the Western Pacific station at Keddie to the mine, which is situated at Taylorsville in Indian valley. The Plumas Power Co. was recently formed by San Francisco people, for the supply of power to the mines in the Indian Valley district. The company plans to develop 1200 kw. Operations are about to be resumed at the Gold Mountain hydraulic mine, near Quincy. A large quantity of pipe is being laid. G. W. Fagg is superintendent. Driving for the orebodies on the Seventy-Six portion of the property is progressing steadily at the Plumas Eureka, near Johnsville. This famous property, which has paid $2,831,294 in dividends, is one of the premier producers of the entire county. The Ebert quartz mine has been acquired by the California Con. Gold Mines & Exploration Co., an Arizona corporation.

Quincy, April 14.

SHASTA COUNTY

R. T. White has resigned as general manager for the Balaklala company and will go to the Braden copper mines in Peru. The farmers are awaiting the report by Mr. Gould as to the amount of solids which are being removed from the gases by the Cottrell process, and developments are expected soon. George Bayhew, who was instrumental in the sale of the Evening Star mine for $125,000, has taken a bond on the Texas group, which has lain idle for some years.

SISKIYOU COUNTY

The Siskiyou Electric Light & Power Co. announces that it will extend its lines to Klamath falls and Butte creek valley. Work will be started on a 90-ft. dam to impound the waters of the Klamath river and develop 30,000 hp. The large amount of power which this will make available will permit the development of many enterprises throughout the county. L. E. Buckner and Peter Walls, who have a lease on the Overton mines on Cow creek, made a rich strike last week, the ore taken out during the week is said to have realized $7000. This mine has been noted for years for its rich specimen ore.

TRINITY COUNTY

In our Trinity county news of April 8 it was stated that the La Grange mine was included among several properties which had been taken under option by persons representing the Guggenheims; and we have been informed since by P. Bouery, manager for La Grange M. Co., that the statement was an error so far as it related to the La Grange mine.

COLORADO

CHAFFEE COUNTY

The Low Pass M. Co., owner of the Belle of Granite mine, at Granite, has discovered rich ore in a 5-ft. vein, which formerly yielded high-grade ore. The ore blocked out is estimated to be worth $100,000. That on the dump, placed there years ago, is considered profitable now when treated by present milling methods. The equipment includes an old mill which is to be improved with new machinery. A water-power plant is to be established.

CLEAR CREEK COUNTY

(Special Correspondence.)—J. R. Claypole, of Cripple Creek, has been awarded the contract to drive the Lucania adit 1500 ft. The electric-driven compressor at the Lamartine mine has been purchased and will be placed in position during the coming week. The heading is now in a distance of 4800 ft. The Old Town M. M. & T. Co. has been orgauized to carry on development work, which will be in charge of G. K. Kimball. Shipments are going out from the Blue Ridge mines on Columbia mountain. The 50-ton concentrating plant will be started May 1.

Idaho Springs, April 10.

LAKE COUNTY (LEADVILLE)

The London mine, situated at a high altitude on Mosquito range, close to the line between Lake and Park counties, is reported to have been subleased for a term of 20 years to a syndicate of Eastern men, by which work has been commenced. One of the projects of the syndicate

is to put in equipment for electric power at the mine and build a surface tramway to the property from Alma. Another is to open the great vein at 2000 ft. depth by driving two cross-cuts—one from the north side and the other from the south side of London mountain. These cross-cuts are to open the vein at widely separated points, which will be connected by a drift on the vein. The old workings are entered through a higher adit-level, and a winze that was sunk from that level on the vein. When the two projected cross-cuts shall have been driven, and connected by a drift, the great working level thus established is to be connected with the winze so as to secure ventilation, and to permit the passing of ore from the old workings to the haulage level. This plan, where worked out, will serve to drain the workings and relieve the operators of the expense of hoisting ore and waste. The London is principally a gold mine, some of the ore extracted in past years having been high grade. J. M. Kuhn is the original lessee, who has subleased to the syndicate which is to undertake the work outlined.

The Leadville *Chronicle* estimates the output of zinc carbonate ore at 250 tons per day, and anticipates an increase by May 1. The tonnage of zinc sulphide is increasing, a portion of which has to be concentrated before shipping.

SAN JUAN COUNTY

Development work in the Gold King mine has been kept up all winter, with the result that a large tonnage of ore is now in the bins, and broken in the stopes. The mill at Gladstone is being put in condition to operate, and the Gladstone & Northerly railroad, which extends from Silverton up Cement creek to Gladstone, is being repaired; also, accommodations for miners and millmen are being provided. Within the next few weeks the mine and mill are expected to be in operation. The Ledge Con. M. Co., with R. W. Hollis as superintendent, has performed important development during the winter, the result of which is that the shaft now has a depth of 517 ft., and drifts in ore have been extended some distance both north and south from the sixth station, showing the vein to be 5 to 6 ft. wide. The ore is of profitable grade, carrying gold, silver, lead, and zinc. Development on the third and fourth levels has exposed new orebodies in those places. The mill is being provided with some new equipment, including four jigs, set of rolls, and Callow tanks. The Silverton *Miner* states that the Hamlet mine, situated between Howardsville and Eureka, is to be worked this season under direction of Etienne A. Ritter, of Colorado Springs, consulting engineer for those having a bond on the property, the price specified in the bond being $150,000.

SUMMIT COUNTY

The mine and mill of the Colorado-Toledo M. Co. are operating at Collier mountain, near Argentine, the mill being expected to treat 100 tons per day. The New Pennsylvania Mines Co. is having its mill repaired, and will soon have it in operation.

TELLER COUNTY (CRIPPLE CREEK)

The Vindicator Con. Gold M. Co., owning about 80 acres at the foot of Bull hill, near Goldfield, is operating through two principal shafts, No. 1 and Hull City, and is mining at a depth of 1400 ft., having about 30 miles of development. There is a working force of 200 men. The March output amounted to 3540 tons of ore of an average value of $30 per ton. Of this production, 2880 tons was taken from the drifts and stopes tributary to No. 1 shaft, and 960 tons was hoisted at the Hull City, while 300 tons was shipped by lessees at the Glorietta and other minor shafts. The ore is shipped to the mills in the valley. The mills which are operating on Cripple Creek ores treated a big tonnage in March, the Portland handling 10,000 tons, and the Golden Cycle nearly 25,000 tons. The Cresson mine is keeping up a production of 2500 tons of ore per month. It is reported that the United States Reduction & Refining Co. has just put into effect a treatment rate of $6.50 per ton on ore sampling 3 oz. gold per ton or less, and $7 per ton for ore containing an excess of 3 oz. gold, which amounts to a reduction of 10% from former charges. It is anticipated that this cut will be met by those operating other plants.

IDAHO

LEMHI COUNTY

The Pittsburg-Idaho company, operating a lead-silver mine at Gilmore, shipped 15,000 tons of ore to the United States smelter at Midvale, Utah, between July 1 and April 1, which sampled 36% lead, and 15 oz. silver per ton. The Pittsburg & Gilmore railroad, which extends from Armstead, Montana, to Salmon, Idaho, has a branch line from Junction to the vicinity of the Gilmore mine. New equipment is being put in at this property. A dividend of $10,000 was paid April 12.

SHOSHONE COUNTY

The Success Mining Co., controlled by H. F. Samuels, of Wallace, and his Spokane associates, has paid all indebtedness, and recently paid a dividend of $15,000. The Success mine, situated on the north fork of Nine Mile creek, 4½ miles from Wallace, is a producer of zinc and lead ore. In the past the zinc product was of most importance, but on one of the two veins a strong shoot of galena has been opened on the lower levels which is giving the lead output first place. The Monarch mine, situated in Murray district, is producing 100 tons of ore per day, which is being concentrated, and it is announced that this tonnage will be doubled next month. The property belongs to the Coeur d'Alene North Fork M. & S. Co., for which E. P. Spalding is manager. The main haulage level extends 3200 ft. into the mountain ridge between Pritchard creek and Barton gulch, and this cuts the vein system at a depth of 1400 ft. It is stated that a 250-ft. winze is to be sunk from this level. Other producing mines of the Murray region include the Black Horse, Jack Waite, Bear Top, and Terrible Edith. The Paragon is considerably developed and has some good bodies of ore.

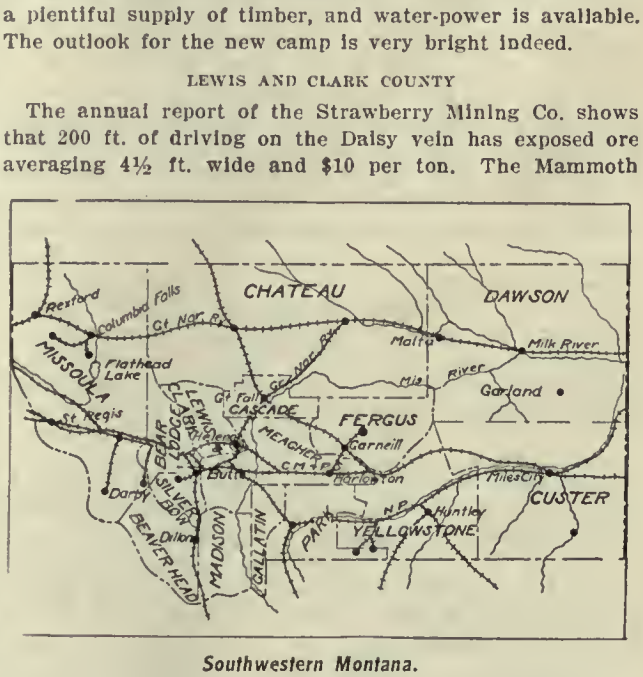
MONTANA

BEAVERHEAD COUNTY

Recent reports from the Elkhorn district are to the effect that the Central Group, owned by Dillon interests, has eight veins, the largest of a width of 27 ft., the ore averaging 4% copper, 12 oz. silver, and $2 gold. There is a plentiful supply of timber, and water-power is available. The outlook for the new camp is very bright indeed.

LEWIS AND CLARK COUNTY

The annual report of the Strawberry Mining Co. shows that 200 ft. of driving on the Daisy vein has exposed ore averaging 4½ ft. wide and $10 per ton. The Mammoth



Southwestern Montana.

vein has also been cut and shows an average of about $10 over 5 to 7 ft. The new mill was expected to start on March 10.

SILVER BOW COUNTY

The North Butte has struck another vein which is reported to be even richer than any yet found in the property. The vein was struck at a depth of 2750 ft. and is

from 15 to 17 ft. in width, a large portion of the ore running as high as 22% copper. Like other finds in the North Butte, few particulars can be learned, but there is no question as to the authenticity of the report, as a prominent person connected with the company has acknowledged the correctness of the story. However, no definite statement will be given out. The Edith May vein is expected to be cut on the 2800-ft. level. The ore on the 1800-ft. level continues to be as rich as when first uncovered, while on the 2400-ft. level the ore runs from 9 to 11% copper.

The Raven company is now driving on the 200-ft. level of Snoozer, but so far as can be learned no ore of a commercial quality has been found. A force of men is at work in the Raven mine doing extensive development work, but if any ore has been found the management is keeping the matter strictly quiet.

NEVADA

ESMERALDA COUNTY

At the Goldfield Consolidated, J. W. Donnelly, the mine superintendent, has organized a rescue team which is shown at practice in the illustration. It consists of eight picked miners, men who are most familiar with the underground workings, furnished with Draeger oxygen helmets. Suitable training quarters have been provided, and practice is

Mine Rescue Team, Goldfield Consolidated.

held every change day. The men all take great interest in the work. While Rescue Car No. 4 was in Goldfield, Sumner S. Smith and his men gave this team thorough training in the use of helmets and in first-aid work. The suit of the Goldfield Consolidated against D. McKenzie for damages sustained by a cave-in in the Mohawk while the latter was operating it under a lease will be tried before three district judges, sitting *en banc*, and their decision will be accepted as final.

The Coalition Mining Co. produced bullion during March to the value of $23,000, making a total since the first of the year of $68,384.43. There is a steady increase in production each month, and it is confidently expected to pay the initial dividend before the close of this year. The lower levels look better, especially the sixth.

LYON COUNTY

It is reported that oil has been found in the well which was drilled for the smelter at Wabuska, and high hopes are entertained of being able to perhaps secure a supply of fuel oil. A small crew is at work in the Nevada Douglas putting the raises and levels in shape to produce ore as soon as the railroad is completed to the property and the smelter is ready.

NYE COUNTY

The March report for the Tonopah Belmont shows that 8295 tons was treated, 3957.323 oz. gold bullion and 386,626.10 oz. silver bullion were produced at a net profit of $169,336.91. The March report for the Tonopah Mining Co. shows that 14,078 tons was sent to the mill, with a resulting bullion recovery of $210,185. Concentrate to the value of $51,360 was shipped, the net profit for the month being $147,678.

(Special Correspondence.)—The Big Four Leasing Co., operating on the Manhattan Big Four mine, has placed orders for a 10-drill air-compressor, two Knowles pumps, and other equipment. The compressor is of the Imperial type, manufactured by the Ingersoll-Rand Co. It is expected to commence the installation of the equipment within three weeks. The shaft is advancing rapidly and will soon attain the 300-ft. point. From here lateral work will be pushed. On the 220-ft. level a north and south drift is being advanced rapidly, and considerable ore is being extracted. About 100 tons of ore is on the dumps, and this is being increased as development continues. It is understood that the ore showing has been so encouraging that the company has decided to install its own mill. The War Eagle mill is handling 300 tons of ore from the workings of the Dexter L. company on Union No. 9 claim of the Dexter Consolidated. At the Morning Star, George Durgin has started the sinking of a new shaft. At a depth of 10 ft. a new vein, one foot wide was discovered and is showing greater width as developments progress. The old shaft is 135 ft. deep, with encouraging showings. Durgin states that he may install a small mill during the summer. Conditions are generally improving in the Manhattan district, and the outlook is for an animated summer. Several leases on the Blue Jacket property at Round Mountain report the opening of ore averaging $20 to $40 per ton. A recent shipment to the mill by the Gibson-Kemont-McVeigh lease netted $47 per ton.

Manhattan, April 13.

The gross output of the mines of the Tonopah district for the week ending April 8 was 8353 tons, of an estimated value of $209,000. To this the Tonopah M. Co. contributed 3350 tons; the Belmont, 2803; Montana, 1000; Tonopah Extension, 980; West End, 200; and Midway, 50. The district in general shows continued improvement.

J. R. Davis, manager of the Round Mountain Mining Co., will submit his report for the year 1910-11 on April 17. It will show that the company as well as the mine is in better condition than ever before. On Feb. 28 the cash in bank and bullion in transit amounted to $60,338.42, while the ore blocked out in reserve amounted to 111,928 tons. Contracts have been made for the machinery to increase the capacity of the mill 50 tons per day. This machinery is expected to be in operation within 60 days, with a resulting one-third increase of the earning power of the mill. J. P. Sweeney has sent circulars to the shareholders and will probably attempt to gain control at the meeting.

OREGON

JOSEPHINE COUNTY

The Circuit Court for the District of Oregon has handed down a decision affirming that the United States may issue patents to mineral claims within the grant of a military road. This, by extension, would also apply to mineral claims within the lands of the Oregon and California railway grants.

UTAH

BEAVER COUNTY

(Special Correspondence.)—This district is showing considerable activity with the opening of spring. The South Utah, which commenced operations in September 1910, has made profits as high as $10,000 per month. This is a good showing considering the fact that the ore is of very low grade and that the mill has been treating only 700 tons per day. After many delays the 100-ton concentrator of the Horn Silver has been started up. The ore treated runs 10 to 12% lead, with 8 to 10 oz. silver. About 25,000 tons of this grade is stored in the old stopes and a large additional tonnage is blocked out, so that there is sufficient ore in sight to run for some time to come. Power is generated in the company's steam-electric plant. The operation of the mill will make practically no increase in the working force, as a considerable amount of labor has been required in the past to store the milling ore. A 5-stamp amalgamation mill has been erected at Beaver City to treat the ore of the Sheep Rock mine. The mill was brought over from Marysvale canyon. The Busy Bee,

eight miles east of Beaver, and in the same mineral belt with the Annie Laurie, is planning the erection of a 10-stamp mill on Indian creek. The Imperial, near the South Utah, has commenced a shaft which will connect with a winze in one of the tunnels and give a depth of 140 feet.

Milford, April 15.

JUAB COUNTY

(Special Correspondence.)—At the annual meeting of the May Day the old officers were re-elected and the annual report submitted. This shows that within the past year the company has paid off the indebtedness with which it entered the year, has shipped ore and concentrate of the value of $70,000, done extensive development work, and has $4000 in the treasury. One assessment of $16,000 was levied. The new orebody found in the Eagle & Blue Bell appears to be a continuation of the rich vein recently opened by the Victoria. Work has been carried on in it for about three weeks, and, although it does not show the high value of the Victoria, the ore is of good shipping grade. The King William has started a new drift from its main level. The appearances are that Beck Tunnel in its new drifts near the Uncle Sam lines is above the large orebody that was opened by the latter property, and sinking will be tried in an effort to find it. A contract has been let to sink the Swansea shaft another 150 ft. A drift will also be driven on the 1000-ft. level. The Brooklyn Zinc Co. is in the process of organization to develop six claims near the Scranton. This will give the district another zinc mine. Total shipments for the week from the district are 187 cars, Centennial Eureka leading with 44 cars, and Iron Blossom second with 42. The week previous there were 189 cars, Centennial Eureka 47, and Iron Blossom 46.

Eureka, April 15.

SALT LAKE COUNTY

(Special Correspondence.) — Work on the 500-ton lead plant at Tooele has been commenced. It is planned to have the plant ready for operation by August 1. Lead ore is already being shipped in, and about 2000 tons is now on the stock pile. The Utah Consolidated has increased its shipment of copper ore, and is now sending in 500 tons daily. About 800 tons per day is being treated. There are prospects that a fight for the control of Utah Consolidated will be waged at the annual meeting on April 18. The company earned only 4.35% during the last year. Proxies are being sought to be used against the present management at the meeting. The Utah Apex company has found 14 ft. of ore running 30% lead in its No. 2 workings. This company has been developing since the mill was shut down last fall and has blocked out a large tonnage of ore. In another portion of the mine a find was made of ore carrying 6% copper, and 33% iron. The Bingham-New Haven has declared a dividend of 20c. per share, bringing the total up to $135,000.

Bingham, April 15.

SUMMIT COUNTY

(Special Correspondence.)—The Daly West has declared a dividend of 30c. per share. The mill-men employed at the Silver King Coalition concentrator have gone on a strike for an eight-hour day. The men worked ten hours when the mill was operating only one shift, but refused to work more than eight when a second shift was put on.

(Special Correspondence.)—The American Exploration Co., controlled by F. B. Bodfish and his associates, has commenced the work of driving a cross-cut for 3600 ft., the purpose of which is to drain various old mines of the Alta camp, including the Copper, Prince of Wales, Davenport, Grizzly, and City Rocks at depths ranging from 600 to 1000 ft. The starting point is in Silver fork of Big Cottonwood canyon, the course is southerly, and the mines referred to are situated on both sides of the divide that separates Big Cottonwood from Little Cottonwood canyon. One of the main objects is to tap the limestone-granite contact on the Alta side. The advantage in entering this mineralized region by an ore-haulage and drainage adit from the Big Cottonwood side is the accessibility of that side by a good wagon-road and its comparative freedom from snowslides. This company has control of the American Flag mine, at Park City, in which large bodies of low-grade ore have been exposed during the last six months. The building of a concentrating mill to treat those ores is contemplated.

Park City, April 20.

WASHINGTON

FERRY COUNTY

(Special Correspondence.) — The Insurgent Gold Mining Co. paid its first dividend March 31, of 1¼c. per share, amounting to $12,500. The Hope company has resumed work at the winze on the Black Tail vein, below the adit. A foot-wall assay of $113 was $61 in gold and $52 in silver. A general sample assayed $55 in gold and $40 in silver. In the North San Poil raise a black flint streak assays $30 per ton. In the back the pay-shoot is about 6 ft. wide, and some of the assays continue high. The shaft is 128 ft. deep. At a depth of 70 ft. a 2-in. streak was thickly studded with native gold. The back of the raise is 90 ft. above the adit-level, and there remains about 115 ft. of the pay-shoot unbroken between the two workings. At about 75 ft. up from the bottom of the raise the shoot was from 10 to 12 ft. wide. At 45 ft. above the floor of the adit-level a drift has been started to run on the course of the vein, N. 30° W., to cross the streak going down from shaft, on its rake northward.

The Imperator-Quilp Co. is sacking ore on the 500-ft. level of the Quilp mine, from a body 12 to 24 ft. wide, which averages about $200 per ton. On the adit-level samples assay over $400, and run as low as $8 or $9 per ton. On the 200-ft. level the pay-shoot is 28 ft. wide, and the daily samples assay about $30 per ton. The 50-ft. level (where the native silver was found), is continuing about 5 ft. wide. The mine is now sending out to the smelters about 25 tons per day. The Republic Mines Corporation is shipping now about 50 tons of ore daily. On the 600-ft. level of the Surprise a streak 6 to 7 ft. wide assays from $20 to $40 per ton. The Knob Hill mine looks better than ever. The heading of the north drift on the No. 2 level is still in a good grade of ore. Smelter returns from five carloads are as follows: Two cars assayed per ton 3 oz. gold and 10.70 oz. silver; total gross value, $65.56 per ton. Two cars, 2.82 oz. gold, and 10.6 oz. silver; total gross value, $62.91 per ton One car, 2.57 oz. gold, and 10.8 oz. silver; total value, $57 per ton.

STEVENS COUNTY

(Special Correspondence.)—The drift on ore in the Gem mine, on Toulon mountain, Orient district, shows a breast of ore 7 ft. wide, assaying high in gold, some of which is in free particles. The Orient Gold Mines, Ltd., is sinking a shaft, the ore opened at the bottom of which contains chalcopyrite intermixed with galena.

Orient, April 5.

MEXICO

GUANAJUATO

The annual report of the Guanajuato Reduction & Mines Co. for 1910 shows that during the year the company milled an average of 19,000 tons per month, chiefly from the dump. Milling and cyaniding costs show a marked reduction, and after paying all expenses, including 6% on its bond issue of $2,800,000, the company earned a profit of $146,767. This company is controlled by the American Finance & Securities Co. of New York.

The mill of the Tajo de Dolores bas been completed and is now in full operation. It has 40 stamps and the ore is treated as slime by the continuous process. In the mine, which is connected to the mill by a two-line tramway, enough ore has been blocked out to furnish a two years supply. At the Peregrina mine of the Guanajuato Development Co. a large tonnage of ore from the Villalpando is being treated. The Cubo M. & M. Co. has shut down its mill. Unwatering at the Loreto mine has been completed and three shifts will immediately be put at sinking and cross-cutting. Good ore is being taken out of the Santo Nino and shipped to the Dwight Furness Company.

Personal

Professional men are invited to send news of their engagements and travels. Such news is interesting to friends.

S. F. Shaw is in Lonon.

D. A. Lyon is in Europe.

Louis Janin is in San Francisco.

R. P. McLaughlin is in Wyoming.

R. P. Russell is in San Francisco.

H. C. Hoover has returned to London.

E. F. Burchard was at St. Louis recentiy.

E. G. Hothorn has been in San Francisco.

C. A. Fisher was at Casper, Wyoming, recently.

Edwin Letts Olliver has gone to Portland, Oregon.

F. J. H. Merrill is examining oil lands in Wyoming.

J. M. Callow has returned to Salt Lake from Arizona.

E. W. Carson, of Los Angeles, is at Goldroad, Arizona.

J. Nelson Nevius was in San Francisco and has gone to Utah.

Ernest A. Haggott will be in Arizona tili May, on mining work.

E. B. Kimball is at the Adler Sanatarium, San Francisco, with a broken arm.

J. A. Burgess is superintendent for the Nevada Wonder Mining Co., Wonder, Nevada.

Siegfried Maurer is assayer for the Long Valley Gold Mine Co., at Quincy, California.

Jesse J. MacDonald is on an extended professional visit to the San Juan oilfields of Utah.

Lyon Smith is mili superintendent for the Tonopah-Liberty M. Co., Tonopah, Nevada.

L. B. Eames is visiting California in the interest of the Dorr Cyanide Machinery Company.

H. F. Lefévre has returned to New York after an absence of two months in Central America.

A. Bement has removed his office from Fisher building to 206 So. La Salle street, Chicago.

W. L. Saunders delivered the Class Day Address at the Michigan College of Mines, April 20.

F. O. Martin has returned to San Francisco from an examination of the Lost Hills oilfield.

Glenn K. McKenzie is with the U. S. Reclamation Service, in the vicinity of Pendleton, Oregon.

Ferdinand McCann is temporarily at Hostotipaquillo, Jalisco, acting as manager for El Favor Mining Company.

F. O. Jasmer, superintendent of cyanidation for the Yoquivo Development Co., Chihuahua, has been visiting San Antonio, Texas.

Joseph Jaffa, of Denver, Colorado, gave ten lectures on 'American Mining Law' at the Missouri School of Mines, from March 20 to March 25.

Paul W. Gaebelein, formerly with the Golden Cycle Milling Co., is now consulting engineer for the Colorado Metals Extraction Co., of Denver, Colorado. He will be assistant to W. L. Bain at the Denver plant.

Samuel Calvin, who died at Iowa City, April 17, was born in Wigtonshire, Scotland, in 1840. He removed to Iowa when but a boy, and is best known for his work as a professor in the State University of Iowa and as State Geologist. The comprehensive reports on Iowa geology made by the present Survey have all been written under his supervision and the present advanced state of knowledge regarding the mineral resources of that State is largely due to his energy and ability. He was a man of high ideals and singularly lovable character who devoted himself unselfishly to his profession. He leaves a record of clean, honest work, and of distinguished service.

Market Reports

LOCAL METAL PRICES.

San Francisco, April 20.

Antimony	12—12¾c	Quicksilver (flask)	51
Electrolytic Copper	14—15¼c	Tin	45—46½c
Pig Lead	4.75—5.70c	Spelter	7—7¾c

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

METAL PRICES.

By wire from New York.
Average daily prices in cents per pound.

Date.	Electrolytic Copper.	Lead.	Spelter.	Silver, per oz.
Apr. 13	12.00	4.41	5.40	53⅛
" 14	12.00	4.41	5.40	53⅛
" 15	12.00	4.41	5.40	53
" 16	Sunday.		No market.	
" 17	12.00	4.41	5.40	53
" 18	12.00	4.41	5.40	53⅛
" 19	12.00	4.41	5.40	53⅜

ANGLO-AMERICAN SHARES.

Cabled from London.

	Apr. 13. £ s. d.		Apr. 20. £ s. d.
Camp Bird	1 12 3		1 11 0
El Oro	1 4 6		1 4 3
Esperanza	1 14 4½		1 13 9
Dolores	1 5 0		1 5 0
Oroville Dredging	0 5 9		0 5 9
Mexico Mines	7 11 3	ex div.	7 7 6
Tomboy	0 15 0		0 15 0

(By courtesy of W. P. Bonbright & Co., 24 Broad St., N. Y.)

MINING STOCK QUOTATIONS—NEW YORK.

(By wire from Catlin & Powell Co., New York.)

	Closing prices, Apr. 20.		Closing prices, Apr. 20.
Amalgamated Copper	$ 61	Mason Valley	$ 7⅞
A. S. & R. Co.	72	Miami Copper	18¼
Braden Copper	3¾	Mines Co. of America	4¾
Butte Coalition	16⅞	Nevada Con	17¾
Chino	21⅞	Nevada Utah	¾
Davis Daly	1⅜	Nipissing	10⅝
Doble	3	Ohio Copper	1⅝
Dolores	5½	Ray Central	1½
First National	1¾	Ray Con	16⅝
Giroux	5⅞	South Utah	¾
Goldfield Con.	6⅛	Superior & Pittsburg	13⅜
Greene-Cananea	6⅛	Tenn. Copper	35⅞
Guanajuato Con	½	Trinity	4
Hollinger	9½	Tuolumne Copper	4⅞
Inspirstion	6⅞	United Copper	3¾
Kerr Lake	6⅛	Utah Copper	43
La Rose	4⅛	Yukon Gold	3⅞

COPPER SHARES—BOSTON.

	Closing prices, Apr. 20.		Closing prices, Apr. 20.
Adventure	$ 4½	Mohawk	$ 35
Allouez	32	North Butte	26¾
Atlantic	3¼	Old Dominion	36¾
Calumet & Arizona	48½	Osceola	103
Calumet & Hecla	480	Parrot	11⅛
Centennial	11⅛	Santa Fe	¾
Copper Range	60¼	Shannon	9¾
Daly West	4⅜	Superior & Pittsburg	13⅞
Franklin	8½	Tamarack	37
Granby	30½	Trinity	3⅞
Greene Cananea, ctf.	6⅛	Utah Con.	13
Isle-Royale	12½	Victoria	1½
La Salle	4	Winona	6½
Mass Copper	5¾	Wolverine	108

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

SOUTHERN NEVADA AND COMSTOCK SHARES

San Francisco, April 20.

Atlanta	$ .09	Montana Tonopah	$ .70
Belmont	5.95	Nevada Hills	2.92
Booth	.10	Pittsburg Silver Peak	.70
Columbia Mtn	.03	Round Mountain	.55
Combination Fraction	.11	Sandstorm Kendall	.08
Florence	1.55	Silver Pick	.05
Goldfield Con	5.95	Tonopah Extension	1.05
Gold Kewenas	.05	Tonopah of Nevada	6.70
Jim Butler	.22	West End	.57
Jumbo Extension	.29	Belcher	1.00
MacNamara	.11	Con Virginia	1.52
Mayflower	.04	Mexican	4.35
Midway	.24	Ophir	2.00

(By courtesy of San Francisco Stock Exchange.)

Book Reviews

Any of the books noticed in this column are for sale by, or can be procured from, the MINING AND SCIENTIFIC PRESS.

MOTION STUDY. By Frank B. Gilbreth. 5½ by 8 in. Pp. 116. Ill., index. D. Van Nostrand Co. New York, 1911. Price, $2. For sale by *Mining and Scientific Press.*

In this book are told in detail the methods used by Mr. Gilbreth in standardizing bricklaying. It is part, and a most important part, of the growing literature of 'efficiency engineering.' The methods used are widely applicable.

CRIPPLE CREEK MINES YEARBOOK, 1911. By Colorado Springs Mining Stock Association. Distributed by the Frank Hervey Pettingell Co., Colorado Springs. Price, 25 cents.

This is an official summary of the certified reports of all the listed companies operating in the Cripple Creek district. It is an invaluable handbook for those interested in Cripple Creek mines.

LOCKYER'S DIAGRAM FOR CYANIDE OPERATIONS. 30 by 36 inches. Price $2.50. For sale by *Mining and Scientific Press.*

This is a particularly convenient wall diagram, showing by inspection the solution content of any vat through a wide range of depth and diameter. It is clearly printed, mounted on heavy linen, with a varnished surface, so that it may be posted at any place in the mill convenient for easy reference. How much cyanide is required to bring the solution up to any required strength can be found by inspection, and the diagram should prove very useful to cyanide engineers.

ELEMENTS OF GEOLOGY. By Eliot Blackwelder and Harlan H. Barrows. 8vo., Pp. 475, Ill., index. American Book Co., New York, 1911. Price $1.40.

This is a thoroughly new textbook. As the authors state, it is neither a manual nor reference book, but it is well designed to rouse and hold the interest of the intelligent beginner. The material is fresh, well written, and well illustrated. It is the sort of book that, in the hands of a good teacher, can be used with high school pupils, or without a teacher can be recommended to the mature prospector or others who want to know the elements of the science of geology.

SMOLEY'S PARALLEL TABLES OF LOGARITHMS AND SQUARES. By Constantine Smoley. Sixth Edition. 5 by 7 in. Pp. 174; flexible back. The Engineering News Pub. Co., New York, 1911. Price, $3.50. For sale by *Mining and Scientific Press.*

The new edition of this well known work includes a table of natural functions giving the sine, cosine, tangent, cotangent, secant, and cosecant by intervals of one minute. Other additions are tables of squares, cubes, square roots, cube roots, reciprocals, areas, and circumferences of circles. The book is convenient in form, and well printed, with type that is unusually large and clear for a pocket book.

ELEMENTARY CHEMISTRY FOR COAL-MINING STUDENTS. By L. T. O'Shea. Pp. 319, Ill., index. Longmans, Green & Co., New York, 1911. Price $1.80.

This is not a textbook of chemistry, but a compilation of the parts of chemistry related to coal mining. Mr. O'Shea, who is professor of applied chemistry in the University of Sheffield, has made good selections as to the material to be included and a helpful book is the result. It is not, however, as elementary as might be inferred from the title, and the men who most need it, in America at least, will not always find the text simple. However, the subject itself is complex, and that the book should be full and accurate is more important. The book is well printed and bound and is the best one available in its field.

Recent Publications

BRITISH GUIANA. The Permanent Exhibition Committee has recently sent out leaflets describing the 'Rice Industry,' 'Sugar Industry,' and 'Balata and Rubber Industries.'

STRATIGRAPHY OF THE OLDER PENNSYLVANIAN ROCKS OF NORTHEASTERN OKLAHOMA. By D. W. Ohern. State University, Oklahoma, Research Bull. No. 4, Pp. 40, map. Norman, 1910. A résumé of results of a systematic re-study of the region.

REPORT OF THE STATE ENGINEER. [CALIFORNIA.] Pamphlet. Pp. 180. Sacramento, 1911. This report covers the period from November 30, 1908, to November 30, 1910, and deals with harbor work, river control, road construction, topographic surveys, water supplies, and similar subjects.

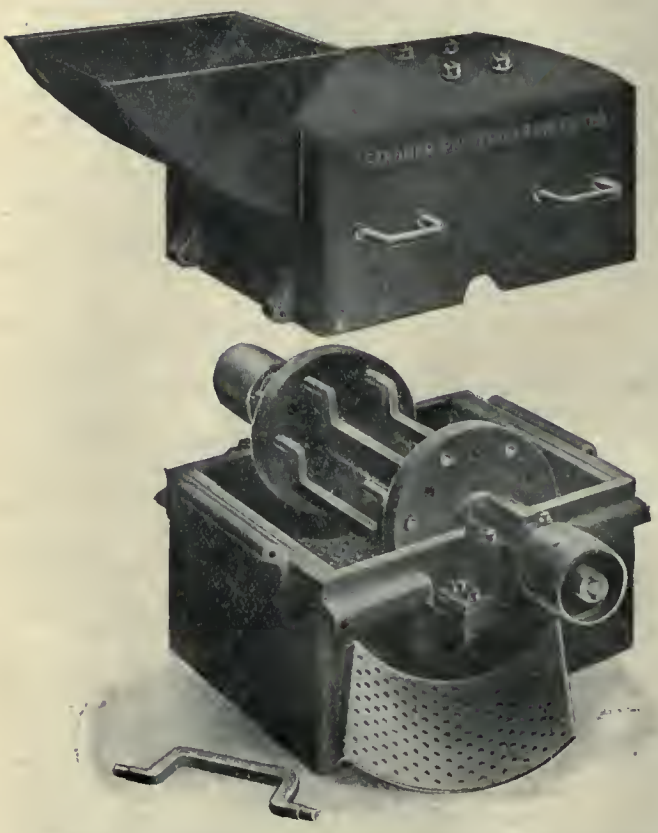
DEPARTMENTS OF MINES (CANADA), reports recently issued include: Bulletin No. 5, 'Magnetic Concentration Experiments,' by George C. Mackenzie, 27 pp. 'Investigation of the Peat Bogs and Peat Industry of Canada,' by Alfred Aurep, 44 pp., Ill. This is a description of five Canadian peat bogs, with appendices describing the manufacture of peat powder in Sweden, the Aurep peat-machine, and the Ekenberg wet-carbonizing process, followed by a translation of Eleknud's pamphlet, 'A Solution of the Peat Problem.' It is accompanied by maps of the bogs and six plates.

PROCEEDINGS OF THE AUSTRALIAN INSTITUTE OF MINING ENGINEERS. Vol. VIII, No. 1. January 1911. The principal papers of interest in this number are 'A Standard of Adequate Ventilation at Metal Mines,' by F. Reed; 'Precipitation of Gold and Silver in Cyanide Solutions of Carbon,' by R. K. Cowles; 'Estimation of Tin in an Ore,' by R. G. Morgan; 'Metallurgical Processes of the Waihi Grand Junction Gold Co., Ltd,' by A. Fyfe; 'Pumping Machinery for Mines,' by W. Percival Gauvain; 'The Thames-Hauraki Pumping Plant,' by A. C. MacDiarmid; 'Milling and Treatment at the Waihi Mine,' by E. G. Banks; 'Mining Methods at the Waihi Mine,' by J. L. Gilman and W. H. Johnston.

UNITED STATES GEOLOGICAL SURVEY publications recently issued include: 'The Production of Sand-Lime Brick in 1909,' by Jefferson Middleton; 'The Production of Gems and Precious Stones in 1909,' by Douglas B. Sterrett; 'The Production of Abrasive Materials in 1909,' by W. C. Phalen; 'The Production of Borax in 1909,' by Charles G. Yale; 'The Gypsum Industry in 1909,' by Ernest F. Burchard. Bulletin No. 439, 'The Fauna of the Moorefield Shale of Arkansas,' by G. H. Girty. Water-Supply Paper No. 270, 'Surface Water-Supply of the United States, 1909. Part X, The Great Basin,' by E. C. LaRue and F. F. Henshaw. Geologic Atlas. Sewickley Folio, Pa., by M. J. Munn. The topographic maps named below were issued during August, September, October, November, and December 1910: Bath, New York; Briceville, California; Carlyle, Illinois; Clay City, Indiana; Coahoma, Mississippi; Dundee, Mississippi; Eaton, Colorado; Fayetteville, West Virginia; Fort Bayard special, New Mexico; Fowlerville, Michigan; Greenwood Lake, New Jersey-New York*; Hardinville, Illinois; Jonestown, Mississippi; Knights Landing, California; Leadville special, Colorado; Leavenworth, Kansas-Missouri; Lincoln, California; McComb, Oklahoma; McConnellsville, Ohio; Marcuse, California; Murphysboro, Illinois; New Hope, California; New Kensington, Pennsylvania; Nicolaus, California; Okawville, Illinois; Pikeville special, Tennessee; Princeton, Kentucky; Quincy, Washington; Ramapo, New York-New Jersey; Red Rock, Washington; Roseville, California; Sheridan, California; Southern California; Sutton special, West Virginia; United States base map (a wall map in 3 sheets) without contours, 49 by 76 in.*; Vernon, California; Walnut Lake, Mississippi; Winchester, Washington; Yosemite National Park, adm. map (bound edition). *New editions.

THE GARDNER CRUSHER

The range of material that may be handled to advantage in disintegrators is rapidly widening. Originally machines of this type were used only for soft material, but now hard clinker and cemented gravel are put through them successfully. The applicability of crushers of this type, in connection with jaw crushers and tube-mills, to quartz milling is attracting attention. The Gardner crusher is illustrated in the cut below. The shaft is designed to be driven 1000 to 1200 revolutions per minute, and the movable arms or beaters shown in the figure are made of the best manganese steel. Below them is a perforated plate, and inside the top are ribs of extra hard metal that can be moved down near the beaters in the case of wear. The secret of the high capacity and low repair cost of the machine lies in the fact that the rock is forced to do its own crushing, by making one piece strike another. As explained by the builders, when a stone falls into the apparatus it is seized at once by one of the cranks and broken into pieces. The beaters break the stone while giving way to it, and the chips are immediately caught by the following crank, which acts on them with still greater force. Moreover, under the impulse, the material is thrown against other pieces of the same character, and in the midst of the vortex of iron formed by the cranks a nucleus of matter to be crushed is produced, which is carried along by the centrifugal force, belabored and pounded as in a cyclone. If the material to be crushed offers too much resistance, the cranks, owing to their mobility, turn on their axles, by which they avoid breaking. It is to be observed also that the hammers never strike any part of the crusher. The explanation of the low motive power required by the Gardner crusher in proportion to its high yield, lies in the fact that the cranks act as does a fly-wheel. It is the impact and the friction of one piece of material against the other which does the work. There is no part of the crusher where the material to be crushed can act as a brake.



The makers, the Gardner Crusher Co., 556 West 34th street, New York, give the following table of capacities for crushing cement:

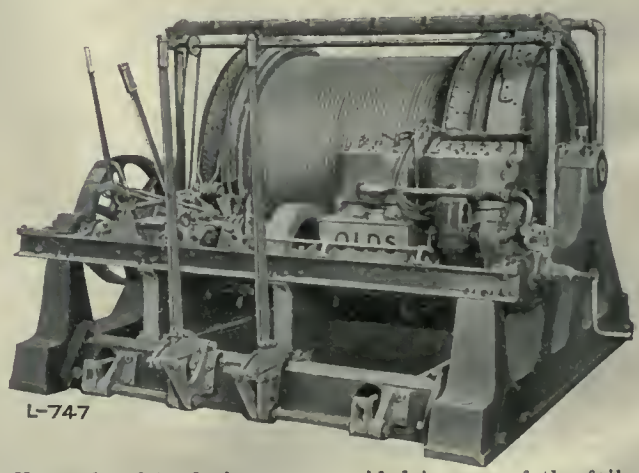
	1	2	3
Feed, inches	4 by 8	6 by 10	10 by 12
Weight	1700 lb.	1½ tons	3 tons
Speed	1000 rev.	900 rev.	800 rev.
Power required	7-10 hp.	12-15 hp.	25-30 hp.
Capacity per hour	3 tons	9 tons	25 tons
Fineness	Everything passing through the 20-mesh screen; about 50% passing through the 100-mesh.		

OLDS GASOLINE MINE HOIST

The engine or power plant of the Olds hoist consists of a multi-cylinder gas-engine of the four-cycle type. The cylinders are cast in pairs, out of the best material that money can buy. These cylinders are annealed to take out all casting strains. Then they are bored and ground to a perfect finish. The pistons are ground into the cylinders, first under auxiliary power, then finished under its own power. The crank-shaft is a hammer forging, with extra large crank and wrist-pin bearings. The valves are of ample dimensions. The carburetor is of perfect design. The ignition system is the 'jump-spark' with both dry batteries and magneto, and two spark-plugs for each cylinder. Ignition troubles are thus positively avoided.

The main working parts of the engine are enclosed in a dust-proof crank-case. Inside the crank-case is a bath of lubricating oil, so all the main working parts are self-lubricated. There is not a single moving part of the engine, except the fly-wheel, that is not protected from dust.

Accessibility to all moving parts for either inspection or repairs is provided. The entire engine can be taken from its frame by the removal of four bolts only, without disturbing another part of the hoist. As no moving part of the engine is exposed, there is no oil flying about, nor is there any condensed steam or water dripping.



Unusual safety devices are provided in case of the failure of the brakes. Two powerful brakes are placed on the winding drum, assuming effective and positive action if everything else about the hoist should fail. One of them can be used as an emergency brake. The clutch lever is operated by hand. When the clutch engages, the engine automatically runs up the speed, and when the clutch is disengaged the engine automatically throttles down to slow speed. At any time after the clutch is engaged, the engineer can throttle the engine by hand to any speed he desires. He cannot, however, make a mistake and run his engine too slow or too fast, as this is governed by a mechanism that operates with the clutch.

The manufacturers claim the maximum of fuel economy and that their hoist is the only one using gasoline for fuel that permits of hoisting different loads at different speeds. The bulletin issued by the makers of this hoist, the Seager Engine Works, Lansing, Michigan, gives a number of testimonials from mining companies.

The Sterlino Lubricator Co., of Rochester, New York, announces the removal of its factory to Norwich, Connecticut, where the shops will be combined with those of the Uncas Specialty Co., the new combination to be known as The Sterling Machine Co. The increased shop capacity and generally improved manufacturing facilities will allow room for expansion and furnish better service for the trade.

The Hodgens-Greene Co. announces the opening of offices at 401-3 State Savings Bank building, Butte, Montana, for the purpose of engaging in general mining and irrigation engineering practice, the exploitation of agricultural and timber lands, mines, irrigation projects, and water-powers, and the management of mining enterprises.

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EDITORIAL

STATE GEOLOGISTS have been meeting at Washington in conference with the Director and other officers of the United States Geological Survey.

ENGINEERS will have large part in the building and conduct of the Panama-Pacific exposition. The choice of Mr. Charles C. Moore to conduct the enterprise is not only excellent in itself, but a compliment to the profession.

OUR excellent contemporary, *The South African Mining Journal*, celebrated its twentieth anniversary on March 18, with a special number of unusual interest. The *Journal* has a record of achievement of which it may well be proud. We extend congratulations and good wishes.

SETTLEMENT of the libel suit of Bayliss *v.* S. Pearson & Son, Ltd., growing out of trouble over management of the Mexico Mines of El Oro, Ltd., has been announced. The defendants disclaimed any intention of making imputations regarding the personal honor or character of Mr. R. T. Bayliss, intending only to criticize his management of the mine. Apology having been offered and accepted, the suit was dismissed.

PORCUPINE will probably be the liveliest gold-mining camp in America this summer. Completion of the railway will make it easily accessible to the great cities of the East, and enough has been done to demonstrate the presence of large quantities of gold ore of a character almost ideal for treatment. It is true that as yet little is known as to the depth to which the ore-shoots extend, but a body 300 feet wide at a depth of 100, and, when carefully sampled, found to assay more than $10 per ton, is itself a sufficient basis for considerable mining activity. Even making allowance for the tendency of decimal points to stray from their proper places, it is clear that much ore of workable grade is present. We print this week a careful description of the deposits, written by Mr. Reginald E. Hore, instructor at the Michigan College of Mines, who is well qualified to discuss the geology of the new district. The boom in Porcupine stocks that started in New York has been temporarily checked. This is not an unmixed evil, since in the list of promoters were the names of nearly all those who did most to discredit Nevada a few years since. Ontario does not need the help of these adventurers, and as for their clients, it may be worth recalling that, while lost woodsmen have often found porcupine meat a savory delicacy, the live animal presents but a prickly exterior to amateur huntsmen.

Zinc Smelting Problems

The metallurgy of zinc is, in many particulars, so peculiar that it can be authoritatively discussed only by a specialist. We have taken pleasure, therefore, in presenting in this, and in our issue of April 15, the review of modern zinc problems that constituted Mr. H. Livingstone Sulman's scholarly address as president of the Institution of Mining and Metallurgy. As befitted the occasion, the review is comprehensive, in that it covers all phases of zinc reduction, and includes summaries of progress throughout the world. In the United States those portions of the address will be read with especial interest that deal with the various flotation processes. Though the principle upon which these processes are based, was discovered at Denver by a schoolmistress while washing sample bags belonging to her brother, an assayer, flotation processes have never been applied on any large scale in the United States. There are undoubtedly large bodies of ore here that can be treated by such processes, but up to the present other means of meeting the situation have been preferred. Such American engineers as have been interested in flotation, Messrs. Hoover, Nutter, and others, have been busy making available the great bodies of zinc residue in Australia. Recently a corporation has been organized to exploit flotation processes in the United States, and doubtless mills will be built in various parts of the country. To a certain extent these processes will come into competition with ore-dressing by means of magnetism and static electricity, but in a broader way the fields are distinct. It is difficult, for example, to think of a flotation plant competing in the Wisconsin field where small units, cheaply built, and requiring the minimum of skilled attention, now operate so successfully. In the Western States where more complex ores occur and gold and silver as well as zinc dust must be taken into account, there is a broader field; and in the West there is much zinc now going to waste. A few years ago the feed of one of the large lead-concentrating plants in a Western State contained within one per cent of as much zinc as would then have rendered the whole operation profitable at Joplin, Missouri, and yet no zinc was saved. Even now there is need, in more than one mill, of a supplementary zinc-saving plant. As Mr. Sulman states, magnetic concentration has usually been applied only to dry ores, and the problems involved in handling wet pulp under magnets are numerous and difficult. As early as 1905, however, at the plant of the United States Zinc Company at Pueblo, Colorado, machines were in use that accomplished this feat. The practice was unusual, and, so far as we are aware, has not been introduced elsewhere. Progress has been rather along the line of better separation of dry ores previously concentrated by ordinary wet processes and improvements in standard methods of zinc smelting. While American spelter-makers have, perhaps, introduced nothing of great novelty, they have made most important improvements so that zinc smelting is no longer far behind other methods of furnace work. The hydraulic-pressed retort is but one of many minor improvements that collectively have raised standards from the old days of hand-fired furnaces with eighty per cent recovery of metal and no by-products, to that in such plants as the Depue works of the Mineral Point Zinc Company. Mr. Sulman's statement of the advantages of briquetting as against charging with ordinary pulverized material is worthy of careful consideration, though at plants where charges are mechanically mixed, and properly dampened and loaded into the retorts, it is entirely possible to satisfactorily treat ores high in lead and iron without briquetting.

Perhaps the most marked development in American methods of handling complex ores is exemplified in such plants as those at Canyon City, Colorado, and in eastern Kansas, where ores are burned with forced draft, the zinc and lead oxides, mixed with some sulphate, being caught in bag-houses and used as a basis of paint, while the cinder left on the grates, and containing copper, gold, and silver, is smelted in ordinary blast-furnaces. The oxide, it is true, is not so well adapted to paint manufacture as is that made at regular oxide plants, but it finds a ready market and the process meets certain situations well. Mr. Sulman mentions Mr. H. Pape's plan of forming an oxide of zinc first and using this in retorts for making spelter. This was done a half-dozen years ago at the Bertha furnace, Pulaski, Virginia, by Mr. J. A. Van Mater. Having on hand a large quantity of calamine tailing containing approximately twenty per cent zinc, Mr. Van Mater burned it to oxide, obtaining thereby an eighty per cent product excellently adapted to sweetening regular furnace charges, and saving many pounds of otherwise worthless material. In a sense he used the oxide furnace for fine concentration, and its possibilities in this direction are perhaps worthy of study. In the Appalachian region flue-dust from the iron blast-furnaces contains much zinc and is regularly saved and sold to zinc smelters. In this there is the germ of a proposed method involving treatment of zinc ores in blast-furnaces, saving the dust, and reducing it in retorts. Whether this will ever be done regularly is uncertain, and the progress being made in direct treatment electrically somewhat reduces the probability. In that connection may be mentioned two papers by Mr. F. T. Snyder that will be read with interest by all concerned with zinc reduction. In the first, on 'The Reliability of Electric Furnaces for Commercial Work', read before the Chicago section of the American Electrochemical Society, January 20, he presented a startling picture of the extent to which electric furnaces have been introduced already in commercial work. The second paper, read at the recent New York meeting of the same society, went into the details of 'The Condensation of Zinc'. That the Canadian commission which is investigating the zinc situation, has in mind the possibilities of electric smelting, is known, and that something feasible in that direction may develop is hoped. In the meantime metallurgists are greatly indebted to Mr. Sulman for his full and fair review of the present situation.

Modern Zinc Problems

By H. Livingstone Sulman

(Continued from page 518)

*The slime problem has been studied by Horwood, who operates by superficially attacking one class of sulphide particle, while leaving the surfaces of the other unaffected, and thereafter submits the product to oil flotation. He usually employs heat to effect this differentiation, a low calcination temperature oxidizing the surface of the galena, while the blende remains unaltered. The Minerals Separation method is preferred for the subsequent differential flotation, owing to its ability to deal with slime mineral. Indeed, a certain proportion of mineral slime is essential to the formation of a coherent froth in this particular oil process. The device of 'deadening' the surface of but one or two different sulphides Horwood has shown may be accomplished by chemical as well as by physical means. His process has been successfully used in certain instances, though the handling of powdery slime in the furnace, maintaining the temperature within the somewhat narrow range permissible, and the consumption of somewhat large quantities of acid in subsequent flotation, are difficulties which at present tend to limit its application. I believe, for example, that it has not been found applicable to the Tasmanian type of ore. Nevertheless, the modification of the surface nature of mineral particles, either in a positive or negative direction in regard to differential flotation, is a principle which is receiving much attention.

It is quite possible that the sphere of usefulness of oil concentration will be considerably enlarged by special preliminary treatments in cases where the raw ore does not lend itself to the direct application of the process. In this connection Dick's process for the treatment of oxidized copper ores must be mentioned. He finds that by heating such material to a comparatively low temperature in a reducing atmosphere, and cooling it in the same, the copper mineral is converted into finely divided metal or into a form capable of ready oiling and flotation. In this simple manner excellent extractions may be obtained on ores hitherto beyond the reach of all but leaching methods, which, owing to local conditions, are frequently incapable of economical application. As so often insisted upon, no process is likely to have a monopoly of employment, even upon a comparatively narrow range of ores, but it may meet special cases with completeness. That under mention will also be watched with interest in its competition with the so-called 'metallizing' process on ores of similar character. Further methods for the proximate separation of minerals require some consideration.

Magnetic separators employing fields of high intensity, and applicable to substances of a low range of magnetic permeability, have still a wide range of usefulness. The Wetherill and Mechernich machines both attained to considerable success in the earlier treatment of Broken Hill middling. I take the following figures from my note-book as showing what was achieved by one of them a few years since. The material to be concentrated contained 29.9% zinc, 8.6% lead, and 12 oz. silver. Two products were obtained: one 44.7% of weight of the whole being a 'leady blende' carrying 36% zinc, 12.9% lead, and 15¼ oz. silver, and the other (20.7%) a blende of 45% zinc, 8.3% lead, and 13 oz. silver. These when mixed yielded a product amounting to 65% of the total, assaying 39.1% zinc, 11.05% lead, and 15 oz. silver. This is equivalent to recoveries of 88.5% zinc, 87% lead, and 81% silver, subject, however, to the usual drawback of a decreased price for the two latter metals. These results have since been exceeded only by oil concentration. Hitherto magnetic separators have been confined to the treatment of dry ore, and however well designed, have always given trouble on account of dust, which is particularly objectionable and dangerous with leady ores. Wet types have been extensively experimented with, and Mr. Ullrich has lately introduced a multipolar ring machine for the treatment of ore pulp. It claims the intensity of field of the older types, and by the application of certain devices overcomes the difficulty of removing small particles from a liquid. Several of these machines are already working, and their possibilities in regard to slime mineral are also receiving close attention.

Electrostatic methods for the separation by electric repulsion of good conductors (such as certain metallic sulphides, pyrite, chalcopyrite, galena, chalcocite, native metals, graphite, magnetite, and hematite) from poor conductors (the silicates, carbonates, oxides, and sulphates—also zincblende) are revived in the Huff machine and process. The first of these processes to be applied in practice was that of Blake and Morscher, in which separation was effected by a revolving electrode energized by direct sparking from a Wimshurst static machine. To these inventors is due the credit of having been the first to introduce a commercial separator on the electrostatic principle. This was followed by Sutton and Steele: in their machine the electrode was charged inductively by a brush discharge, and was furnished with an ingenious interrupter whereby any desired degree of saturation of the separating roller could be obtained to suit the varying electrical capacities of the minerals to be separated. An electrostatic generator was also employed in this type. The main advances in the Huff machine are in the employment of a dynamo-current of suitable intensity, and the discarding of electrostatic generators of the Wimshurst type. The separator is thus capable of adjustment to any required strength of electrical field, and is less liable to interference from climatic conditions. In other particulars it follows previous designs. The limiting factor of electric separators is, so far, their inability to handle fine powders, and their liability to dust trouble unless the dust be first removed.

*Presidential address delivered before the Institution of Mining and Metallurgy, March 22.

After the earlier failures of the centrifugal machine applied to large-scale metallurgical operations, many may have regarded such methods as obsolete, but fresh applications appear possible wherein prominence is given to grading effects little apparent in the shallow basket machine. An interesting apparatus is now on trial. It consists of a long non-perforated cylinder, provided with top feed and bottom discharge devices, the whole rotated from suspension bearings at a high speed. In this elongated drum very marked differences in the classification of particles according to their mass are made, whereby it is claimed that even china clays may be graded with a considerable range and sharpness; even from the best clays it separates some residual mica, otherwise practically impossible, and can also convert portions of inferior clays into products of high class. I have tried it experimentally on other materials and obtained evidence of a good separation. As the grading action depends on length of flow in relation to mass of particle, it is possible that, for some ores, we may have in this appliance the elements of a new machine for slime concentration. Other inventors are still hopeful of the direct concentration of mineral from slime by traveling-belt vanners, and more than one such apparatus is undergoing large-scale trials in England.

In the mechanical treatment of slime, whatever may evolve, we reach the limit of proximate methods of separation. No crushing method of separating one mineral from another with which it is in close physical association can ever be perfect. Whether it be of sulphides from each other, or of either from gangue, the cleavage is always more or less imperfect, as the microscope demonstrates. Even sufficiently separated mineral particles will be likely to retain other chemically combined metals, as silver in blende, for example. This is the departure point of smelting and hydrometallurgical methods, which nevertheless are also subject to their own peculiar limitations. The smelting of complex ore suffers from two main disadvantages: upon the one hand their reduction in the lead-blast furnace is hindered by the presence of an undue amount of zinc, which usually calls for special amounts of flux, and thus is slagged off and lost; and on the other hand, if treated in the zinc distillation furnace, the lead contents cause the destruction of the retorts. The problem has been attacked from both points, and, as is usual, later workers have profited from, instead of being discouraged by, the failures of their predecessors.

Dealing with the former method, H. Pape's reduction of low-grade zinc-lead ores in Germany should be noticed. This consists of smelting them in the blast-furnace with sufficient low-grade silicious ore to slag off the zinc as silicate and recover the lead as metal. The slags are crushed and briquetted with sufficient carbon (together with a binding agent) to effect not only the complete reduction of zinc as metal, but to furnish sufficient heat in the subsequent 'blowing' operation to keep the material molten during the last stages of oxidation. This elimination of the zinc, similar in effect to the New Jersey treatment of franklinite ore, is conducted in a blowing furnace fitted with a special grate, upon which the briquettes are charged to a depth of three or four feet. Upon ignition, a low-pressure air-blast is applied beneath the grate, and the zinc, first reduced by carbon, is blown off and recovered as oxide; the separation proceeds almost to completeness, while the depleted molten slag is discharged through the grate. The zinc oxide is collected in chambers and bag-house plant, the better quality being sold for paint, the poorer to the zinc smelter for reduction to spelter. Nearly 10,000 tons of metal is reported to have been thus produced, and 42,000 tons of zinc slag, as well as low-grade ore, has been treated so in 1910. Zinc residues from spelter production should be amenable to a similar process, large-scale trials having demonstrated the possibility of their profitable handling by such methods when varied in certain details to suit the material. In complex ore-treatment processes, depending upon the prior removal of zinc by distillation, comparatively little progress had been made, if we except electric smelting methods.

It is customary among smelters of other metals to speak of the metallurgy of zinc as behind-hand and lacking in the care and completeness which characterizes their own practice. This reproach is unmerited, as the conditions of reduction of zinc oxide to metal are difficult and peculiar, and the reactions involved highly endothermic. The ore charges, necessarily kept in the condition of rough powders throughout the operations, are very poor conductors of heat, and the production of metal therefrom implies the continued pumping in of heat energy. This imposes a maximum charge thickness of about 8 in., a 24-hour reduction period (from charging to recharging), the provision of small-sized retorts of special construction and with only six weeks life, and in general the handling of large quantities of raw material in very small units. Finally, as it does not pay to carry the extraction of the spelter below a certain limit, the 'seconds' are thrown away, still carrying several units of zinc. Nevertheless, the recovery of metal, upon the whole, is remarkably good. In modern German and Belgian practice a 90% yield of spelter is maintained with roasted blende carrying 50% zinc. Lead recoveries, until the advent of the Huntington-Heberlein process, and others, did not greatly exceed this standard of recovery.

It must be remembered that in the metallurgy of zinc only two operations are required to yield marketable metal—roasting and distillation. When compared, for example, with the various operations in copper practice, involving roasting, sintering of fine, blast-furnace treatment, converting and electrolytic refining, its simplicity partly atones for other disadvantages. Unfortunately, English zinc smelters can not claim equality with the better Continental or American practice, 85% being nearer the usual recovery of spelter here; conservatism, and perhaps undue jealousy in regard to local experience, are responsible for this. The hydraulic-pressed retort, so invariably used abroad, has yet gained but little popularity in this country, where the heavier hand-

made and more expensive article is still the rule. Although gas-fired furnaces are completely replacing the older Welsh-Belgian type, much remains to be done to bring our practice up to the level attained in Continental centres. With a few notable exceptions, a spelter works in Wales is but too often only a revelation of the good work which can still be done with old-fashioned and badly conditioned plants.

The conservatism of zinc distillers seems to be indicated in the indifference of the smelter to 'briquetting' as opposed to 'loose charging' methods. Those who have had experience with the former would not willingly return to the latter, notwithstanding the increased working cost of from 1s. 6d. to 2s. per ton of material briquetted, and the cost of installation. The advantages are pronounced. A furnace will take from 50 to 75% more ore than when loose-charged, all other distillation costs remaining the same, while charging and discharging operations are more rapid and cleanly. The retort will normally take a full charge owing to the greatly reduced slagging, and to the fact that any slag which may accumulate from one charge must be scraped out before a fresh well-fitting briquette charge can be introduced, instead of being allowed to accumulate, as is too often the case with loose-charging. In addition, leady and irony zinc ores, after roasting and briquetting, can be distilled with the same ease as good zincblende material, as no damage to the retorts results from lead, which remains suspended as prills throughout the coked briquette. In loose-charging, the lead sinks through the powdery charge, especially during the 'stirring out' of the residues, and becomes oxidized to highly corrosive litharge during the interval between discharging and charging. The briquetted residues, containing all the lead and silver, are available to the smelter in convenient form.

In the distillation of briquetted lead-zinc ore, a further point of interest is the freedom from lead of the resulting zinc; spelter of 99.5% purity is readily obtainable from complex ore, whereas that from ordinary blendes, distilled by the almost universally practised loose charging method, generally carries from 1 to 1½% of lead. The volatility of lead in zinc vapor is pronounced, but it may be separated to a considerable extent by the filtration of the metallic vapors through a porous medium. This fact has been utilized by Hopkins, who has successfully used a carbon or coke plug between the retort and condenser pipe. It was assumed that the hot carbon stopper exercised some peculiar chemical or physical effect upon the lead; but porous septa of the inert material have since been claimed to possess the same function by other inventors. In the briquetting process the filtration is exercised in the pores of the briquette itself. Under conditions of forced oxidation, such as in the blast-furnace or blowing hearth, lead is as freely volatilized in the form of oxide as is zinc. In the cupola treatment of certain low-grade products containing 11% of zinc and 6% of lead, I have volatilized all the lead while eliminating nine-tenths of the zinc.

In Germany the blowing of oxidized low-grade zinc-lead ores has been practised, a bag-house plant being employed to collect the mixed oxide fume; this was when treated with sulphuric acid for the production of crystallized zinc sulphate, the residual lead sulphate being sold to the smelter. The use of a special type of blast-furnace and the employment of different methods for effecting the separation of the mixed oxides blown off also constituted the central idea of Ellershausen's method; one which, like Asheroft's, very nearly achieved success in the treatment of complex ores.

A marked feature of the zinc industry is its limitation to comparatively few smelting centres. Belgium, Westphalia, and Silesia on the Continent, Swansea in Wales, Kansas, Illinois, and New Jersey in the United States are the seats of the principal zinc reduction operations of the world; and to one or other of these practically all zinc ores are shipped for treatment. Two small plates are installed at Cockle Creek and Port Pirie in Australia, but these can not be said to be effective in view of the large amounts of zinc concentrate now shipped to Europe from Broken Hill, and I am unaware that any great extension of zinc smelting in the southern continent is contemplated. This localization is due to the necessity for cheap fuel, and to the occurrence of the peculiar clays required for retorts; climatic conditions must be suited to the trying conditions of the worker, and above all, the necessary skilled labor must be available. It has been found very difficult to install zinc distillation works without close regard to these limiting factors; in regard to labor especially, it takes many years to train the workers, whose skill and practical knowledge may be said to result from environment, and, in this branch of operative metallurgy, becomes almost hereditary. The failure of one of these conditions may bring about local changes in the industry, as in the case of the gradual failure of the natural gas supply in the Kansas gas belt, and the closing down of many spelter works situated there; only about two per cent of natural-gas-fired furnaces survive, the industry having gradually migrated to the coalfields of Illinois, or to Joplin.

In Australia the labor difficulty is pronounced because of the immigration restrictions imposed on skilled imported labor, and because of the somewhat trying climate conditions of heat and dryness. The cost of distillation naturally varies with the output of spelter. In the larger installations in South Wales £3 per ton of spelter produced may be taken as the cost, including the calcining of the ore. As the latter charge is usually 7s. 6d. per ton, over 15s. per ton of spelter, allowing for unrecovered zinc, is required for this item alone. The actual reduction operation, inclusive of fuel, labor, retorts, etc., will therefore amount to about 40s. per ton of metal produced. But this figure must be increased by the value of the metal lost in the operation, and this is implied in the deduction by the smelter of 8 units from the zinc tenor in the purchase of such ore; this is equivalent to about 35s. Thus 75s. in lost metal value and working cost is incurred in the reduction of one ton of spelter from oxidized ore by

distillation as that process is now practised there.

The 'ultimate' or leaching method of treating complex ores, consisting in the extraction by a solvent of zinc oxide from material containing it, was first practised on an extended scale by Asheroft, at Broken Hill. His failure must be regarded as only antedating certain success along such lines, and metallurgists owe him a greater debt than is sometimes recognized. The difficulties he encountered have in large degree been overcome by later methods; the more immediate cause of his non-success, the production of electrolytic zinc from its sulphate solution, is so far overcome as to form the basis of recent methods; those of Laszczynski and Bradley & Williams will be briefly referred to later. Others avoid the necessity for electrolysis by precipitating the dissolved zinc in such a manner as to obtain a product for the zinc smelter. Typical of such procedure is the zinc bisulphite process, designed to meet the requirements of complex ores which are incapable of reduction by proximate means, wherein roasted ore is submitted to extraction in suitable apparatus by water and sulphur dioxide gas, the latter being derived from the ore during the roasting operation, the zinc is dissolved as bisulphite and separated from the residues which contain the lead-silver, and are sold to the smelter. From the solution the zinc is thrown down as insoluble monosulphite by the removal of one of the equivalents of sulphurous acid; the filtered precipitate, on light muffle calcination, parts with the second equivalent, yielding a dense oxide suitable for spelter production. The eliminated sulphur dioxide is added to the calciner gases, enriching them for fresh leaching work. In this method the ore by aid of water and fuel, furnishes its own extraction reagents, without the interposition of the sulphuric-acid chamber. The sulphate of zinc, simultaneously produced to a certain extent, is allowed to accumulate in the liquor until strong enough for recovery by crystallization. This affords another example of the widened channels for by-product utilization which are continually arising. A short time since it was an established dictum that to leach out zinc in the form of sulphate was to court almost insuperable difficulty, as owing to the limited market for this salt it required conversion to oxide, at a prohibitive cost. The growing demand for white pigments free from lead has changed this, zinc sulphate now largely required for the production of 'lithopone'; indeed the unit of zinc in crystalline sulphate has a considerably higher market value at present than a unit in the form of oxide for smelting purposes.

Although chemical methods have their own difficulties, due to secondary reactions (such as the formation of certain amounts of insoluble zinc ferrite during roasting, whereby complete extraction of the metal is impossible), and are in general somewhat more expensive than proximate methods, they have the great advantage of gathering all the lead, silver, and copper which may exist in the ore into a single smelting product in which these metals are paid for according to the usual scale. Further, the multiplicity of products of varying metal tenor as well as the decreased payment for some of these, is avoided. The initial cost of ore roasting is also offset to a large extent by shipping to the smelter a fully oxidized product, thus dispensing with the preliminary roast of sulphide concentrates otherwise necessary.

A further means for the reduction of zinc sulphate is provided by electrolysis, the deposited zinc being stripped from the cathode and re-melted into spelter, usually of high quality, while the acid regenerated at the anode is used for leaching fresh oxidized zinc from roasted ore, or other product, furnishing a further batch of zinc sulphate liquor. The Bradley-Williams process has been developed in England, that of Laszczynski in Austria and Sweden. Both processes are also available for copper. The careful purification of the liquors is an important factor in either case, as the oxidation of ferrous and manganous salts in the electrolyte to persalts at the anode, causes partial re-solution of the deposited zinc, with consequent loss in efficiency. The bagged anode of Laszczynski's device to a large extent prevents this oxidation, and does not demand so complete an elimination of manganese and iron. Soluble silica, as experienced previously, is also a source of trouble when sulphuric acid is the leaching solvent. In electrolytic zinc methods efficiency in the use of current requires careful maintenance, as energy is the chief item of expense. The electrolyte must be kept uniform by circulation, and current density suitably regulated to prevent 'treeing' of the electro-deposited zinc. Where blende or complex ore is treated it requires careful calcination to obtain good zinc extraction, and in this respect is subject to conditions common to all zinc-leaching processes involving the employment of acid liquors. Some addition of fresh acid will be commonly required for the saturation of bases other than zinc.

In practice it is found that about 5500 electrical horse-power-hour, as a mean figure, is required to produce one ton of deposited zinc, or, roughly, two-thirds of an electrical horse-power-year. With power at 45 kronar, say 50s., in Sweden, the cost for the electrical production of one ton of zinc is therefore about 33s. for energy, this item amounting to rather under 60% of the total process cost. In England the cost of fuel-generated electric power on the large scale is at least double this; with the unit so supplied the electrical horse-power-year costs about 118s., involving an electric energy cost of £3 15s. per ton of electrolytic zinc, to which labor and working costs, remelting charges, etc., must be added. While, therefore, localities favored with cheap water-power will hold an advantage in the production of electrolytic zinc, if plant for the latter be installed at existing zinc reduction centres, dependent upon fuel-generated energy, the balance sheet apparently would still be in favor of the distillation process, despite its poorer recovery in metal. A disadvantage of the electrolytic process lies in the extensive plant demanded, while constant attention of its many units is needed to prevent undue leakage of current. Close supervision is thus called for.

The comparison of the two methods is, however,

not strictly parallel, as distillation applies at present mainly to normal, rather than complex, ores; whereas electrolytic methods—and leaching processes generally—are designed to deal with material not suited to the former. They thus secure an important advantage in the purchase at low prices of the associated silver, lead, and other metals, and in the subsequent realization of these by sale to the lead smelter at ordinary rates. From a narrower point of view electrolysis methods have also to face the competition of other leaching processes, which yield products other than metallic zinc—lithopone from zinc sulphate, as an example—though such outlets are limited in comparison with spelter. A feature of electrolytic zinc is its extreme purity, 99.9% being readily obtainable. This commands higher prices than ordinary brands of spelter, from £28 to £30 per ton being obtained for remelted cake. Such prices, however, can only be regarded as exceptional, the demand for high quality spelter being limited to the production of the finer ductile brasses, such as are used in the manufacture of solid-drawn cartridge cases, etc., and constituting only a small fraction of the total consumption.

The electric smelting of complex zinc ores is now a matter of widespread interest; the processes of De Laval, at Trolhaettan, and that of Snyder, worked at the Canadian Zinc Co., of Nelson, British Columbia, may be selected as typical and involving the two types of electric furnace: the first named employs the electric arc, and the second slag resistance, as means for converting electric energy into heat. Compared with the ordinary retort furnace the utilization of the energy in the electric furnace is high; in the former only about 5% of the total fuel is actually used in spelter production, whereas in the Snyder furnace it is claimed that 75% of the total electric energy supplied is utilized in the reactions, the balance representing the heat of the escaping carbon monoxide and of molten spelter and that lost by radiation conduction, etc. In the arc system the energy is not so fully absorbed in useful work.

In the Snyder process the complex ores are first calcined to oxides, and mixed with the fluxes necessary to form slag with the gangue. Such slags are regulated to a formation temperature of between 1000 and 1100°C. and to a sufficiently high degree of electric resistance: they are of low specific gravity and have no tendency to dissolve zinc oxide. The charge is preheated by the escaping gases which result from the reduction operation. The furnace consists of a double well of molten lead-bullion into which the conductors pass, these wells being electrically connected only by the slag which lies above them, and into which the heated charge is periodically introduced. A layer of carbon is maintained upon the surface of the slag bath whereby it is heated to incandescence. The zinc is volatilized and condensed in suitable chambers, while the lead, silver, etc., sink through the slag into the wells in which the molten metal is maintained at the proper height.

Snyder claims to have smelted pure zinc oxide in such a furnace, for 1050 kilowatt-hours per metric ton of oxide. Mr. Richards has given the heat equation as follows, a kilowatt-hour producing 860 calories:

1050 kilowatt-hours	= 903,000 cal.	
Heat absorbed in reactions	= 687,000	903,000 cal.
Loss of heat in spelter and gases	= 116,000	
Balance, loss in radiation, etc.	= 100,000	

The total electro-thermal loss is 216,000 calories, or 24%, of the electric energy supplied to the furnace. Snyder has laid down the principle that "the heat absorbed in an electric furnace by chemical reactions is electrical energy utilized at an efficiency of 100%. It is only a portion of the sensible heat of the materials treated which is lost by radiation and conduction. These losses should be expressed upon the total energy of the current used after deduction of the heat absorbed in chemical reactions, and not upon the total energy of the current." On the latter basis Mr. Richards quantifies the loss of radiation (100,000 out of 216,000 calories) as 46% of the electro-thermal losses. This is but an alternative method of stating the case, and it seems advisable to point out that there is no utilization of electricity herein for purposes of electrolysis, the energy applied electrically being converted entirely to heat; electrolytic application of the energy would involve greater current consumption than is here shown. It is the carbon admixture which supplies the balance of the energy required. This principle may be said to be equally true as applied to heat generated from fuel.

Notwithstanding the excellent figures demonstrated to be attained, they are conditioned by the cost of the electrical unit: indeed, the limitations imposed in this respect apply as closely to electric smelting as to electrolysis. Electric zinc-smelting may be regarded as a very efficient way of applying a more expensive heat unit, and as permitting a greater concentration or intensity of heat within a narrow area than is attainable by ordinary combustion methods.

RATE OF BURNING OF FUSES

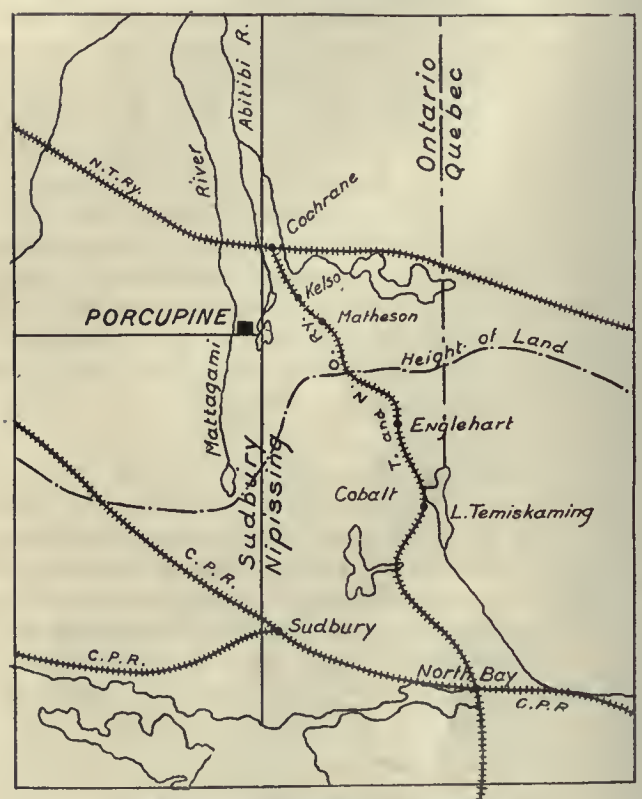
The explosives chemical laboratory of the United States Bureau of Mines at Pittsburg, Pa., is contemplating a study of the influence of temperature and pressure upon the rate of burning of time fuse. It has been found that fuses having a normal rate of burning of 27 seconds per foot may, under the influence of pressure alone, burn as fast as 8 seconds per foot. Conditions of temperature may cause it to burn as slowly as 70 seconds per foot. A centrifugal method has been developed for determining the liability of explosives to exude or 'leak' nitroglycerine from cartridges. Many accidents have occurred from this cause.

Outcrops of manganese ore in a country of precious metal mines should always be carefully prospected, or assayed, for silver and gold, as manganese oxide is often the gossan of a vein of lead-zinc-silver ore, just as a silicious iron outcrop often covers a copper deposit. Such outcrops of black manganese ore are not uncommon in Nevada.

Gold Quartz Deposits of Porcupine, Ontario

By Reginald E. Hore

Gold-quartz deposits discovered in northern Ontario in the summer of 1909, and tested during the past year, have proved to be important. The scene of the discovery is in forest-covered country where low hummocky rock outcrops appear at the southern edge of a vast flat clay belt. Porcupine lake, from which the camp receives its name, having a latitude 48° 30′ is a little farther south than the international boundary between British Columbia and Washington. It is 360 miles north of Toronto, 100 miles northwest of Cobalt, and 200 miles south of Hudson's



Map Shcwing Position of Porcupine.

Bay. The main line of the Temiskaming & Northern Ontario railroad, running from North Bay, the junction of a Toronto branch of the Grand Trunk railway, with the transcontinental line of the Canadian Pacific, to Cochrane, a junction point with another transcontinental railroad now under construction 250 miles farther north, passes 25 miles east of the gold camp. A branch line of this railroad, which is owned and operated by the Ontario Government, is now being constructed into Porcupine, and is expected to reach the lake in June 1911.

The exploration of the deposits, which has up to date proved highly satisfactory, has been carried on under difficulties arising chiefly from lack of summer transportation facilities. Part of the distance from the railroad was readily covered by motor boats on the water-ways; but part had to be negotiated over wet clay roads. It is a country in which level roads are easily found, but the clay stretches, protected by thick forest, and poorly drained, are usually so wet that the summer roads across them have been poor and for heavy loads practically useless.

In winter, however, these roads, if given a reasonable amount of attention, afford a means of transportation unequalled by any wagon-road. During the present winter, therefore, great quantities of supplies are being hauled over the sleigh road from rail at Kelso to the gold camp. The completion of the branch railroad line will settle the transportation problem for some of the mines, while others will have to make but short hauls. With crushed rocks from the mills, the wagon-roads can be much improved. The goldfield is fortunately situated near the Mettagami river, and waterfalls will be utilized to generate power for one mine. The building of a plant is being energetically carried on, and it is expected that the camp will be supplied with electric power early in the summer. For preliminary operations in exploring properties, there is an abundant supply of wood on the claims, and there are numerous small lakes and streams. At Porcupine lake, a shallow body of water two miles long and three quarters of a mile wide, numerous buildings have been erected, and as these include three hotels, visitors can find suitable accommodation there. The trip over the railroad from Kelso to Porcupine takes about six hours. Kelso can be reached twenty-four hours after leaving Toronto.

The most important orebodies which have been developed are those of the Dome and Hollinger mines, both of which are in Tisdale township, but three miles apart. To explore these deposits, machinery and supplies were rushed in on the winter roads a year ago.

At the Dome mine, which is controlled by men who are also interested in the Sudbury nickel deposits, a large quartz mass enclosing much rock but measuring on the surface 200 by 600 ft., has been thoroughly tested to a depth of 60 ft., and explored by drilling to a depth of 400. The ore is white quartz containing native gold associated with pyrite. In places, especially near the wall-rocks or masses of enclosed schists, the gold in coarse grains is readily visible. Most of it is, however, very fine. The microscope shows that in specimens examined, while the gold is closely associated with pyrite, much of it is not in actual contact with pyrite, and only a comparatively small amount is intergrown with the sulphide. The country rocks are gray sericite schist, gray slate, and a schistose conglomerate. All the rocks are impregnated with carbonates—ferrodolomite. Three shafts were sunk and drifts and cross-cuts made at regular intervals on the 60-ft. level. A sample of the ore broken was crushed by a Nissen stamp and passed over an amalgamation plate and a Deister table. The recovery on the plate and table proved the average samples to represent a good grade of ore. There is a large tonnage of ore above the 60-ft. level. Diamond-drilling has proved the existence of good ore to a depth of 400 ft. It is evident, therefore, that there are several hundred thousand tons of quartz and pyritic schists which can be mined and milled at a good profit. The exploration of the ore deposit is now temporarily suspended while operations

are being made for mining and milling. A permanent hoisting shaft is being sunk, and the exploration workings will be used in breaking down the ore. According to a writer in the *Canadian Mining Journal*, a high-grade concentrate is obtained on the table and the tailing warrants cyanidation. Tests show that on re-grinding the concentrate a large percentage of the gold can be recovered by amalgamation. Concentration will therefore be abandoned, and in the experimental tests 48% of the gold has been recovered by amalgamation after two-stage grinding to 90% through a 200-mesh screen. The ore is practically free from cyanicides. Mill-runs of ore at the experimental plant of the Merrill Metallurgical Co. last fall proved so satisfactory that it was decided to build a mill at the property as soon as possible, and the plant has been shipped. Four units of ten stamps each will be erected at once and provision made for later additions. After two-stage preliminary crushing, the ore will be conveyed to the stamps, then pass through 18-mesh screen and over plates, then into classifiers, tube-mills, and over a second set of amalgamating plates. The overflow from hydraulic classifiers goes to Dorr thickeners, and the slime is then agitated in a series of continuous Pachucas. Combined thickeners and storage-tanks will feed to Merrill slime-presses. The gold will be precipitated by the Merrill zinc-dust process.

Kelso Mines. Cars Loaded With Freight for Porcupine.

Hollinger Mine. Shaft No. 1, Stock Pile, and Test Mill.

Stage and Freight Teams on the Road to Porcupine.

On the Porcupine Trail.

At the Hollinger property, part of the holdings of the Timmins-McMartin-Dunlap syndicate, which developed the La Rose mine at Cobalt, there is a system of gold-quartz veins forming part of a veined zone which runs in a northeasterly direction across Tisdale township. Exploration up to date has been confined to the largest of these veins. The ore, like that at the Dome, is white quartz showing native gold associated with pyrite. Some gold is found, as on several other properties in Tisdale township, in coarse particles readily visible to the naked eye. The country rock is a gray sericite schist, chiefly composed of carbonates, sericite, and quartz. The vein has been carefully stripped, and shows more or less continuously for several hundred feet. Three shafts were sunk in the ore. Two of these, 660 ft. apart, have been connected at the 100-ft. level by a tortuous drift following the vein. A winze has been sunk in the vein to the 200-ft. level, and it is said to be in ore as good as that at the surface. According to N. A. Timmins, the vein being worked has averaged 6 to 8 ft. in width; the value has been fairly uniform throughout, the returns from sampling and assaying have averaged $49.80 in gold per ton, while from the Tremaine test-mill the recovery has averaged over $50 per ton, corresponding to a saving of about 85% effected without concentration or effort to treat the sulphides. The Timmins interests are now erecting a 30-stamp mill, and the Hollinger mine will have first claim for treatment. The nature of the secondary processes to be used has not yet been decided. During 1910 the gold production in Porcupine came from the test-mills on this property and the Dome.

At the Vipond property, owned by the Porcupine Gold Mines Co., coarse gold occurs with pyrite in quartz veins in rusty-weathering carbonates, which are in part chloritic. Development during the summer was not extensive, but some rich ore was taken out. During the fall a 2-stamp mill was hauled in over the clay roads and is now in operation.

At the Rea mine, Connell claim, belonging to the Consolidated Gold Fields of South Africa, a white

quartz vein 15 in. to 5 ft. wide has been stripped for over 200 ft., and is now being tested by drilling. It carries free gold associated with pyrite. In places there are rich shoots which show numerous particles of coarse gold, part in comparatively clear quartz, part on and near one wall. The country rock is a light colored rusty-weathering ferrodolomite rock which is apparently an altered hornblende andesite. Near the main quartz vein there are a number of minute quartz veins running into the carbonate.

On the Foster claims, controlled by F. A. Heinze, there is a quartz-ferrodolomite vein which has been exposed continuously for several hundred feet. It shows a remarkable series of quartz veins traversing rusty-weathering carbonates. Coarse gold can be seen in several places in the quartz. The country rock is a gray sericitic carbonate.

Northwest of Porcupine there are a number of deposits which have been explored to more or less extent. Considerable work has been done by the Crown Chartered and Scottish Ontario companies, and more recently by the Tisdale Mining Co. Several important discoveries have been made on adjoining claims, but have not been as yet extensively explored.

The general geological features of the new goldfields are similar to those of well known areas of pre-Cambrian rocks in the Lake Superior district. The ore deposits and their immediate wall-rocks are in many ways remarkably similar to the most common type of gold-quartz deposits in California. The rocks in the immediate vicinity of the gold-quartz veins are of types common in the Keewatin and Huronian formations. The Keewatin rocks, all of which are much metamorphosed, and many schistose, are chiefly altered igneous rocks, mostly volcanic, with a subordinate volume of altered sediments. The Huronian is wholly sedimentary. Most of the important gold discoveries are in members of the Keewatin series.

The most constant feature of the immediate wall-rocks of the veins is the high percentage of carbonates and sericite which they contain. The wall-rocks are usually completely, or almost completely, made up of secondary minerals. The lighter colored rocks are chiefly composed of carbonates, sericite, and quartz, while darker ones contain chlorite and magnetite. In one case, at the Rea mine, a dark colored rock of this type grades into a more distinctly igneous type containing partly altered crystals of plagioclase feldspar and hornblende, and which was probably originally a hornblende andesite. In another case, at the Hollinger mine, the wall-rock is light in color and free from chlorite and magnetite, and was probably originally a light colored siliceous volcanic rock such as the quartz-porphyry which occurs in the vicinity. In a third case, at the Dome mine, there is in addition to altered volcanics, a conglomerate in which the matrix consists largely of carbonates, sericite, and quartz. Other deposits, while showing a variety of rock types, are similarly characterized by an abundance of carbonates in the wall-rocks, and it is probable, therefore, that such carbonates were introduced by solutions which penetrated the fissures later filled with gold-bearing quartz.

The carbonates have been variously designated as ferrodolomite, ferruginous dolomite, dolomite, ankerite, and siderite. Commonly they weather rusty, and the presence of iron is thus evident. In other cases the surface weathered specimens are comparatively free from red stains and the iron content is probably low. None of the available analyses of rusty-weathering carbonates show an iron content as high as in siderite or normal ankerite. For such rocks the term ferrodolomite is here preferred, though the term ankerite has been used for quite similar rocks in some localities, and is in common use in the new camp. The rocks are similar to some which are found in Keewatin rocks in such association with types of sedimentary origin, that the carbonates are believed there to be sedimentary beds also. The wall-rocks of the Porcupine gold deposits are nevertheless believed to be the result of secondary replacement by solutions containing an abundance of potassium, which is now present in sericite, and of carbonates and carbon dioxide.

The various deposits can be grouped from their form into four classes: (1) Single fissure fillings or veins; (2) a series of intricately connected filled fissures forming a vein system; (3) quartz-ferrodolomite lodes in which quartz veins form an intricate network in a band of carbonates; (4) quartz masses of irregular and unknown shape. The veins and vein systems show that extensive crystal movements preceded the deposition of the ores. Evidently there were numerous fissures running more or less continuously for several miles in a northeasterly direction. The extensive fracturing of the rocks was not unlikely accompanied by the movement of igneous material closer to the surface. The wall-rocks were probably altered by and the gold-quartz veins formed from hot solutions which penetrated farther than the main mass of molten magma. Since the crystallization of the quartz it has evidently been subject to severe stress, as the grains are distinctly strained and somewhat granulated. The quartz veins in Tisdale township are younger than any rock exposed there, the fissures cutting Huronian as well as Keewatin rocks. There is little or no evidence that the quartz veins have been formed by replacement. Apparently the carbonate deposited in the wall-rocks previous to the vein formation acted as a barrier preventing the escape of silica into the wall-rocks, except along the minor fissures in the latter. Numerous veinlets of quartz run from the large quartz masses into the carbonated wall-rocks; but the quartz in such cases is very distinctly confined and often separated from the rock by a very finely granular border of carbonates.

The gold occurs in quartz that is usually characterized by pyrite and to a less degree by sericite and calcite. Plagioclase feldspars have been found in the Hollinger vein by C. W. Knight, and in the Vipond by John Stansfield. The quartz is commonly massive. It is generally white, but some veins are of bluish gray color. The quartz is in part of coarse

grains 0.5 to 1 mm., and in part of finer grains 0.05 mm. in diameter. The coarse grains commonly show numerous inclusions, indicating a probable high temperature and complex character for the solution from which it crystallized. It shows marked strain shadows indicating subsequent subjection to deformation stresses. The finer quartz is comparatively free from inclusions and does not show marked effects of strain. It is evidently younger than the coarse. Some of it was probably produced by the re-crystallization under pressure without moving far from its original place. Some evidently was brought in from elsewhere. Gold occurs sometimes completely enclosed in single coarse quartz grains, but is more common otherwise.

Quartz-Ferrodolomite Lode, Foster Mine. A 15-Inch Quartz Vein in Schistose Carbonates.

White Quartz in Gray Schist, Hollinger Mine.

It is most common in specimens showing fine-grained quartz, and is frequently in or in contact with the fine quartz. Gold occurs also in calcite and in pyrite. The pyrite is in part at least as old as the coarse quartz. The calcite, while older than some of the gold, is younger than the coarse quartz. The coarse quartz of the vein is evidently younger than the ferrodolomite in the wall-rock. While the gold-quartz veins have characters which mark them as deposits from hot solutions, such as are given off when a molten magma is intruded near the surface, there is not in the vicinity of the deposits any mass of igneous rock which is likely to have been formed from the same magma. According to W. G. Miller, there are within a few miles of Porcupine large masses of granite which are intrusive into the Huronian. It is possible that these may be genetically connected with the gold deposits. It is interesting here to note that many of the California deposits occur also in metamorphic rocks a few miles from the edge of large masses of granitic rocks.

In view of the above description, it is of interest to quote here some general remarks made by Waldemar Lindgren,* of the United States Geological Survey, on the characteristic features of California gold-quartz veins. The similarity of the Porcupine deposits to them will be evident:

1. "Within the typical gold-bearing region (of California) the veins are distributed with marked impartiality, and occur in almost any of the great variety of rocks which make up the metamorphic series."—A similar statement would be true of the Keewatin series in Tisdale township.

2. "The gangue is quartz, with a smaller amount of calcite: the ores are native gold and small amounts of metallic sulphides."—In Porcupine calcite is very subordinate in the quartz veins, the ore is native gold, free or in pyrite.

3. "Adjoining the veins the wall-rock is usually altered to carbonates and potassium-micas by metasomatic processes."—This can be stated to be quite characteristic at Porcupine also.

4. "The veins have been filled by ascending thermal waters, charged with silica, carbonates, and carbon dioxide."—The same deduction may be drawn from the nature of Porcupine wall-rocks and veins.

5. "The gold-quartz veins of California do not in their surface relations show any remarkable dependence on acid igneous rocks."—It has been pointed out that there are no such rocks in Tisdale township of the same age as the gold deposits. The deposits may, however, be genetically connected with granitic masses, such as are exposed a few miles away, and which underlie the rocks in Tisdale township. An analogy is to be found in the granodiorites of the Sierra Nevadas.

NATURAL-GAS LEAKAGE IN COAL MINES

Two coal mines in West Virginia were recently sampled and analyzed for natural-gas leakage apparently due to a natural-gas well passing through a barrier pillar. Gas was found bubbling up through the water, which, upon examination, corresponded with the natural gas obtained from the well. Samples of mine air vitiated by explosives fired in mines were examined and found to contain in some cases harmful amounts of noxious gases. Samples of natural gas from Nevada were examined, and in one case found to be exceedingly rich in methane.—*U. S. Bureau of Mines.*

*Bull. Geol. Soc. Amer., Vol. VI, 1895, pp. 221-240.

A Farncomb Hill Story

By A. J. Hoskin

Probably every well informed American miner or, at any rate, every Western gold miner, has heard about or actually knows something concerning the wonderfully rich, beautiful, and mineralogically interesting native gold specimens taken from fissures in Farncomb hill, in the Breckenridge district, of Colorado. The most interesting period in the history of the working of these veins was some twenty-five or more years ago, but the residents of the region still take much pleasure in their reminiscences of the days when the coveted yellow metal was taken out of the ground 'in chunks.' At the present time, this same region is attracting wide notice because of the successful dredging that is being conducted by several companies. As a rule, the gold that is being recovered from the placers of Breckenridge is comparatively coarse and nuggets ranging up to an inch in length are occasionally found in clean-ups. Various stream channels are being worked in the district, but the finest nuggets are found in those channels that head well up in Farncomb hill. Of course, the coarsest gold is found nearest its original lode source, so that the dredges working in French gulch recover much coarser gold than the boats that operate in the Swan river and the Blue river. The source of the gold now being found so abundantly in the bed of French gulch was undoubtedly quite close at hand and was probably the upper portions of veins which, during rather recent geological times, have been broken down by natural agencies. This gulch is flanked by Farncomb hill, and there can be no question as to the original deposition of the gold in the veins of that famous mountain. Despite the disintegration and erosion which have destroyed and removed a very considerable depth of the original solid structure of this mountain and have converted the upper parts of gold-bearing fissures into constituents of placer ground, some of these same veins were left for the destruction of man. A quarter of a century ago fortunes were quickly made—some of them as quickly dissipated—by humble, but hardy, prospectors who were either successful or 'lucky' in discovering these remarkable orebodies.

Although the presence of such rich auriferous veins was long suspected, these deposits eluded the search of miners for years, since the hills and valleys of the district were clothed quite completely with an abundant covering of 'wash' that rendered an inspection of the rocks in place impossible except at much labor and expense. Accordingly, much credit is due to those prospectors who overcame this natural obstacle by sheer perseverance and the exercise of hard manual labor. At the same time, there is a sort of glamor accompanying any discovery of great moment, even if it be by mere chance, and the lucky men feel a double sort of reward—they get fame as well as riches from their fortunate strokes. The rich Farncomb hill veins were finally uncovered through chance. The residents of Breckenridge delight in telling tales of the adventures of the men who dug the beautiful gold from its matrix in 'chunks' and 'slabs.' There is none of this wonderful mining now, placering having taken the scene of action. This is not stating that there are no more of the wonderful deposits still intact, and it seems strange that greater effort is not exerted, nowadays, to carry on the underground mining that was typical of the years gone by.

In the days mentioned, three miners were working a partnership claim up on the famous hill, almost to the very top, where the covering of soil was thinnest and where, therefore, the excavations necessary to reach bedrock were most shallow. Two of the men were married. One of these married men was fortunate enough to have his wife with him to keep house in a cabin not far from their labors, in the then little but lively camp of Lincoln. The two other men 'batched,' and when at work in their cabin was necessarily left unguarded. This fact led to the practice of all three men pooling their finds and carrying everything of value to the cabin occupied by the lady, there to be left in her custody during the hours when her husband was at his mining labors. Success rewarded the efforts of these hardy prospectors, and they, ere long, were quietly carrying home, each evening, pocketfuls and bucketfuls of the native gold. Such a statement of quantity seems hard to credit; but it seems to be unquestionably true that the fortunate miners of that time did actually 'pack' away the precious metal by the pound. It thus became the duty of this miner's wife to act as guardian of quite an accumulation of gold.

Now it happened that this same woman had, before Fortune's advent, for frugal reasons, put in a small stock of general merchandise, which she kept on sale to the prospectors and miners who could not readily travel the several miles to Breckenridge for supplies. As a still further means of livelihood and as a convenience to her patrons, she also conducted a primitive postoffice. In those same days there roamed over the region, doing desultory prospecting, a man who is still a resident. He will vouch for this story in which he will appear as the star character. One day this man, whom we will call Jack for short, drifted into the cabin store, as was his frequent habit, just to "rest a bit and to inquire for mail." This particular day, however, stands out clearly in his memory. It was upon this occasion that he learned for the first time of the three prospectors' good fortune. The lady in charge had inadvertently left the door of her cook-stove open and the caller's gaze became riveted upon an ordinary bread-pan within the oven. In order to thoroughly dry the quartz and other gangue brought home with the native gold and thus render possible its pulverization in an ordinary mortar and pestle, it was the lady's duty to occasionally make this moisture run. The men would subsequently complete the separation by crushing and panning. While this appears now to have been a very crude scheme, it was, nevertheless, an effective one. On this particular day, the bread-pan was overflowing with the tempting masses of beautiful gold. An overwhelming covetousness instantly seized Jack. He shortly withdrew to

concoct a scheme whereby he might, without resort to force, become the possessor of at least a part of this treasure in the oven. Cogitation soon conceived a fictitious, sudden, but powerful attack of bowel derangement which he might relieve by the taking of doses from the bottle of patent medicine that he recalled having noticed upon a top shelf on the opposite side of the room from the stove.

Returning to the store and simulating the symptoms of colic, Jack requested the lady to sell him the remedy, at the same time excusing himself from gallantly climbing up for the bottle on the plea of his distressing ailment. The proprietress therefore laboriously placed a chair and a table in position and clambered up. While she was thus busy in securing the package from the shelf and was necessarily standing with her back turned toward the room, the man quickly reached into the oven and deftly accomplished his pre-arranged theft of one of the largest nuggets which lay on the surface of the panful of gold. The clever scheme worked out precisely as he planned and he was now the possessor of a beautiful treasure. It being mid-summer, this mountaineer wore rather scanty clothing, especially during the middle of the day when he was wont to do his tramping and climbing. Upon his trips, he found comfort in the simple apparel of hat, shirt, trousers, and footwear, the shirt, furthermore, being open at the chest. Excitement immediately followed the possession of the nugget. As is frequently the case in questionable dealings, this proposition turned out to be a 'hot one.' The gold nugget was actually quite hot, too much so for comfortable handling. At such times as this, persons who have had absolutely no premonition of impending necessity often do very original and dexterous feats. In his emergency, therefore, this man instantly dropped his heated acquisition into the opening of his flannel shirt, whence it immediately gravitated to a stable horizon just above his belt-line. Probably for the first time in his life he now appreciated the fact that the skin on one's palm is considerably more fire-proof than is that of one's abdomen. The gold cure has become famous as a treatment for the liquor habit, but this man established the effectiveness of an external application of the metal as a sure cure for bowel complaint. Whether or not the gold really exerted any magical effect, Jack's ailment of the minute before had vanished. Having no further need or desire for the bottled remedy—and possibly to avoid spending his hard-earned money for something he did not need—he very unceremoniously bade his lady friend adieu by yelling as he flew through the door, "I can't wait. I don't want it."

A minute or two later, his hasty exit was fully explained in the lady's mind, for she noted the absence of some of her batch of baking. Just then gold nuggets were rather plentiful at this small establishment, while good jokes were more rare. So it was a jolly party that discussed the day's happenings in the store that evening. It was generally agreed that the visitor had received fair punishment for his crime, and nothing was ever done toward the enforcement of a legal penalty.

PLACERS IN CALIFORNIA AND ARIZONA

There are few placers in either California or Arizona that are not known and claimed. There are large areas in California still unworked, but these are mostly in the arid regions of Mojave and Colorado deserts. Some important instances are the dry placers at Summit, north of Randsburg, in Kern county, and extending southwesterly to Goler and Garlock. There are placers 2 miles north of Randsburg. In fact, the entire desert wash of that region contains gold which in some localities has been concentrated by winds and rain to a condition of payable ground. Another locality is that 10 miles north of Barstow where a large area of gravel is gold bearing. In the Colorado desert gold is found in the wash in the Cargo Muchacho mountains, 15 miles north of Yuma; at Picacho basin, on the Colorado river; in the Monte Negras, 45 miles northeast of Thermal, and at numerous other places. It is needless to say, however, that every place known to contain gold in payable quantities has been or is being worked. The same may be said of Arizona. Extensive placers occur in the valleys of both the Colorado and Gila rivers. One locality is near the Gila, 20 miles above its confluence with the Colorado. In the valley of the Colorado, placers are known from the vicinity of Yuma up the river to above Ahrenberg. In the vicinity of the latter town is cemented gold-bearing gravel, which has never been profitably worked because of the indurated character of the ground. Modern disintegrating and dry-washing machinery will overcome the mechanical difficulties. The difficulty is to find a spot sufficiently rich to pay. In central Arizona placers have been worked since 1860 and a large amount of gold obtained. The region covers southern Yavapai, northern Maricopa, and a good portion of Yuma county. It is possible that many good places remain unworked, but have been too poor to pay by the slow, small-scale, primitive methods of the earlier days. To such areas modern methods and machinery must be applied. There are doubtless many places where profit would result from the intelligent application of capital and energy, but these favored places must be sought out by actual trial.

Mining costs vary with the nature of the deposit; its geographical position controlling costs of supplies, labor, etc., and the personal equation of management. Magnetic separation costs vary directly according as the crude ore is easy or difficult of comminution preparatory to separation, and inversely as the amount of magnetic oxide contained in the ore. The actual separation process costs but a few cents per ton.

A good substitute in place of glue or various kinds of cement for fastening emery cloth to the disks of grinders is to heat or warm the disk and apply a thin coating of beeswax; then put the emery cloth in place and allow to set and cool under pressure.

Economy in Drill Steel

By G. E. Wolcott

There is no single item in connection with the economical breaking of rock with dynamite, of more importance than the quality of the cutting tool em-

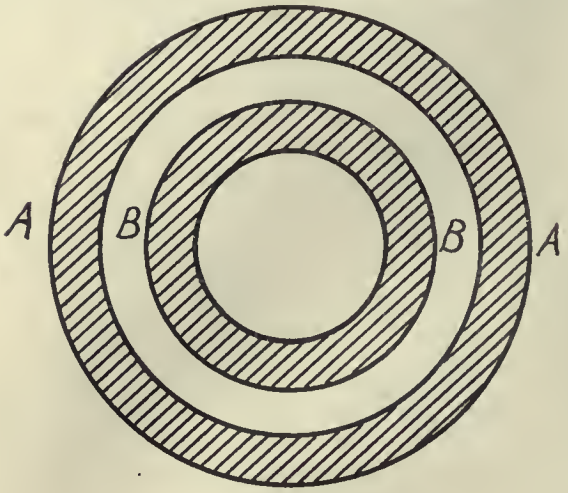


Fig. 1.

ployed in drilling. The best machine will accomplish indifferent results with poor steel. With poor cutting tools there is a loss due to higher power consumption for a given amount of drilling, a loss in

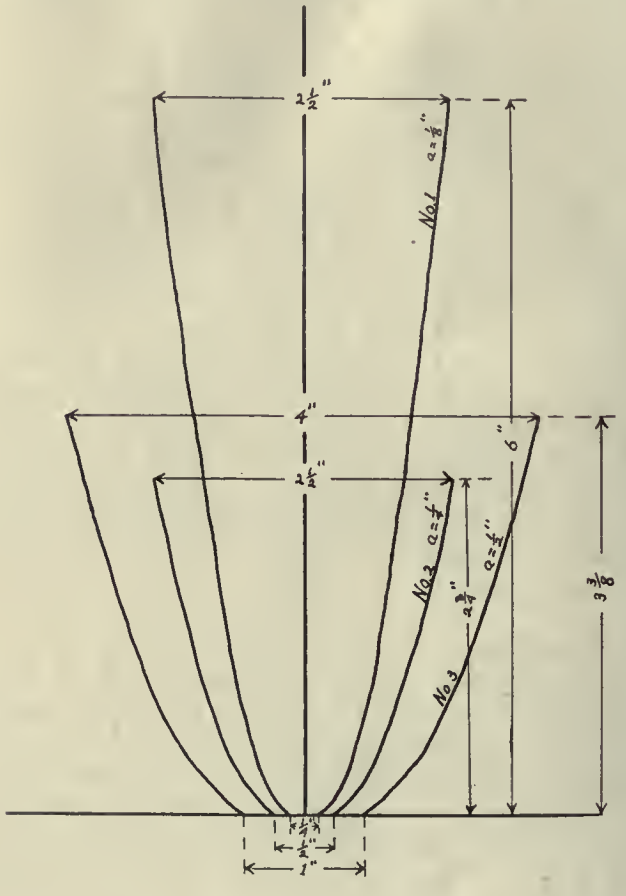


Fig. 2.

time of high-priced labor, and a further loss because of the necessity for more frequent renewal of the bits. The initial cost of drill steel is of little importance as compared with its quality and the shape and quality of the cutting bit formed upon it.

If a piece of steel 3 ft. in length weighs 10 lb. and costs 10c. per pound the initial cost will be $1. If during a year's use it is sharpened on an average once every two days, and the sharpening costs 5c. per bit, the steel will have cost $9.10 during the year for sharpening alone. A steel costing 40c. per pound will be cheaper at the end of the year if the amount of sharpening it receives is reduced by one-half. If the increased drilling efficiency due to a more resistant bit be taken into consideration, it is no exaggeration to say that a steel costing $1 may be cheaper than one costing but 10c. per pound.

The development of the air-hammer machines during the past few years and the tendency of these

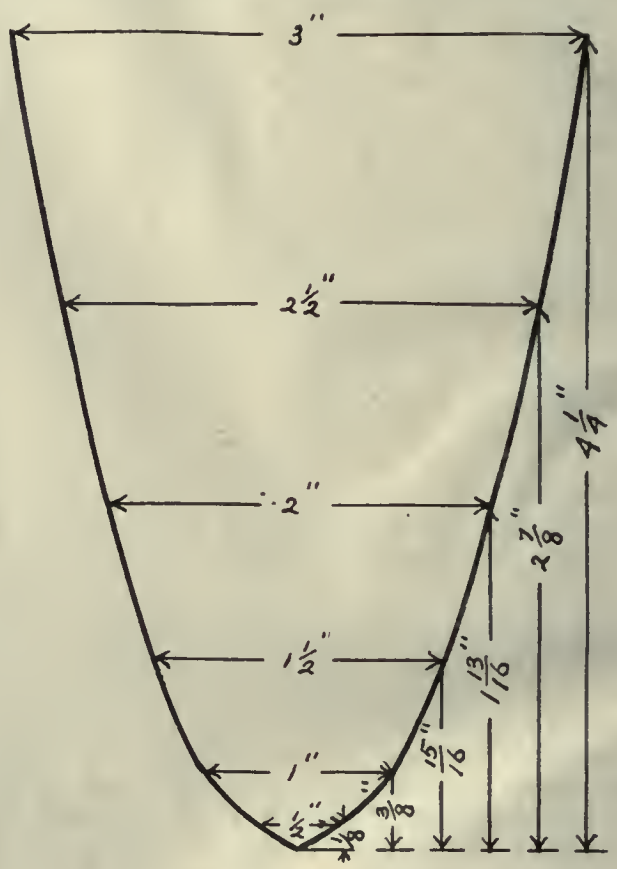


Fig. 3.

machines to break steel, has led to the manufacture of special brands to meet the more exacting demands. Of these, vanadium steel seems to be giving most satisfactory results and is now being manufactured at a cost not much greater than ordinary steels. It is quite probable that the next few years will see this steel used almost exclusively for rock-drilling purposes.

The arguments above presented are of equal force when applied to the proper shaping and tempering of the bit. The best of steel can not do satisfactory work when poorly sharpened, and too much stress can hardly be laid on the proper shape of the cutting bit. It is the purpose of this article to bring out certain points in this connection that, so far as I know, have heretofore received little consideration.

In the cutting of a round hole by a rotating bit, the amount of material to be cut by a certain portion of the bit will increase going away from the centre of rotation. For this reason the cutting edge of a bit having a square face will always dull first at the outer corners. In Fig. 1 if *A A* and *B B* represent

two annular segments or portions of rock to be cut, and the width of these segments is the same, then the area of the segments will vary directly as the distance from the centre of rotation. It follows from this that if a bit is so made as to dull equally over its whole cutting edge the number of edges or their lengths must increase in direct proportion to the distance from the centre. In practice it is not practical to increase the number of cutting edges, but the length of the cutting edge may be made in direct conformity to this rule. A steel so sharpened will dull equally over its whole face and will stay sharp longer than any other shape. The exact shape of the bit will be a logarithmic curve, the equation of which has been deduced by C. C. Van Nuys of the

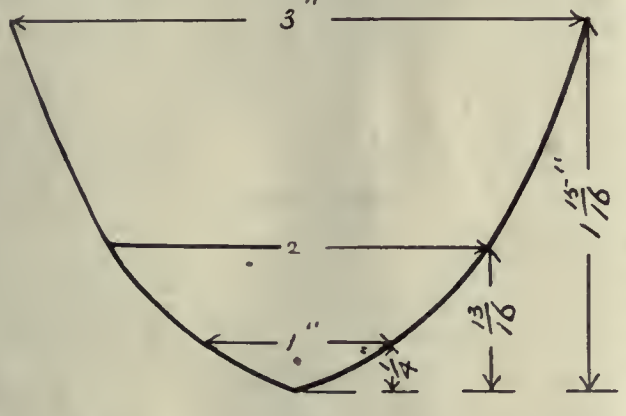


Fig. 4.

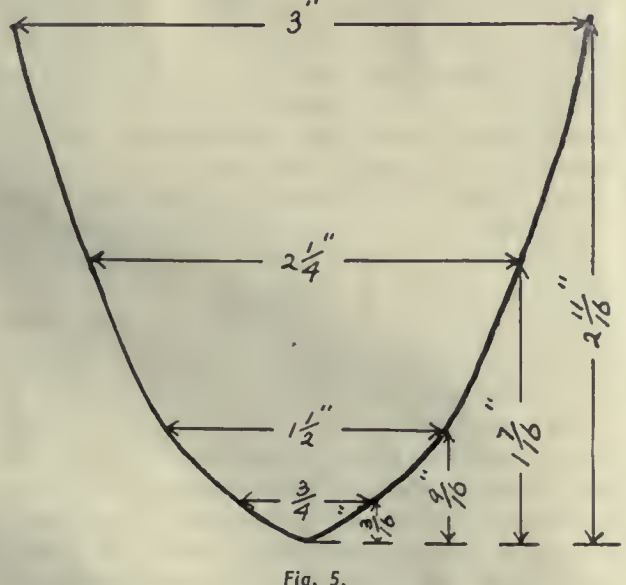


Fig. 5.

South Dakota School of Mines. The derivation of the curve involves the use of integral calculus and will not be given here. Its equation is

$$y = \frac{x}{2a}\sqrt{x^2 - a^2} - \frac{a}{2}\log_e\left(x + \sqrt{x^2 - a^2}\right) + c$$

In this equation x cannot have a value less than a, so that a is the point of nearest approach to the y axis. The y axis is here taken as the centre of the rotating bit and the x axis as passing through the point nearest the y axis. By assuming a value of 1 for a the above equation is simplified to the form

$$y = \frac{x}{2}\sqrt{x^2 - 1} - \tfrac{1}{2}\log_e\left(x + \sqrt{x^2 - 1}\right)$$

By assuming 1 as a unit of one-fourth, one-half, or any desired portion of an inch or any unit of measure we may plot any desired curve from this equation which will answer the requirement that its length vary as its distance from the y axis. The condition cannot be fulfilled for any point nearer the y axis than the unit taken.

Fig. 2, on the opposite page, shows three curves plotted from this equation by assuming values to a of ⅛ in., ¼ in., and ½ in, respectively. A bit having the shape of curve No. 1 would stay sharp longer than either No. 2 or No. 3, but would not be a practical shape, as its extreme length would cause it to break readily at the point. Fig. 3 shows the dimensions of a bit up to a width of 3 in. when a is taken as ¼ in., and Fig. 4 shows the dimensions with a taken as ½ in. In both cases the shape of the bit near the point must be assumed and can only be approximately correct.

For practical purposes the shape of a bit will hardly be more pointed than that shown in Fig. 3 or more blunt than shown in Fig. 4. Fig. 5 shows an intermediate shape plotted by assuming $a = \frac{3}{8}$ in. In all of these figures the measurements given are correct to within $^1/_{16}$ in. In each a may be considered as the modulus of the curve and upon its value will depend the relative width and length of the bit. Any desired curve may be plotted from the following value of x and y, and in any of them the condition is met that the length of the curve is proportional to the distance from the y axis. The shape of the curve must be assumed for values of x less than a.

When	$x =$	1 $\times a$	$y =$	0
	$x =$	1½ $\times a$	$y =$	0.526 $\times a$
	$x =$	2 $\times a$	$y =$	1.073 $\times a$
	$x =$	3 $\times a$	$y =$	3.361 $\times a$
	$x =$	4 $\times a$	$y =$	6.685 $\times a$
	$x =$	5 $\times a$	$y =$	11.101 $\times a$
	$x =$	6 $\times a$	$y =$	16.50 $\times a$
	$x =$	10 $\times a$	$y =$	48.25 $\times a$
	$x =$	20 $\times a$	$y =$	197.9 $\times a$

A bit shaped according to the curve discussed above will stay sharp, except for breakage, longer than for any other shape having an equal length of cutting edge. As compared with a square bit it will turn more easily in a hole when used with an air-hammer machine. Whether used with an air-hammer or piston machine it will cross a slip, as a rule, more readily than a square bit. This is due to the fact that there is less tendency to break the cutting edge and to the fact that there is a longer surface in contact with the rock on the side away from the slip, which prevents the steel from being forced out of line.

In the development of the air-hammer machines a bit has been used which approximates the shape given from plotting the above curve. The object sought has been to make a steel that would turn more readily in the hole; incidentally it has been found that it stays sharp longer and that it crosses a slip more readily. I well remember one mine superintendent making the remark that the high centred bit was theoretically all wrong, but that it was practically all right. The above discussion seems to show that it is both practically and theoretically correct.

Discussion

Readers of the MINING AND SCIENTIFIC PRESS are invited to use this department for the discussion of technical and other matters pertaining to mining and metallurgy. The Editor welcomes the expression of views contrary to his own, believing that careful criticism is more valuable than casual compliment. Insertion of any contribution is determined by its probable interest to the readers of this journal.

Re-grinding Sand

The Editor:

Sir—I should be pleased if any of the readers of the *Mining and Scientific Press* would furnish data as to the tonnage of sand (that is, ore crushed in a stamp battery through 30-mesh screens, and the slime removed) that can be ground to pass 150 mesh in 24 hours by a Wheeler grinding pan five feet in diameter. Also I would like to know the horse-power required to do the work. There exists here a great diversity of opinion as to the performance of the ordinary grinding pan such as is in common use in Australia and elsewhere.

EX-KALGOORLIEITE.

Mexico, March 24.

Tank Versus Vat

The Editor:

Sir—With regard to an item in your April 1 number bearing the above heading and signed KCN, I wish to acknowledge my appreciation of KCN's sense of humor, in timing that article to appear on the first day of April: there is no doubt that it is an excellent joke, for I have heard several good laughs over it. I think it is common practice in all business, whether cyanide operations or anything else, to be as concise as possible. So when we learn that in a cyanide plant a tank for holding sand during treatment, is a vat, naturally we begin to call it so, rather than take a round-about way of saying what we mean. A cyanide tank might refer to nearly any tank in the mill, but I think that without any further qualification it would be understood to mean a tank for the storage of barren solutions, and not a gold sump, an agitator, or a sand vat.

BYRON L. EASTMAN.

Grass Valley, California, April 2.

The Clancy Process

The Editor:

Sir—It will be seen from reading D. Mosher's article on the Clancy Process published in your issue of March 25 that there is no ground for the comments and figures which he has given. If Mr. Mosher wants cheap cyanide and thinks he has it in calcium cyanide, it has nothing to do with my process. I do not use calcium cyanide nor do I attempt to produce calcium cyanide from cyanamide. In all cyanide plants using lime, surely a certain amount of calcium cyanide may be formed. Would Mr. Mosher then attempt to restrict the use of lime in the cyanide process unless he is paid a royalty? That Mr. Mosher has shown in his writings that he does not use cyanamide or calcium cyanamide, may be seen from the disparaging manner in which he speaks of my use of cyanamide in conjunction with the cyanide solution. He states that he can not see any value in the use of cyanamide other than protecting the cyanide through reducing the cyanate by means of the NH_2 group present in the cyanamide, and forgets that when I use oxidation means other than the atmospheric oxygen, a considerable proportion of cyanate may be formed in the solutions. If this destruction of cyanide to cyanate can be prevented by the use of cheap cyanamide in presence of sulphocyanides is it not a consummation devoutly to be desired? To demonstrate that Mr. Mosher has not caught even a glimpse of the claims of my process, suffice it to insert a quotation from his article and leave the rest with the readers: "Unless Mr. Clancy has found some special effect in the use of cyanamide in his researches, I can only see a slight commercial value in its adoption in cyanide treatment."

JOHN COLLINS CLANCY.

New York, April 4.

Ore in Sight

The Editor:

Sir—I have read with great interest C. S. Herzig's article on 'Ore in Sight,' in the *Mining and Scientific Press* of February 18, and hope that his suggestions on methods used in estimating 'reserve ore' may be of as much benefit to many engineers as they are of especial interest to me.

The paragraphs which especially occupied my attention related to sampling and ore-reserve estimates. Methods of engineers who have insisted on the 'ore opened and sampled on three sides' rule of thumb, without taking any consideration of the past record of the property in question, size of vein, quality of the 'raisins' extracted, geological deductions, and exceptional facilities for exceptionally low operating expenses, have worked against the interest of certain of my friends.

To be concise, I cite a mine from which probably $300,000 was taken prior to purchase by Eastern men, about $150,000 having been recovered, but records and hearsay indicated that the ore stoped 'plated' about $6. Operating for the Eastern company, crushing some 11,000 tons through 30 mesh, I ascertained the concentrate to average 3%, and recovered on plates average of $3.48 for total tonnage. In doing this all quartz broken passed through the mill, all development rock from drifts and raises, and only 312 cars were dumped as waste during 30 months. The pay-ore occurs as lenses, irregular but massive, assays above $7 in such lenses, the greatest horizontal distance between being 125 ft., greatest vertical distance 26 ft., width of vein in lenses 10 to 20 ft., width between lenses averages 8 ft., value about $3 by assay. There was recovered by amalgamation possibly 50% of the ore value, due to many causes, principally lack of funds and equipment, and being forced to operate with mill of the type of 1872. Several engineers who examined this property have simply shrugged their shoulders because the "raisins have been extracted," and the vein presents today low-grade ore on the border of such 'raisins.' No consideration was given to ore overhead above

the raisins, though opened 700 ft. long and 400 to 500 ft. up to the surface, because there were no raises through to the surface, and this ore was only opened on two sides. The entire surface of all claims is covered with dense and heavy timber, all machinery operated by unfailing water-power, purchased at 10c. per inch, under 800-ft. vertical head. Why are some engineers so dense; is it, as you remark, the human factor?

J. D. WHITNEY.

Red Bluff, California, February 20.

Cost of a Shaft

The Editor:

Sir—I, together with many other readers of the *Mining and Scientific Press*, will be greatly obliged for information regarding the following: Average cost per cubic foot of hoisting from a shaft of any depth from the surface to 150 ft., wages $3.50 per day. The hoisting is to be done with a horse-whim. Cost of keeping horse $1.50 per day. The shaft is to be 4 by 8 ft. in the clear. What will be the average cost of labor for timbering such shaft, including guides and ladders, timbers 6 by 6 in., 5-ft. centres, lagging 2-in. plank? Also give a good cheap method for framing timbers for such shaft.

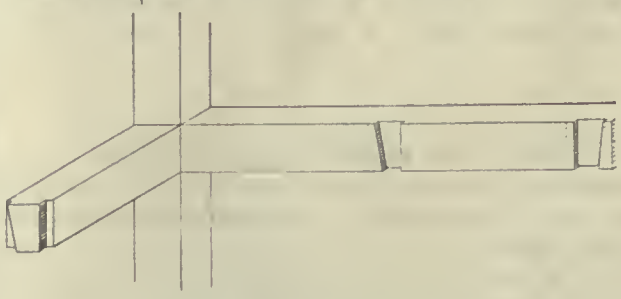
E. A. GRUSHUS.

Fort Bidwell, California, March 6.

[In replying to such inquiries as the above, where so little information is given and nothing is known of the existing conditions, it is necessary to assume average conditions, and upon such conditions the following conclusions are based. To give arbitrary figures of cost of work undone is not an easy matter. In problems such as this there must be a wide range of possibility. Often in isolated places work is accomplished with a small force of men, which although satisfactory, is not done by the least expensive method. One man, under such circumstances, is often found acting in the capacity of blacksmith, carpenter, hoist-man, time-keeper, and not infrequently he is also the superintendent. There is also a difference in the cost whether the work is carried on night and day, or on day shift only. The single item of keeping the horse will illustrate this. If 2 men can do a job in 2 days, in which a horse is a factor in the cost, it will be cheaper to put 4 men on and finish it in 1 day, thus cutting down the expense of feeding the horse. In this instance we will assume that the work is so arranged that but 5 men are employed: the blacksmith, who is also all-around man on top, and 4 miners down below. When required, one of the miners may be employed on the surface as assistant, to the hoist-man (blacksmith, etc.). He will be required most when the timbers are sent down, at which time he places them in the bucket and lashes them to the hoisting rope. The man below takes them out, and upon the arrival of the bucket at the top a second load is sent down. When all the timbers for a set have gone down the extra top-man also goes below and the two men then proceed to put the timbers in place. In this case the top-man does the blacksmithing, frames timbers, dumps the bucket as it arrives at the surface, disposes of the waste or ore on the dump, or elsewhere, keeps time, cares for and drives the horse when hoisting, and attends to all of the wants of the men down in the shaft on his shift. The problem of handling water has not been mentioned, but if there is much water a hoist-man should be on duty at night also. Timbers 6 by 6 in. are light for shaft work, and if only moderate pressure should develop they would be found unsatisfactory. It is suggested that it would perhaps be wiser to use at least 6 by 8-in. timbers, placing them with the broad side up. Having considered everything that seems pertinent to this work, the conclusion is reached that such a shaft as mentioned would cost an average of about $22.75 per foot of depth, or, perhaps, 38c. per cubic foot. It is unusual to estimate the cost of shaft sinking by the cubic foot, but if the cost for one foot in depth be determined, it is an easy matter to arrive at the cost of a cubic foot. The shaft suggested would be about 6 by 10 ft. outside of the timbers, and if the rock 'breaks big,' it would in all probability be of still larger dimensions than those mentioned. The cost of hoisting only, which contemplates the wages of the top-man while employed in this work, and the cost of keeping the horse all the time, would be $1.30 per foot in depth of the shaft, or $0.0216 per cubic foot. The whole cost per foot in depth, is estimated as follows:

Drilling	$11.20
Powder, fuse, caps, etc.	1.36
Blacksmith, coal, breakage of tools, etc.	1.30
Mucking	2.80
Hoisting (top-man)	0.40
Horse	0.90
Timber (500 ft. B. M. per set)	2.00
Placing set (including building and removing platforms under last set)	2.50
Framing timbers 1 set (top-man)	0.30
Cost per foot of depth	$22.76

The accompanying sketch shows a good and inexpensive method of framing timbers for such a



Timber Framing for Small Shaft.

shaft, either vertical or inclined. It shows one corner, with the posts in place both above and below the corner of the plates. Also the way the end pieces and the centre piece should be framed, as well as the beveled mortice cut to receive these pieces. In using shaft timbers of small dimensions this is a better way to frame them than to attempt the overlapping corner. Many miners cut a shallow 'dap' at each corner of the shaft, both on the upper and the side of the timbers, to receive the posts. This keeps the latter from slipping inward. These daps are not shown in the sketch. They are generally cut ½ in. deep.—W. H. S.]

Concentrates

Most of these are in reply to questions received by mail. Our readers are invited to ask questions and give information dealing with the practice of mining, milling, and smelting.

The best size to use on portland cement molding would ordinarily be glue and alum size put on thin and warm, made in proportion of ½ pound of glue and same weight of alum dissolved in separate pails, then poured together.

A cement for pipe joints is made as follows: Ten pounds fine yellow ochre, 4 pounds ground litharge, 4 pounds whiting, and ½ pound of hemp, cut up fine. Mix together thoroughly with linseed oil to about the consistence of putty.

Overloaded machines and structures, decayed gangways, worn-out floors and stair-treads, unannealed chains and hooks, frayed and stranded ropes and tackle, and a host of minor industrial equipment, are items which should pass under systematic and intelligent review from time to time as possible sources of accident.

Electric hot-plates are very convenient for laboratory use, and while electric energy is theoretically expensive for heating, it is economical in use as the heat is concentrated at the point desired, and this makes the plate so much easier and more convenient to work around that less heat is wasted. Hot-plates can be home-made, using Krupp resistance wire, but it is less trouble to buy them ready made.

In order to make labels adhere to metal or stone, lay a piece of mending fabric used by tailors under the label, and heat the whole. If the heating can not be accomplished by means of a spirit lamp, the label should be ironed down under a protective cloth or paper in the same manner as woolen goods are pressed. This method is also very useful for attaching paper labels to minerals. Another way to make labels adhere to metals or minerals is to put a coating of glue or varnish over them after they are stuck to the surface.

If good, clean, yellow brass sand castings are desired, the brass should not contain over 30 per cent of zinc. This will assure an alloy of good color and one which will run free and clean. Tin or lead may be added without affecting the property of casting clean. A mixture of 7 pounds of copper, 3 pounds of spelter, 4 ounces of tin, and 3 ounces of lead makes a good casting alloy and one which will cut free and is strong. If a stronger alloy be desired, more tin may be added, but 4 ounces is usually sufficient. If the alloy be too hard, reduce the proportion of tin.

Glass roofs, the skeletons of which are constructed of iron, are extremely difficult to keep water-tight, as the iron expands and contracts with atmospheric changes. To meet this evil, it is necessary to use an elastic putty, which follows the variations of the iron. A good formula is: Two parts rosin and one part tallow, melted together and stirred thoroughly with a little minium. This putty is applied hot upon strips of linen or cotton cloth, on top and below, and these are pasted while the putty is still warm, with one edge on the iron ribs, and the other, about one-fourth inch broad, over the glass.

Metals for casting purposes should not be overheated. If any of the softer metals shows blue colors after cooling, it is an indication that the metal is too hot. The metal should be heated enough so that it can be poured, and the finished casting have a bright, clean appearance. The mold may be very warm, then the metal need not be so hot for bright, clean castings. Some of the metals will not stand reheating many times, as this will cause them to run sluggish. Britannia metal should not be skimmed or stirred too much, otherwise there will be too great a loss in the dross.

The mending of defective places in grindstones is best done with a mass consisting of earth-wax (so-called stone-pitch), 5 parts, by weight; tar, 1 part; and powdered sandstone or cement, 3 parts, which is heated to the boiling point and well stirred together. Before pouring in the mass the places to be mended must be heated by applying red-hot pieces of iron to them or using a plumber's torch. The substance is poured into the hollow of the stone and the pouring must be continued while it cools and shrinks until it is even with or slightly above the surface. It must then be carefully smoothed off.

Castings of any metal can be done in a plaster mold, provided the mold has dried, at a moderate heat, for several days. Smoke the mold well with a brand of rosin to insure a full cast. Where there are only one or two ornaments or figures to cast, it may be done in a mold made out of dental plaster. After the mold is made and set enough so that it can be taken apart, it should be put in a warm place and left to dry for a day or two. When ready to use, the inside should be well smoked over a gaslight; the mold should be well warmed, and the metal must not be too hot. Very good castings may be obtained in this way; the only objection being the length of time needed for a thorough drying of the mold.

A quick and convenient way of doing lettering neatly is to use the gummed black letters sold by stationers. These can be had in several different sizes. In a large office where many tracings are made that need to carry approximately the same title, those parts of it which do not vary may be carefully lettered on tracing cloth and then a negative made from this by printing on an ordinary film in a printing frame. Several negatives can be made in this way, and in making a blue-print one of these is placed in the frame together with the tracing. The title will then appear in blue letters on a white ground, and the necessary addition can be made with an indelible pencil. Another good way is to print off a number of labels on thin paper; one of these can then be pasted on the tracing. Small printing outfits can be obtained at no great expense.

SILVER KING COALITION M. CO. JUDGMENT

The decision handed down by Judge J. A. Marshall in the Federal Court at Salt Lake on April 10, in the trespass suit of the Silver King Cons. *v.* the Silver King Coalition Mines Co. involved many points of interest. The plaintiff company was awarded a judgment of $734,242.80. The contention of the plaintiffs was that the defendants had worked a number of claims owned jointly and had failed to account for ore extracted. The trespass was proved; the opinion of the justice was that the defendant had intended to obscure the question where accuracy was readily obtainable and should therefore be made to bear the burden of the uncertainty due to its fault.

"I find as the extent of the excavation 573,937 cu. ft., in which there is waste and caved material amounting to 435,350 cu. ft.; that there has been removed from the excavation since this suit was commenced 31,551 cu. ft. of the waste. This waste and caved material now found in the excavation, of course, fills a larger volume than when it was solid and unbroken. I find that this expansion amounted to 100%; so that originally this material amounted in volume to 233,450 cu. ft. This leaves 340,487 cu. ft. of the excavation which was removed as ore which is to be divided into first and second-class ore. At this point the evidence is absolutely uncertain. To attempt to make an accurate division based on this evidence would be nothing but a guess, and the only certainty about it would be that the guess would be wrong. Nothing is left but to conclude that one-half of the volume was first-class and one-half second-class ore. Of the first-class 9 cu. ft is found to constitute a ton, while 12 cu. ft. of the second class is equivalent to the same weight. The result is that 18,916 tons of first-class and 14,187 tons of second-class ore was extracted.

"There is a great want of certainty with respect to the value of this ore. The price of the metals and the metallic contents of the ores change from day to day. There is no reliable evidence as to when the ores from this stope were marketed. Under these circumstances I think the defendant must be held for the highest monthly average price received by it for ores during the period of the taking. This price as to first-class ore was $60.07. The total received for first-class ore then amounted to $1,136,284.12; the cost of mining, tramming, and sampling the ore amounted to $6.33 per ton, or a total cost of $119,738.28, leaving a net value of $1,016,545.84. As to the second-class ore, the highest net value during the same period was $3.53 per ton, and the total net value is therefore $50,080.11. The defendant is also entitled to a further credit of $34,097 for the cost of development work confined entirely to the Vesuvius claim, and which was necessary to the extraction of this ore. The result is that the net total amounts to $1,032,528.95, one-half of which, or $516,264.47, is due to the plaintiff. To this should be added simple interest at 8% per annum from January 1, 1906."

The following costs and values per ton for the Silver King Coalition Mines Co. are of much interest in view of the above judgment:

2500 tons shipping or first-class ore.

Smelter returns		$44.60
Mining cost	$5.56	
Sampling and tramming	0.63	
		6.19
Net values per ton		$38.41

10,000 tons milling and second-class ore (concentration, 3.5 into 1).

Gross or metal value		$16.02
Mining cost	$5.56	
Milling	1.51	
Milling losses	4.16	
Sampling and tramming (percentage for freight and smelting per ton of concentrate)	3.98	
		15.36
Net value per ton		$0.66

The above clearly shows that the profits of the mine have been due to the returns upon its shipping ore, and to but little extent upon its mill returns. The considerable milling loss (25.4%) was due to the fact that the second-class ore was largely oxidized. The cost of sampling is given at 22.1c., of tramming at 40.8c. per ton. The cost of mining the ore in the Parsons stope and delivering the sand at the surface was between $5.65 and $5.75 per ton. This does not include interest on the investment nor other fixed charges. The cost of milling, not including interest on the investment nor general expense, was, for 1905, $1.549 per ton of crude ore, for 1906, $1.931, and for 1907, $1.888, and for the entire three-year period $1.766 per ton. It will thus be seen that the figure given for the cost of treatment of ore from the Parsons stope for the 10,000 tons of ore first specified is less than the average for the three years, probably because of the ease of treatment of Parson's stope ore. The cost of running drifts and cross-cuts is given at $12 to $14 per foot, a single compartment raise $13 to $15, three-compartment raises $22 to $25, and winzes $15 to $18. In these cases the ore was trammed half a mile underground, then hoisted 1300 ft. Miners worked 8-hour shifts and had the delays due to removal of powder smoke and of getting to and from the working face.

GOLDFIELD CONSOLIDATED

In his report for March, J. F. Thorn, general superintendent, gives the following figures:

During the month of March 1911 the total production of the company was 25,714, containing $1,119,951.75, or an average extraction of $43.55 per ton, of which the whole was milled with an average extraction of $41.38 per ton, or 95.45%. The total net profit to the company was $846,283.13, or $32.91 per ton.

Development work: 3960 ft. of development work was performed during the month of March.

Operating costs: the total cost of mining, development, transportation, milling, office and general expenses was $8.55 per ton, distributed as follows:

Mining:

Development	$1.22	
Stoping	2.21	
		$3.43
Transportation		0.10
Milling		2.44
Marketing		1.22
General expense		0.56
Bullion tax		0.63
Construction		0.17
Total cost of operation		$8.55

In the Combination mine an orebody has been opened in the foot-wall of an old stope on the second level that has produced 565 tons of ore worth about $169,500, or about $300 per ton. It is impossible to estimate the extent of this orebody, but the indications are that it will extend to the surface, at least 50 ft. above the present back. The stope is now 20 ft. long and 15 ft. wide, and is being extended in length. In the Mohawk mine the 354-sill has been considerably extended, and has produced 1320 tons of ore worth $66,000, or $50 per ton. And nearly 100 ft. farther into the foot-wall another orebody was cut that seems to be from 8 to 10 ft. wide. One hundred feet of driving has been done on this shoot, and has produced 430 tons of ore worth $38 per ton. This is probably a branch from the big orebody cut in the 354-sill. In the Clermont mine the downward extension of the 306 orebody on the 600-ft. level (near Laguna) was cut by an intermediate 40 ft. under the 600-ft. level. Not enough work has been done to estimate either the tonnage or value of this orebody. In the 750 north drift 6 ft. of $15 ore has been cut. The face of the drift is still in ore. The indications, however, are that it is not a very long shoot. Nothing of any importance has been found in the Red Top, Grizzly Bear, or Laguna. The mines as a whole are looking well.

Special Correspondence

BLACK HILLS, SOUTH DAKOTA

Success of the Employees Aid Fund.—Claims Paid. — Evans Con. — New State Mine Inspector. — Hidden Fortune Sale. — General Notes From the Black Hills.

After operation for three-quarters of a year, the Homestake Employees Aid Fund has made a splendid record. Under the plan of operation employees contribute $1 per month each, and the company gives $1000. Benefits, $800 for death, insanity, or total disability, down to $1 per day for sickness or inability to work caused by injury, are paid. The disbursements for the month of March, made on April 18, are a sample of those of past months. The cash account shows receipts: From employees, $2942; Homestake Mining Co., $1000; cash on hand March 1, $6216.80; interest March 1 to 26, $8.49. Disbursements: death benefits, $2400; injury, $922; sick, $659. Cash in treasury March 31, $6186.29. Thus during the month there were three death claims paid. The benefits included fourteen for $31 each, going to men who had not been able to work a single day during the month, and run from that amount down to 50c. In all 158 checks were made out, representing as many different claims against the fund. The fund is a complete success and is well liked by all employees.

The Evans Consolidated Mines Co. is the name of a newly incorporated organization that has secured a large tract on Spruce gulch, including the Lexington Hill and some adjoining properties. A large amount of money was spent by former owners, but work was suspended, owing to internal difficulties, at a time when a comparatively small amount of money might have developed ore. The new company finds itself possessed of a 20-stamp cyanide mill and the usual surface buildings, and will start work in a vigorous manner when the weather settles. The Gilt Edge-Maid company has been fortunate enough to secure the services of N. Treweek as superintendent. Mr. Treweek was State Mine Inspector for South Dakota for six years, until April 1. This company will proceed at once with the erection of a concentrating plant, and in the meanwhile Mr. Treweek is directing the work of opening the mine to supply a large tonnage. The Black Hills smelter works, at Galena, under the management of Paul Danckwardt, is getting things moving in good shape, after suffering delay by the failure of the railroad to finish the siding to the plant. Material is now being delivered and work is being pushed on the excavations.

R. L. Daugherty, of Lead, took office as State Mine Inspector on April 1, succeeding N. Treweek. Mr. Daugherty is a man of large experience in the Black Hills, and for some time prior to his appointment was a shift-boss in the Homestake mine. Previously he had been employed at the Holy Terror and other mines in the Hills. The term of office is two years. Sheriff's sale of the Hidden Fortune property, to satisfy receiver's costs, taxes, etc., amounting to about $36,000 will be held May 6, if further postponement is not made by the court. Several persons have examined the property, and stockholders have labored hard to straighten out the financial difficulties, but it seems at the present moment that the mine will go to outsiders. It is known that the Homestake would be a willing purchaser at the price named in the foreclosure proceedings, and the Golden Reward, it is stated, is willing to take the mill, if it can be gotten cheap. It is quite possible that the two companies will combine at the time of the sale, buy the property, and divide it between them on the foregoing basis.

The North Homestake company, at Maitland, resumed work on April 17 with a crew of three shifts in the shaft. The three-compartment shaft is to be sunk from the 220-ft., or present level, to the 500-ft. point. The Minnesota company, at Maitland, has started a crew of miners driving a tunnel near the southwest corner of the ground to make available for mining a vein of free-milling ore. As soon as the tunnel is completed and the tramway tracks extended the mill will be started. Milling operations will be resumed at the Reliance, at Portland, on May 1. The mill, since suspension of work, has been remodeled by removing the Chilean mills and substituting stamps. The work is under the superintendence of M. E. Hiltner.

Eastern interests have secured an option on the Gladiator group, on Deadwood gulch, the property of Burt Rogers, of Deadwood, and will shortly begin development. This property is situated in what is locallly known as the phonolite belt. Development has so far shown at various points on this belt bodies of ore of varying value, and some smelter shipments have been made. It is, however, practically virgin territory, and indications warrant careful development. The Forest City group, near Hill City, has been bonded by Colorado people, and this highly promising free gold prospect will be thoroughly developed. The ground is owned by John Forsyth and associates. The Forest City Mining Co.—no relation to the foregoing—is steadily operating a small stamp-mill near Oreville on high-grade free-milling ore, and is preparing to deepen the main shaft.

The Golden Slipper, in the Hill City district, which is being worked for the benefit of creditors, is producing some handsome ore. The vein was recently picked up after a fault, and now shows three feet of quartz that will mill close to $50 per ton. Mr. Kamman, superintendent for the Pa-Ha-Sa company, which took over the properties of the old Harney Peak Tin Co., has been directed to dispose of placer ground owned by the company. The company owns a large number of placer locations that have been farmed for years, and these will be sold.

BUTTE, MONTANA

New General Manager.—Colorado Mine.—Development at the Ophir. —Rich Ore in the North Butte.—Encouraging Result at Tuolumne. —Silver Lake Mining Company.

Harry Gallwey, for several years superintendent of the Parrot Silver & Copper Mining Co., has been appointed general manager of the Butte, Anaconda & Pacific railway. The position of superintendent of the Parrot goes out of existence with the appointment of Mr. Gallwey to the railway's service.

W. H. Wiley is engaged in making an examination of the Colorado mine of the Davis-Daly company in the interests of Eastern stockholders and until his report is made to those for whom he is making his investigation nothing will be decided on as to the future. The recent find on the 1700-ft. level has been opened a distance of 250 ft. by drifts, but the orebody has now practically pinched out. So far as opened it runs from 18 in. to 16 ft. in width. Men are now engaged in driving for the orebody on the 1500-ft. level.

The Ophir mine of the Butte Central Copper Co. will not reach the depth of 1000 ft. before the end of July, which is a few weeks later than at first calculated, for the reason that a pumping station has to be cut at a depth of 750 ft. At the present time the water is being pumped from the 500-ft. level to the surface, and as soon as a depth of 1000 ft. is reached an electric pump will be installed. Those in charge are very confident of the future, and it is just possible after the shaft has gone down to a depth of 1000 ft. another contract will be made for the sinking of 500 additional feet. In regard to the proposed concentrator, it is learned that no further steps will be taken until ore is blocked out sufficient to pay for it three times over.

The North Butte people still continue to be very reticent as to the recent rich bodies of ore opened up, but it may be stated on good authority that none of the reports sent out have been exaggerated. Among those who are quite familiar with the situation, it is positively asserted that the vein found in the shaft at 2750 ft. is a north branch of the Edith May vein, east of the fault. Both the width and richness are remarkable.

Cross-cutting on the 1600-ft. level of the Tuolumne has met with success beyond the expectations of the management. A few weeks ago cross-cutting north and south was commenced and the veins were reached within forty-eight

hours of the same time. The north vein was found first, and a rich body of ore opened which will run at least 12% copper. The exact width and extent are not yet known. The south vein joined the Edith May vein, and this was found even more valuable than the north vein. The shaft is now reaching the 1800, where a station is to be cut, after which it will be continued to a depth of 2000 ft., where another station will be cut.

The Silver Lake Mining Co. has filed articles of incorporation for carrying on a general mining business and for the construction and operation of a railway from the Georgetown district to the spur of the Butte, Anaconda & Pacific railway so as to bring the ore from the district to the smelter at Anaconda. The company is incorporated for $1,500,000, divided into 150,000 shares at a par value of $10 each. The company owns the George and Bonanza mines, and negotiations are pending for others in the locality. The George is a particularly rich mine and has a large amount of ore blocked out ready for shipment.

SOUTHEASTERN ARIZONA

Twin Peaks District.—Character of the Veins.—Exploration Work.—Geological Report.—Plant at Deep Shaft.—Organization of Company.—Frisco Milling Plant.

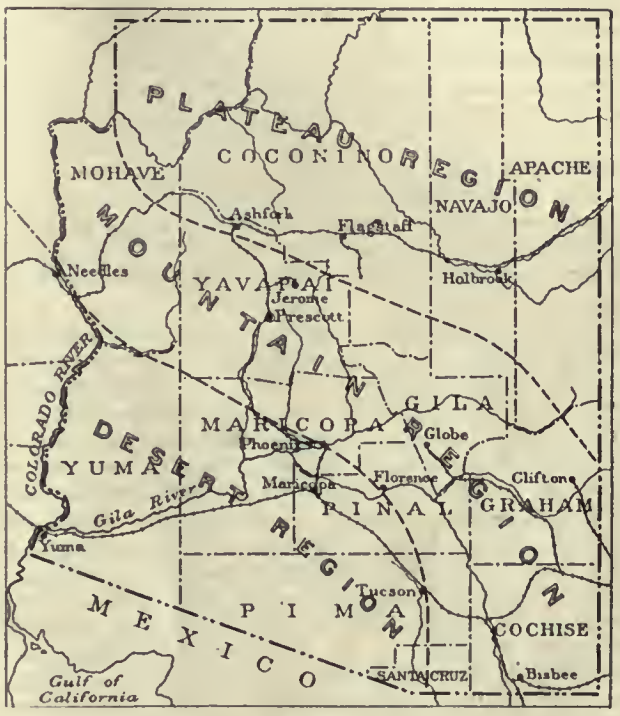
The Twin Peaks mining district lies on the New Mexico-Arizona line, 22 miles from the small town of Duncan, Arizona. The principal property is owned by the Twin Peaks Mining & Milling Co., having the following officers: Daniel Fraser, president and manager; John Evans, Jr., vice-president; A. N. Newhouse, secretary-treasurer; Alexander Fraser is superintendent at the mines, Joseph Fraser is fiscal agent, and James Fraser is superintendent of new work, consisting largely of prospecting throughout the tributary region.

The Twin Peaks ores contain gold and silver, principally the former. The country is andesite and rhyolite, resting upon granite. Numerous extensive porphyritic dikes traverse the country NE.-SW., which is the trend of the Twin Peaks vein. The vein here averages 8 ft. in width and looks like a fissure; though at depth it will probably prove to be a contact between andesite and the large porphyry dike. There are 32 claims in the property, with 15,000 ft. on the vein, which crops continuously for more than a mile. It has been worked for the past six years, and is now opened to 200 ft. in depth, with a great many shallow openings at different places. The first work done was on a high-grade shoot, about mid-length of the holdings, where a shaft was sunk 120 ft., all in fine ore. Water coming in, another shaft was sunk 160 ft. a few hundred feet from the first; and when water came in there, work was started on what was determined should be the main working shaft, now down 200 ft. At this depth water is now coming in, but all preparations have been made to take care of it, and here it is purposed to go to 400 ft., driving at each 100 level. In this shaft, at the 100, there are drifts east and west. The west drift, in 70 ft., is in a good body of high-grade sulphide; the east drift, 90 ft., is in oxide carrying more than $25 in free gold. The ore in the east drift is the same shoot showing on the surface for several hundred feet and which there carries an average of about $30. In neither drift is there water. The sulphide is a black material, much resembling the 'black metal' of the silver miners, but the greater value is in gold. On the 200-ft. level a station was being cut when I left the camp. The shaft was, however, in about 2 ft. of very fine ore, sulphide, and as the vein dips out of the work it is probable that the ore here fills the vein, which will be determined in the station work. There is a very large porphyry 'blowout' a few hundred feet west of the shaft, and they anticipate finding a good orebody when the drift in the vein shall have reached this point.

Geologically the district has been described as "both intrusive and effusive, including rhyolite, andesite, monzonite, basalt, granite, phonolite." There is a very little of the latter; this is not considered significant. The region is of course volcanic, and the metamorphism of the rhyolite has made great quantities of *mal pais*.

The gangue of the ore is silica and feldspar. During my stay at the properties I went over them carefully, and it was wonderful 'how it would pan.' At many places on the vein the material was broken off without attention, and in no instance did I fail to get a color, oftentimes a great many. The many open-cuts show rich ground. Near the extreme eastern end of the properties there is a 70-ft. tunnel, in ore all the way, the average being above $18 in gold.

The company has a well-equipped plant at the deep shaft, power being obtained from a gasoline engine. There are numerous comfortable houses for employees. There is a good road to Duncan. Some time ago the company bought a $50,000 milling plant for $3500, the former owners having found the plant entirely inadequate for the character of the ore they had to treat, and doubtless some portions of this will be installed at the Twin Peaks. The cyanide process will prove available for treatment. The company is financially solid, and the intention is to get depth as quickly as possible. The mine was discovered six years ago by James Fraser, and he, his brothers, and Mr. Newhouse carried the enterprise for four years, when a company was organized and some stock was sold. In the exploration, however, the original owners pooled their interests, and they take one share of stock for each share sold, this giving the investor



Arizona.

an equal share with them. Stock now has been withdrawn from the market. This company is the only concern working steadily for the past few years in the entire district, though there are many others owning properties.

Placer mining is being revived in the Clifton-Morenci district. Two new plants are being erected, one by the 'Frisco Placer Mining Co., and one by F. J. Paine, A. Hodgert, and W. M. Whipple. The plant of the 'Frisco company is an interesting one. The gravel will run into a large hopper and out over a grizzly; the large boulders from this travel down an inclined chute for 75 ft., to remove all adhering sand and cement. At the end of the chute the sand drops into a sand-bin; the smaller material from the grizzly passes into a bin and thence to a 1½-in. mesh trommel. The oversize from this goes to the waste dump and the fine goes into a sand-bin below, thence into $^{1}/_{16}$-in. mesh trommel; from the trommel the oversize passes through regular sluice-boxes to waste, while the fine passes into a sand-bin, thence to riffles, and finally through a Pearce amalgamator. It is believed this will save all the gold. The working is dry until the material reaches the two sluice-boxes beyond the last trommel. The plant is about 30 ft. above the Frisco river, from which any amount of water may at all times be secured.

NEW YORK

Reaction in Porcupine Shares.—Little Interest in West Dome.—Progress at Dome.—Utah Consolidated Meeting.—Broughton Sustained.—Proposed Restrictions on Stock Issues in Massachusetts.—Death of T. L. Chadbourne.—Lake Superior Merger.—Review of the Copper Situation.

It is an established principle in physics that action and reaction are equal. A large number of the members of the New York market are now ready to declare that the reaction is greater than any initial movement that can be imparted to the trading. When Porcupine started to lift, and the outside public began to make inquiry there was a remarkable demonstration. A wave of relief was apparent, a long breath was drawn, action was about to begin, and, indeed, did begin, only to subside before any results could be achieved. The market has settled back into a distinctly waiting attitude. The boomers of the camp are talking as big as ever, but the praises fall for the most part on deaf ears.

The slump in Porcupine was emphasized by the lack of interest taken in the flotation of F. Augustus Heinze's much advertised West Dome property. The public paid little heed to the quotations or the trading when the shares were introduced on the New York market this week. The activities at the camp are not, however, in any way lessened. The Dome Extension is to build a 40-stamp mill. The Preston East Dome is installing a plant, consisting of boiler, 6-drill compressor, pumps, and hoist. The North Dome is setting up two drills. Work is at a standstill on the Dome, but on the Hollinger development work is said to reveal extraordinarily good ore. Plans are being prepared for an addition to the plant in the way of three tube-mills to work in connection with the 30 stamps which are expected to be dropping by July, at which time it is expected that the cyanide plant and the tube-mills will also be ready to start.

The annual meeting of the Utah Consolidated held in Jersey City this week was marked by a somewhat acrimonious discussion between Urban H. Broughton and George L. Walker of Boston, who is the author of Walker's Weekly Copper Letter. Mr. Broughton's statement was in the nature of a defense of his administration and gave in detail the circumstances which led up to the examinations made independently by John W. Finch and C. C. Burger and the ensuing issuance of the circular announcing a heavy decrease in the estimated ore reserves of the company. The more important matters, with regard to the future of the property discussed at the meeting, were the impending retirement of Mr. Broughton as president and the results of the development work carried on during the past few months; some 14,000 ft. of work having been done with satisfactory results. In addition to the copper ores developed, lead ore has been found, and a considerable tonnage proved; it is estimated the ore will show a net profit of $6 per ton. Mr. Broughton was very decided in his expressions concerning the contract between the Utah Consolidated and the International Smelting & Refining Co., believing the contract to be worth a great deal to the mining company. The result of the meeting was overwhelmingly in favor of Mr. Broughton.

Stocks seeking a market on the Boston Exchange or on the Boston Curb are hereafter to run the gauntlet of legislative requirement if a bill now before the Assembly of the State of Massachusetts is passed. It provides that the president and directors must file a sworn statement giving name, location, amount of stock, and the name, address, and stock holdings of each shareholder, and a true description of the property. Within thirty days of each annual meeting a statement of condition, assets, and liabilities must be filed; at the request of one-fourth of the stockholders an examination must be made by independent engineers, while officers are made personally responsible for any impairment through mismanagement. Any broker dealing in shares not entitled to be listed is liable to a fine of $1000 or imprisonment for not more than three years, or both, and any promoter who advertises shares for sale without complying with the listing requirements, or who makes false statements in any certificate or report, shall be liable to a like penalty or penalties. All of which is certainly drastic enough to keep unscrupulous promoters at a safe distance from Boston if it becomes law.

The Calumet & Hecla merger lost one of its most important adversaries through the sudden death of Thomas L. Chadbourne, of Houghton, Michigan. Mr. Chadbourne died of heart failure at his winter home in West Palm Beach, Florida. He was counsel for the Calumet & Hecla in Michigan for many years, but resigned because of his opposition to the present merger plans, especially with regard to the Ahmeek. The Ahmeek property was an especial pet of Mr. Chadbourne, and because he thought unfair the basis on which it is to be absorbed, he fathered and pushed through the Michigan legislature a bill providing for appraisal of properties to be consolidated and for the purchase of the shares of any and all dissenting shareholders who may refuse to come into any projected consolidation. The Boston Stock Exchange sentiment has been against the big Lake merger for the reason that it will take so many active issues away from the traders. Floor members are taking some consolation from the fact that Isle Royale, which was expected to become a component part of the big company, is to remain an independent concern, though it will be conducted under Calumet & Hecla management. Isle Royale is considered, like Ahmeek, one of the greatest speculative possibilities among the Lake mines.

Copper has broken below 12c. and the position of the various important producers is causing some close figuring. Curtailment is tacitly acknowledged to have failed. New production, while it will not be a predominant factor during the current year, must be reckoned with during 1912. Ray Consolidated, Miami, Chino, Braden Copper in Chile, and the Kennicott in Alaska, will all be in line by the end of the year. In the meantime the hoped-for revival in general business has not come and the metal market can not be said to have improved. There are many large producers that are making barely a safe margin over present dividend requirements. Of the more important factors in copper production there seems to be but five that can earn present dividends on current production with 12c. copper, namely: Calumet & Hecla, Utah Copper, Nevada Consolidated, Old Dominion, and Granby. There are smaller deep-level properties, such as Tuolumne, Butte-Ballaklava, Shattuck Arizona, and some others that have just now some rich orebodies out of which they can make a large profit for the time being. Such properties can not, of course, be justly compared with the porphyry mines. The Ray Consolidated plant is fast getting into action. The first section of the mill is treating 850 tons per day, getting extraction of about 70%. The concentrate, which runs about 30% copper, is now being sent to the smelter at El Paso. The second section of the mill is to be started this week. The Ray Consolidated ores are running about 2.35% copper.

The annual report of the Miami Copper Co. shows ore reserves, as of January 1, 1911, of 18,000,000 tons assaying 2.58% in copper. Of the whole mineral ground 58 acres has been explored by underground work or by drills. Of the territory explored 15 acres show so low a copper content that it will not be worked farther. The annual meeting of the Miami was held this week and Theodore L. Herrmann was chosen as director to fill the place of Andrew Freedman, resigned. Mr. Herrmann is also a director of the Utah Consolidated. The first shipments of the concentrate from the Miami to the smelter at the Greene-Cananea have just been made. The first tests of the Miami mill have just been completed with the gratifying result that the capacity of the plant has been found to be much greater than was expected. The first unit can handle 700 tons per day, which is nearly twice as much ore as it was estimated to treat. The mill is equipped with Deister tables and is to be one of the most complete plants of the kind in the country.

The development at the Hidden Creek property, under option to the Granby, is said to be encouraging, some 4,000,000 tons of ore having been developed, averaging 2½% copper. This ore is to be sent to the smelter at Granby.

Operations at the Granby are liable to be somewhat curtailed in the near future owing to labor troubles of the Crows Nest Pass Coal Co. The British Columbia Copper Co., like the Granby, is extending its holdings, having taken an option on the McKinley property, sixty miles distant from the Greenwood smelter and twenty miles off the line of the Canadian Pacific. The figure named in the contract is $100,000, and the railroad has agreed to connect with the mine by a spur if the option is taken up. The activity in the stock of the Arizona Copper Co., which is traded in Edinburgh, has attracted some attention. The market rumor is to the effect that the new management, installed since the death of John Gill a few months since, is negotiating for a sale of the control to the Guggenheims.

WASHINGTON

Airing of Alaska Land Scandal.—Investigation Called For.—The Potash Controversy.—Closing the Mints.—Investigation of Pancoast Disaster.—Bureau of Mines Appropriation.—Workman's Compensation Act.—Bills Introduced.

The Alaska mineral-land scandal has once again been hung out on the Senatorial wash-line for an airing, all through the adroitness of Robert La Follette, the insurgent Senator from Wisconsin. The Senator the other day introduced an innocent-appearing little resolution, calling upon the new Secretary of the Interior to transmit to the Senate a list of all claims, locations, filings, or entries made upon lands withdrawn from the Chugach National Forest in Alaska and "restored to the public domain" by the Executive order of October 28, 1910; giving the date of each claim and the names of the persons who made the same, and also what, if any, assignments of these claims have been made, and to whom. Those who claim to know, say that the facts will disclose favoritism to the Morgan-Guggenheim interests in Alaska. It is understood that the administration will show that there is no reason to believe that the Guggenheim interests predominate in the management of the Controller Bay Railroad & Navigation Company.

Asbury F. Lever, of South Carolina, has introduced a resolution in the case asking the President for information as to what connection the resignation of David J. Hill as Ambassador to Germany has with the potash controversy. The South is taking a keen interest in this difficulty, as the increased price for potash demanded by the German syndicate in the face of contracts with Americans is seriously affecting the fertilizer manufacturers, all of whom use potash.

Washington newspapers are authority for the statement that the Government may close or abolish some of its mints. They say that Franklin McVeagh, Secretary of the Treasury, is ready to instruct the assay offices and mints to begin issuing gold certificates against gold bullion and foreign gold coin. As soon as this begins, the coining of gold will practically stop. Nothing but small silver coins and pennies will be struck off hereafter, unless there is an unusual demand for gold coins, and it is estimated that the mints at San Francisco and Philadelphia, running on short time, will fill all the Treasury's needs. A saving of several hundred thousand dollars per year will be effected by the change.

An investigation into the cause of the death of Joseph E. Evans, the miner employed in rescue work by the Bureau of Mines, who lost his life while trying to save the entombed miners at the Pancoast colliery, at Throop, Pa., is now under way. Newspaper dispatches to the effect that Evans' helmet was defective and that he tore it off in the mine are not believed here in Washington. Director Joseph A. Holmes gives the theory that in the excitement of the rescue work, Evans worked so hard he used up the oxygen more rapidly than it could be supplied. In other words, the caustic-potash cylinder could not absorb the poisonous matter from Evans' breath rapidly enough to prevent him from breathing it again before it was purified. That the widow of the hero, Evans, has not been forgotten is seen in the action here and at Pittsburg. At the present time two separate funds are being collected for the widow—one a subscription from the Bureau of Mines employees, and the other from mine operators and mining engineers, who are greatly interested in rescue work. The latter fund has been started by John Hays Hammond, who has subscribed $250.

In the rush incident to the closing of the last session of Congress, a few typographical errors crept into the Sundry Civil law, one of which sought to give the Bureau of Mines $135,000 for fuel investigations instead of $100,000 which was really allowed by Congress. John J. Fitzgerald, New York, chairman of the new appropriation committee, has introduced a resolution in the House which will restore the old figure.

Joseph Howell, representative from Logan, Utah, has introduced an amendment to the workman's compensation act which, if passed, will extend the benefits of this law to employees of the Bureau of Mines, engaged in hazardous work. The act provides that workmen and employees on the Isthmian Canal and for the Reclamation Service who are injured shall be entitled to receive their pay for one year. Martin D. Foster, of Illinois, the chairman of the new committee on Mines and Mining in the House, has introduced a bill to apply a portion of the proceeds of the sale of public lands to the endowment of schools or departments of mines and mining. Bills have also been introduced to repeal the duty on coal and coal slack or culm, bitumen and asphaltum, and iron ore. Atterson Rucker, Fort Logan, Colorado, has introduced a bill providing for the cession by the Government to the States of all unoccupied public domain.

JOHANNESBURG, TRANSVAAL

Shaft Sinking on the Western Rand Estates.—Width of Reef.— Cast-Iron Shaft Lining. — Centrifugal Pumps. — Bailing Skip.—Pilot Drills.—Globe & Phoenix Mine.

The Western Rand Estates Co. Ltd., owning a large block of gold claims on the extreme southwestern part of Witwatersrand, is carrying out most interesting sinking operations in the aqueous dolomites which overlie the reef on that company's property. A series of bore-holes was put down on the farm Gemsbokfontein—the property of the company—a few years ago, and these disclosed the presence of two principal gold-bearing reefs. The first of these auriferous conglomerates encountered was termed the Western Rand Leader and was struck in three bore-holes at depths of 1972, 1677, and 2302 ft. respectively. The assay value and reef widths disclosed in the cores were as follows:

Hole.	Inches.	Dwt. per ton.
No. 4	10.5	158.0
No. 8	15.5	18.83
No. 9	8.0	6.6

The lower reef, known as the No. 2 West Reef, was encountered in eight bore-holes at depths varying from 2004 to 3229 ft., the width of reef disclosed varying from 5 to 29 in., and the value from 2.5 to 22.74 dwt. per ton.

The company commenced sinking a circular shaft on Gemsbokfontein in September 1909, but owing to difficulties encountered in sinking through soft decomposed chert and dolomitic breccia, the depth at the end of last June was less than 80 ft. Work is now proceeding at a better rate, but the shaft will have to penetrate between 1200 and 1300 ft. of dolomite, which has never before been attempted in South Africa. The shaft is 17 ft. 9 in. in the clear, and will be lined throughout with lead-jointed cast-iron lining, varying in thickness from $1^3/_{16}$ in. for the first 100 ft. to about $2^1/_4$ in. at the lowest depth of the water-bearing strata. The whole shaft will be completely water-tight, the lining being strengthened by concrete filling behind. The lining is made in ten segments to the circle, the width of each ring varying from 2 ft. 6 in. to 5 ft. Bearer-rings, which will be let in at intervals on the solid rock, project 2 ft. beyond the circle. The matter of handling water has been met by the installation of two Sulzer pumps, capable of raising over 2,000,000 gal. per 24 hours. These pumps are a novelty on the Witwatersrand. They are cen-

trifugal and are operated by a 300-hp. motor; a balling skip of new design has also been delivered on the property. It consists of a tubular contrivance, capable of holding 600 gal. of water, and provided with a tight-fitting piston which is capable of being operated by the hauling wire. On reaching the bottom the piston automatically sinks to the bottom on the slack and on being raised sucks up water through a clack-valve and fills the skip. The shaft is at present being sunk by hand, but it is intended to install machines at a later date. Pilot drills are kept at work in the bottom of the shaft to minimize the danger of a sudden rush of water from the bottom.

The Globe & Phoenix is the most notable mine in Rhodesia, partly on account of its rich ore and partly because of the attraction its shares have had for speculators. The workings are deep, the main shaft being down to 2481 ft. on the dip. During the last year or so, most of the development has been on the sixteenth and seventeenth levels above and below an intrusive dike. Operations have recently been hindered by necessary overhauling of the plant and retimbering the main shaft. The presence of antimony has caused trouble to the metallurgist. When 3-oz. ore yields only 2¼ oz., it means the loss of what is practically another gold mine, and the dump provides the enterprising metallurgist with an interesting problem. During the past year the repairs to the shaft have made it impossible to raise sufficient ore to keep the extraction plant going, so the directors decided to mine ore richer than the average so as to make the total profit the same as if the mill had been at work the whole time on average ore. Thus 88,397 oz. was recovered from 41,257 tons, realizing £376,372 and yielding a profit of £236,569. The dividend was 115%. In spite of hindrances to development the ore reserve has been fully maintained throughout the year and stood on December 31 at 178,221 tons averaging 33.9 dwt. The orebody is notable for the occurrence of rich shoots running to 5 and 6 oz. gold per ton. Many improvements in metallurgical treatment have recently been introduced by H. T. Brett and much of the antimonial sulphide is now removed by concentration and roasted. During the last month or so the extraction has by this means been raised from 75 to 86%. It is possible that before long a further more drastic alteration of the plant will be undertaken and all-sliming introduced.

KALGOORLIE, WESTERN AUSTRALIA

Diamond-Drilling at the Great Boulder. — Encouraging Results. — Associated Northern Option. — Drop in Bullfinch Shares. — Deviation of Drill-Holes.—Low Water-Supply. — Use of Motor Vehicles.—Super-Phosphate Production.

Some encouraging results have been obtained by diamond-drilling at 2800 ft. in the Great Boulder. A series of holes was put in toward the Ivanhoe and Horseshoe boundaries with the following results: A horizontal bore westerly from the main shaft cut ore at 194 ft., it being 19 in. wide and worth $170 per ton. At 210 ft. 14 in. of ore, worth $23, was cut. From the same point, another hole, at 220 ft., cut 3 ft. of ore worth $57, and 6 ft., assaying $22, close to the Golden Horseshoe boundary. One hole from the Boulder was continued into the Ivanhoe, and encountered a lode 12 ft. west of the east boundary, and 57 ft. north of the south boundary, it being 3 ft. wide and worth $21.50. Further drilling at 2800 ft. in the Boulder in a southwest direction, at 95½ ft. from the shaft, a vein 1½ ft. wide was cut, worth $36; and at 144 ft. cut 2 ft. of ore worth $86, 13 ft. from the boundary. The Ivanhoe reports that in cross-cutting west at 2270 ft. they passed through 2 ft. of ore worth $4.58 per ton, 139 ft. west of the main shaft. This is supposed to be the middle lode, which has not been worked below the 1669-ft. level. The Perseverance at 2050 ft. reports 6 ft. of profitable ore. The shaft is down 2200 ft., and the cross-cut 140 ft. The sixteenth level of the Chaffers in the Main Reef shaft shows a 5-ft. vein worth $3.50. The Great Boulder announces its reserves at 803,151 tons containing $7,934,696. No estimate has been made of the No. 1 lode below No. 1 level; of No. 2 lode below 1650 ft.; of No. 3 below 1767 ft.; and of No. 4 below the 10th level. Rather good news comes from the St. George mine of the Boulder No. 1, at Mt. Magnet, in that a new lode 12 ft., worth $30 per ton, has been cut in the cross-cut east from the north end of the 100-ft. level. The Associated Northern has taken an option on the Gimlet South and South Extended leases for six months. The price asked is $170,000. A boiler, winch, condenser, etc., are already on their way to the mines, and work will soon be started. The Bullfinch Proprietary has erected a Cornish boiler, and a hoist for sinking the new main shaft, and other development. There has been a great drop in the shares of this mine lately, partly due to reports from outsiders warning people not to rush into speculation on the Yilgarn field. The trial of the late Chaffinch manager and others will come on shortly. The Associated Northern is still drilling from the 550-ft. level; but no ore is cut, and it would seem that there is nothing below the once famous pipe of ore, which comes into the property at 300 ft. from the Brownhill lease, and leaves again at 550 ft. into the Oroyo North block. The mine keeps one ball-mill at work, the other two being on custom ore, which comes in from all parts. Referring to diamond-drilling on this field, it is to be hoped that cross-cutting in the Boulder will disclose the good ore found in the bore. There is a lot of chance about a bore-hole, as most mining men know well. Serious deviations take place, and it seems that the drill always tries to work at right angles to the strike of the rocks. Richard Hamilton, of the Boulder, gave several instances of this in his address at the annual meeting of the Australian Institute of Mining Engineers in 1909. A London paper recently published the story that the deviation of a drill was due to magnetism, tending to drive it away from the pole toward which it was boring. Experienced men here do not accept the argument.

As we have had no rains for many months, water in some of the outside centres is very low, and others have had to close down mines until it rains. Large dams with a clay or cement bottom have been constructed at most places, but evaporation is high. As in Nevada and other mining States of the United States, the motor-car has been very valuable in Western Australia in prospecting and carrying passengers to new fields. The motor buggy is fairly satisfactory, as it is high, and can clear stumps and rough ground easily.

During 1910 the Collie coalfield produced 261,587 tons, this being 47,207 tons ahead of the previous term. This coal is used on the railways, mixed with Newcastle coal, and on steamers calling en route to the east; 518 men are employed. The Northampton field produced 125 tons of lead ore, valued at $6000. About 400 tons of black tin was won on the Greenbushes and Marble Bar fields; while 2300 tons of copper was produced from the mines at Phillips river and West Pilliarra. It may be of interest to note that a ship laden with 1500 tons of copper ore from the latter field, was caught in a cyclone recently and overturned, only one man out of 23 being saved. Renewed interest is being centred in the Ora Banda field, north from Kalgoorlie. The wheat production of this State is increasing rapidly, and good results are obtained by using super-phosphates. There are two large plants near Perth for its manufacture, operated by the Mt. Lyell Co., and by Cuming, Smith & Co. The former can hardly meet the demand for its product. Phosphate rock comes from Christmas island, in the Indian ocean; while sulphide for acid manufacture comes from Huelva, in Spain. It is hoped before long to use deposits of these minerals which occur in Western Australia. The phosphate rock is broken in jaw-breakers, and ground in a ball-mill. The sulphide is crushed to about ½-in. size, and roasted in Herreshoff furnaces. Both nitric and sulphuric acids are made at the works. The resulting product is bagged and transported to the farming districts. Taking advantage of a trip to the coast, I inspected this plant, also the lime treatment of the water supply at Mundaring weir. The latter is working satisfactorily, the inside of the main conduit is getting coated with lime, this preventing further corrosion, while the corrosive element is being precipitated out.

General Mining News

ALASKA

JUNEAU DISTRICT

It is expected that $600,000 will be spent during the summer on the Alaska-Juneau in the construction of a mill and in development work. F. W. Bradley, the president of the company, will visit the mine soon. The De Groff Mining Co. has purchased the adjoining Mills mine and will proceed to enlarge the mill on its own property at Chichagof, near Sitka. A San Francisco company is opening the Bear's Nest mine on Douglas island. The California-Nevada Copper Co. is working three shifts and will eventually employ 200 men.

KETCHIKAN DISTRICT

Large bodies of magnetite have been discovered near Sulzer on the Kasaan peninsula, and at other places in this district, but are as yet undeveloped. Recently the suggestion has been made that they might be profitably worked if electric smelting were used, as in Shasta county, California.

THE TANANA

(Special Correspondence.)—An important deal was put through recently when L. M. Drury and associates took over the entire property belonging to Hoel Bros., Johnson & Witmer. This comprises four claims on the divide between Wildcat and Vault creeks. On two claims a vein 30 ft. wide has been traced for 1000 ft. A 2-ton sample from one of the prospect-holes on this vein recently milled $9 per ton. The vein on the other two claims is smaller and higher grade, running from 8 in. to 2 ft. wide, a one-ton sample from which milled $45 in the Fairbanks mill. There are two 80-ft. shafts on the latter, and a 60-ft. drift at the bottom of one. The new owners are planning development on a larger scale this summer.

Owing to a blockade of the railroad for most of the month, due to heavy snows, only three runs of ore were put through the Chena customs mill. A run of 8 tons from J. C. Kinney at Ester netted $256, or $32 per ton. L. J. McCarty, at the head of Fairbanks creek, also sent in 39 tons which gave a bar worth $4740, or well over $100 per ton. The largest returns were from 52 tons shipped from the Rhoads Hall mine on Bedrock creek. The bar weighed 415 oz., the gold being worth $16.42 per ounce, or a total of $6814. This is probably the last shipment to leave the claim, as W. C. Hall is now in San Francisco getting a mill to be erected this summer. The next run at the Chena mill will be 70 tons or over from the Golden-Sherrard lease at the head of Cleary. A small run taken by milling every tenth sack shows that the entire lot will average $105 per ton.

Herchberger & Zimmerman are opening up a very promising vein between Twin creek and Skoogy gulch. There are 20 tons of rock on the dump at present. The vein varies from 1 to 5 ft. thick and assays well. A mill-run will be made soon. Two very good samples of galena have come in recently. One from the Excelsior, owned by Cook brothers, on Fairbanks creek, assayed 313 oz. silver and $3 in gold. Another sample from Freeman and Scharf at the head of Fox gulch showed 260 oz. silver and $6 in gold. After being closed down for several months the Tolovana mine will start stoping. George Hunter, the manager, has just returned from the outside. The mine has paid all its expenses during development. A mill run on 5800 lb. completed recently netted $250.

Steady development work is going on at the Peterson lease on the Friedrich vein. Adits are being driven at a depth of 120 ft., and very good ore has been found on both sides. This property will probably erect a mill this summer. Having almost raised the necessary $20,000, the Quartz Development Co. will soon commence operations. At present, the board of directors is looking over properties that have offered favorable propositions. With the choice of the property to work on, no difficulty will be experienced in raising the rest of the money needed. Hoel Bros., Johnson & Witmer, who recently sold out their Vault creek holdings, are getting a plant and will soon start to open up some good prospects found by them at the head of Treasure creek.

The Fairbanks Core & Drill Mining Co. will soon put an issue of stock on the market. The purpose of the company is to bring in drills and prospect quartz properties for an interest. A large set of tools will also be brought into the country to prospect placer ground where the holes will not be over 200 ft. deep. E. H. Mack is secretary and general manager for the company.

The famous No. 17 Goldstream will be worked from four shafts by Petersen & Kellum. The first clean-up has already been made, giving returns of over $5000. To further investigate the dredging ground, tied up by Lemons and Powell last year, Dupree Lance, a London mining man, has just arrived with two of the directors of the company, H. J. Robson and William Turton. The properties lie on Fairbanks and Pedro creeks.

Dredge on Bonanza Creek.

Fairbanks, March 21.

ARIZONA

COCHISE COUNTY

A big discovery of lead and silver ore has been made in the Arizona-Cleveland in the Gunnison range of the Dragoon district. The richest ore runs 600 oz. silver; the company expects to ship a 30-ton carload this month. A large air-compressor and a 50-hp. hoist have been ordered. The East Side Gold M. Co., ten miles east of Bisbee, is preparing to erect an air-compressor and a gasoline hoist. Fourteen men are at work on the property of the McKinley Mining & Development Co. The most important thing at present is to get the roads in shape, after which $10,000 will be spent in improvements.

GILA COUNTY

The recent test of the Miami mill showed the surprising result that it can be operated at nearly double its rated capacity. Unit No. 4 is now ready for operation; this is equipped with Burch rolls instead of Chilean mills, and units 5 and 6 will be equipped with either Burch rolls or Chilean mills. The capacity for six units will be 4000 tons. Three tons of concentrate was shipped to Cananea, April 11 and 12.

YAVAPAI COUNTY

The vein opened in the lower tunnel of the Starbuck mine averages 4 ft. in width and carries high-grade silver ore. The find is considered the most important one ever made on the property. Placer gold amounting to $180 was brought to Prescott last week from the claims on Oak creek, which belongs to George Brook and Harry Schlosse.

YUMA COUNTY

Gold has been discovered about 25 miles northeast of Yuma and 16 miles east of Brawley, and many prospectors are on their way to the scene of the find. In the North

Star claim of the Copper Reef Con. Mines Co., the crosscut from the 300-ft. station of the inclined shaft is in 25 ft., while the California adit is in 760 ft. and has cut the California vein, which is 14 ft. wide, with 18 in. of good ore.

CALIFORNIA

CALAVERAS COUNTY

The mill-men at Angels Camp quit work on Monday on account of a 50c. reduction in wages per day. The 5-stamp mill at the Duryea mine in Chile gulch was sold last week and will be moved to about a mile below the Foote & Thompson on the Mokelumne river.

ELDORADO COUNTY

The *Mountain Democrat* reports that L. J. Strait, whose work was stopped by the Débris Commission until a dam should be built to hold the débris, has devised an entirely new plan of operation which obviates the construction of an expensive dam. H. C. Cline is re-opening the Davidson mine at Shingle Springs; a shaft is being sunk to the 300-ft. level. A 10-stamp mill will be erected to treat the ore, which averages $14.50 per ton. A party of students from the University of California is exploring a cave in the limestone, near Cool, and has made some interesting finds. Good ore has been struck in the Barney mine, near Omo. W. A. Bell is beginning to re-open the Dalmatia mine, near Kelsey, which was closed down some years ago. A test run has been made at the Georgia Slide mine, at Georgetown. A large new mill is planned.

KERN COUNTY

The Yellow Aster mill is handling 500 tons per day of ore that will average $2.75 per ton, and is making good profits. The Inyo Coso company is finding high-grade ore in its new adit, which is in about 400 ft. The aerial tramway, made by A. Leschen & Sons for the West Gold M. & M. Co., in Wilson canyon, is being delivered. A 50-ton redwood tank for the Arondo mine, in the Argus range, has been delivered. The U. S. Geological Survey has completed its field work on the Ballarat quadrangle.

SAN BERNARDINO COUNTY

The Needles smelter is treating only 100 tons per day at present, but by the middle of next month is expected to be in full operation at its rated capacity of 350 tons per day. The core-drill, to be used in prospecting the Desert Chief mine, is daily expected in Barstow. A tube-mill will be erected at the Bagdad-Chase mine, near Barstow, by G. E. Roth, to treat the tailing.

SHASTA COUNTY

The 25-ton furnace at Heroult has been in regular operation for some time with but few brief delays. The work on the construction of the three new furnaces, which will require 6000 hp. more, is being hurried and it is expected to have them ready by the first of July. The National mine, near the head of Churn creek, which was abandoned a couple of years ago, has been explored by G. M. Sleezer, who has found good ore, and has re-located the property. He has shipped 60 tons of ore that averaged $45 per ton. The new stamp-mill on the Uncle Sam has started. The Old Diggings district is busy supplying siliceous ore to the smelters.

SIERRA COUNTY

Men are at work repairing the damage to the North Fork ditch, and later the Middle Fork ditch will be repaired also. This was carried away by a snowslide. It is planned to blast deep enough into the bank so that any subsequent slide will go over the ditch without injuring it. Shaft-sinking is in progress on the vein from the lower adit on the Plumbago mine. Work has started again on the Standard mine, which closed down early in January. The contract has been let for the construction of the 10-stamp mill for the Tightner mine. It will have 1200-lb. stamps and the pulp will pass to two concentrating tables and then to buddles and vanners after it has gone over the plates. The slime will be treated in a cyanide plant. The mill will cost about $20,000. The mill is 700 ft. from the dump, so a tramway will be built to convey the material to the mill. It is expected that $50,000 profit will be made in treating the dump.

TUOLUMNE COUNTY

The new 10-stamp mill at the Duffield, near Arastraville, will be started about May 1. A new pump is to be erected. ——The electrical equipment for the Gold Ship mine, near Groveland, has been ordered and will be supplied by the D. D. Demarest Co. The order includes an electric hoist, two 40-hp. transformers, a 50-hp. motor, and a pump. An electric transportation system and a lighting system will probably be installed in the near future. It is understood a large amount of development work will be done during the present year.——The 5-stamp mill being installed at the Gianelli mine, above Arastraville, will soon have its 15-hp. gas engine running. The vein, 4 in. to 3 ft. in width, is one of the richest yet uncovered in the district, assaying from $10 to $500 per ton.——Electric power is to be used at the Humbug gravel mine, at the base of Table mountain, near Jamestown, at which active operations will be resumed as soon as the branch transmission line, now well under way, is completed. The mine is worked through a long tunnel which taps the channel beneath the mountain, and in the early days yielded much gold.——Several shallow shafts have been sunk at the Mill Villa to determine the value and extent of the gravel deposits, and the results indicate that the enterprise will prove profitable.

The management of the Tarantula mine will concentrate its efforts on the development of the property. A large force is employed in the mine. It is reported that the new 20-stamp mill will soon be in operation. The company's holdings comprise several claims on the Mother Lode near Shawmut.——Title to the valuable holdings of the Tuolumne River Power Co., consisting of 65 miles of ditch, water-rights, power-sites, etc., has passed to the Yosemite Power Co., whose principal stockholders are said to be Maine capitalists. It is said that the purchasing company will expend several million dollars in the construction of an electric-power site.

Tuolumne, April 22.

COLORADO

CLEAR CREEK COUNTY

(Special Correspondence.)—From a shipment of eight tons of ore made from the lease on the Lamartine being operated by Charles Carlson, the sum of $800 was realized. ——A body of ore from 2 to 7 ft. wide has been uncovered in the stope being carried in the west drift of the Bellman vein. Tests show value of 2.50 to 3.25 oz. gold per ton. George S. Wilkie is manager.——The track at the Newhouse adit is to be extended from the dump down Clear creek as far as the Wilkie mill. The plant will be run upon ore from the Saratoga mine.

Idaho Springs, April 14.

GILPIN COUNTY

(Special Correspondence.)—A big body of medium-grade ore has been uncovered on the 100-ft. level of the Baxter mine on Quartz hill. There is also showing an 8-in. streak of smelting ore that is worth from 10 to 15 oz. gold per ton. G. R. Gibson is manager. Anderle & Co., leasing on the Egyptian mine, are shipping 50 tons of ore each month that brings $21 per ton in gold and silver.——The Coeur d'Alene M. Co. has completed a road from the mine to the county road, and shipments will be started at once. The water in the Grand Army workings has lowered to the 1200-ft. point. It has been decided to allot the ground to lessees.——Shipments from the Champion mine are averaging $18 per ton; the ore being taken from the 800-ft. level.

Central City, April 14.

SUMMIT COUNTY

(Special Correspondence.)—The Shoe Basin mine, which is owned by Peoria, Illinois, people, who also own the Peruvian mine, advanced its tunnel 216 ft. during March, and on April 1 was in a distance of 936 ft. The tunnel was started October 25, 1910; it is expected to cut the Peruvian vein at 1025 ft., but 1250 ft. remains to be driven on the

vein before connection is made with the old Peruvian shaft, which shows continuous ore to the bottom of the shaft.

It is understod that the Little Jumbo mine, operated by Mr. Rosengarten, who is one of the oldest operators now in the district, is going to build a 100-ton mill this year. There is an ore-shoot developed at good depth and a large amount of ore blocked out. The ore is lead-zinc carrying silver and gold, and the orebody is continuous for 700 ft. in the lower tunnel, and averages over 4 ft. wide. It is heavily mineralized and it is only a matter of separation to make a lead and commercial zinc product. The ore is very similar to that of the Wellington mine at Breckenridge, but carries more silver.

The Colorado Toledo mill started operation April 1, and is operating one 8-hour shift daily, with the usual trouble in separating the iron from the zinc. The mine has large orebodies and two 8-hour shifts are being worked, blocking out ore while experimenting with roasting, so as to make a better separation. The construction of the mill has proved satisfactory, and it can handle ore more economically than any other mill in the district. The Wagner process, as well as the Motter method of separation, is under investigation.

Montezuma, April 13.

IDAHO

SHOSHONE COUNTY

(Special Correspondence.)—The Stewart mine, controlled by F. A. Heinze, is making a good showing. Five hundred tons of ore is sent to the mill every day and first-class ore at the rate of 600 tons per month goes to the East Helena smelter. The first-class ore runs 40% lead and 40 oz. of silver per ton. The second-class is concentrated 6½ into 1, and the concentrate runs 50% lead and 30 oz. in silver. The Stewart has cleared off all indebtedness, except about $50,000, and that will be paid off in about six weeks.

One hundred thousand dollars is being expended to make the Hunter mine, near Mullan, one of the best equipped plants in the Coeur d'Alene district. Among the improvements contemplated are the enlarging of the mine and the installation of an electric hoist and electric trains for hauling ore from the shaft to the bins on the tunnel level. The capacity of the mill will be increased from 400 to 800 tons daily. The latter work is to be completed early in June. One hundred and fifty men are at work, the principal operations being on the 400-ft. level.

Separations as clean as could be desired and with a small loss are being made in the mill at the Success mine in the Coeur d'Alene. Sufficient ore is broken down in the stopes to run the mill several months, and there is enough ore blocked out to assure a steady output for several years. Some of the stopes that were worked twenty years ago are being re-opened and are ready to yield a large tonnage. Having been worked for the lead alone, most of the clean zinc, or mixed lead and zinc, was left on the walls.

Development work on the Federal company's mine at Mace, Idaho, has opened a large orebody on the 1800-ft. level. The ore was encountered at No. 12 chute and has been driven on to No. 22 chute, a distance of 400 ft. It is believed to continue to the end line of the Mammoth claim. The new ore is superior to anything that has been opened in the mine and prolongs the life of the property indefinitely. A new orebody, showing 13 inches of steel galena, was discovered recently in the 1400-ft. level. The west drift in this level was extended to the end line of the claim, and it was within a few feet of the line where the new ore was found. The company is negotiating for the purchase of the Cleveland claim, into which it is believed the orebody extends.

Favorable indications are seen in the Northern Light property in northern Idaho, where a find of importance was made in a cross-cut from the shaft at a distance of 65 ft. from the surface. The shaft began in ore which dipped at about the depth of 40 ft. Several stringers of ore were cut in sinking the shaft. The cross-cut picked up one of these at 10 ft. and shows that the vein had widened to fully 10 ft. and that it is full of ore, the richest galena showing throughout the quartz. The cross-cut will be continued to cut the other stringers, and as these were better in the upper workings than the one just discovered even more is expected of them. The shaft will be continued to a depth of 100 ft. before the next cross-cut is made.

Wardner, April 22.

MONTANA

FLATHEAD COUNTY

(Special Correspondence.)—Preparations are being made for an active season by placer miners in the Libby Creek district in western Montana. The Libby Creek Placer Mining Co. is arranging to erect a small sawmill to cut lumber for flumes and buildings about twenty miles south of Libby, where it holds a large area of ground. Operations have been started on the Rice placer claim in the Republic district, where there is abundant water this spring.

Spokane, April 20.

SILVERBOW COUNTY

(Special Correspondence.)—The St. Lawrence mine of the Anaconda group, after having been closed for several months during which the shaft was retimbered, has resumed operations.

According to all reports there is much activity in the Radersburg district, and there is a large amount of Eastern capital being put into both old and new properties. The Ohio, the Ohio Keating, and the Black Friday are shipping regularly, while development work is going on in the Bluebird, Mammoth, Combination, Keating, and the Rena. Locations are being made north of the Keating to the schoolhouse near the town, while all the ground two miles south of the Black Friday into South Radersburg district has been taken. W. L. Credon, the mining engineer, has just returned from the district where he has been making an examination of ground for Duluth capitalists.

A suit has just been filed in the district court against the East Butte Copper Mining Co. for $30,000 for personal injuries. John D. Wiser alleges in the complaint filed that while employed by the company he was working in a coal-bin when one of the cables attached to a large elevator used in lifting the coal, broke and struck him across the back, breaking several ribs, injuring his back and causing internal injuries.

Butte, April 24.

NEVADA

CHURCHILL COUNTY

The new shaft at the Nevada Hills, at Fairview, is down 200 ft., but no cross-cutting will be done until 650 ft. is reached, when connection will be made with the Wingfield and Fairview Eagle veins and the old Nevada Hills workings. The machinery is being delivered and electric power should be available on May 15. The company is advancing $40,000 to the hydro-electric company to build the power-line and will 'take out' this sum in power. The mill will have a capacity of 125 tons per day and will cost about $250,000. An illustrated description of it appeared in the *Mining and Scientific Press* of April 8.

CLARK COUNTY

The Searchlight M. & M. Co. has started its 50-hp. triplex pump on the fourth level, and no difficulty has been experienced as yet in keeping the water down. The pump has a capacity of 500 gal. per minute and is motor-driven. The electric generator is 100 hp. and furnishes current for electric lighting the plant and company houses.

ESMERALDA COUNTY

The Goldfield Con. will pay a dividend of 50c. per share today, corresponding to its regular quarterly dividend of 30c. plus an extra dividend of 20c. This will amount to $1,779,574, making the total paid in dividends to date by this company $14,587,035, or a total of $4.10 per share. The quarterly statement will also be given out.

HUMBOLDT COUNTY

The Hutchinson gold strike, near Mill canyon, is confirmed by many mining men who have since visited the camp. Tom Kearns has taken an option on the property.

Rich ore has been found in several different places, and it is hoped that the camp will prove a big one.

Mike Timmons, who has a block of ground with the Kindergarten Mining Co. at Seven Troughs, is reported to have obtained $3600 worth of gold from 670 lb. of ore.

NYE COUNTY

The total shipment of the Tonopah district for last week amounted to 7786 tons, of a value of $194,650. Of this, the Tonopah M. Co. sent 3150 tons; Belmont, 2200; Tonopah Extension, 980; Montana-Tonopah, 1006; West End, 400; and Midway, 50. The Big Four Lease has made its second mill-run, of about 400 tons of ore, which will average about $80 per ton. The management is much encouraged by this excellent showing.

STOREY COUNTY

The Mexican produced one-half of the ore of the North-End last week, its output amounting to $11,000. North drift No. 2, from the east cross-cut on the 2300-ft. level, has been driven 7 ft., yielding 19 cars of ore averaging $68.27 per ton. The face is all in ore of the same grade. South drift No. 2 has been extended 10 ft., yielding 20 cars of ore averaging $58.53 per ton. The north drift from the east cross-cut No. 2 on the 2400-ft. level was driven 39 ft. and turned to the east, exposing a 7-ft. vein from which 15 cars averaged $17.91 per ton. In the raise at the end of the north drift 86 cars, averaging $74.88 per ton, were taken out. The roof is now 61 ft. above the 2500-ft. level. Ophir continues to stope a good tonnage from the Hardy vein on the 2100-ft. level. The Yellow Jacket mill was only operated part time during the week on account of a shortage of ore, but 476 tons of Crown Point ore and 160 tons of Belcher ore were crushed.

WHITE PINE COUNTY

The Steptoe concentrator is handling ore at the rate of 11,000 tons per day, all eight sections now being in operation. All the ore is coming from the Copper Flat cut of the Nevada Con. Two of the five reverberatory furnaces at the smelter are now being fired exclusively with oil. Within a short time the power-plant, roasters, and one of the engines will be fired with oil. All the shovels and engines working in the pits at Copper Flat will also be equipped with oil burners. One advantage of this will be the doing away with the cinders that get mixed with the ore and have a tendency to choke the screens in the mill. Good ore is being obtained from the Zack shaft of the Ely Con. The average over 20 ft. wide is said to be 6¾% copper. It is intended to continue sinking the shaft to the 600-ft. level.

OREGON

BAKER COUNTY

The Belcher mine, in the Greenhorn district, was sold last week by U. S. Commissioner G. L. Bender to satisfy a judgment, and was bid in by the representative of M. F. Douche for $25,814.60. There are more than 2000 ft. of underground workings in the mine. The North American mine at Beaumont was purchased at sheriff's sale by E. Callahan, of Baxter. It is reported that the Climax mine will be re-opened this summer. A small force of miners is engaged in driving a cross-cut to reach the vein on the Homestake near the Columbia mine. A. E. Dagany is in charge.

COOS COUNTY

The coalfields of Coos county are the most important in Oregon, and are one of the most valuable resources of that region, as coal mining is one of the leading industries of the county and has great possibilities of future growth. More recently central Oregon has been explored for oil and it has been found in commercial quantities near Vale, Malheur county. Coal occurs in Jackson, Josephine, and Polk counties, and these deposits also may develop in time into steady producers.

JOSEPHINE COUNTY

The Oriole mine, in the Galice district, has attracted much attention recently, several shipments of ore to the Tacoma smelter having netted good returns, and a recent shipment of 20½ tons netted $3724. The fourth tunnel is being driven into the orebody. This will be 950 ft. in length and will open a 'back' of some 600 ft. The ore-zone has been proved for a width of 40 ft. The vein is composed of quartz stringers and nodules interbedded in soft slaty material, the gold being in the quartz. The foot-wall is a metamorphic slate and the hanging wall a quartzite. The property consists of nine claims, with attached water rights.

PENNSYLVANIA

ALLEGHANY COUNTY

(Special Correspondence.)—On Friday evening, April 28, at the monthly meeting of the Pittsburg Railway Club, F. N. Speller, metallurgical engineer for the National Tube Co., will read a paper on locomotive boiler tubes. In the afternoon of the same day the National Tube Co. has invited the Pittsburg Railway Club to visit the Ellwood City plant where the members of the club will have an opportunity to observe the manufacture of cold-drawn steel tubes and hot-rolled seamless steel tubes.

The convention of the American Society of Mechanical Engineers will be held at Pittsburg, May 30 to June 2. Professional sessions will be held in the lecture hall of the Carnegie Institute, and there will be a number of inspection trips to various industrial plants in the vicinity; a boat excursion for the members and ladies up the Monongahela river, a reception and ball at the Hotel Schenley on Thursday evening, and, finally, on Friday evening a smoker and entertainment, given by the Engineers' Society of Western Pennsylvania, in their rooms in the Oliver building.

Pittsburg, April 20.

UTAH

JUAB COUNTY

Four carloads of ore have already been sent to the smelter from the recent strike on the 800-ft. level of the Mammoth. The ore has so far been opened for 35 ft. and is in entirely new ground. The production at the Iron Blossom has been slightly less this week. The Iron Blossom declared a dividend of 10c. per share, amounting to $100,000 last week. This is 4c. per share more than the preceding dividend. The total ore shipment from the district for the week was 184 cars, the Centennial-Eureka leading with 46 cars.

SALT LAKE COUNTY

(Special Correspondence.)—The Utah Society of Engineers held its annual dinner at the Commercial Club on April 20. M. D. Grosh was elected president, C. F. Moore and E. H. Beckstrand as vice-presidents, R. B. Ketchum as secretary, and A. S. Peters as treasurer, to serve for the ensuing year.

Salt Lake City, April 22.

SEVIER COUNTY

(Special Correspondence.)—The Sevier-Miller Coalition mine, situated sixteen miles from Sevier station, has been developed during the winter and has a big tonnage of gold ore exposed and much of it broken. The mill, which is equipped with stamps, amalgamating plates, and cyaniding machinery, is to be started about June 1. The ore assays about $10 per ton in gold, about half of which is expected to be recovered on the plates and the other half by cyanidation. In order to make the latter process more effective a Kelly filter-press is to be added to the present equipment. It is figured that the extraction will reach 90 to 95% of the assay value of the ore. The mill, which has a capacity of 200 tons per day, is equipped for operating by electric power, generated at the company's hydro-electric plant. B. F. Bauer, of the Salt Lake Hardware Co., and F. T. Tilton are largely interested in the property, the latter being in charge.

Sevier, April 20.

SUMMIT COUNTY

The strike of the men at the Silver King Coalition was settled last week by acceding to their demands, and three shifts are now at work. The judgment obtained by the Silver King Consolidated recently has been appealed.

TOOELE COUNTY

(Special Correspondence.)—The Bullion Coalition Co., having nearly 100 patented mining claims in Stockton district, including the Honerine and other groups, is operating with a force of 35 men and shipping 700 to 800 tons of lead-silver ore per month to the smelter; and there are 25 men working on leased ground of the company, from which about 300 tons of ore per month are being shipped. The ore samples 25 to 28% lead, and 20 to 30 oz. silver per ton, and a little gold. The principal vein has an east-west strike and is opened by adits. The old workings, which are in the hands of lessees, are entered through the original adit; the lower workings, where mining on company account is in progress, are entered through the 7000-ft. drainage and haulage adit, and connecting with the latter is a drift of 7000 ft. on the vein. This haulage adit, known as the Honerine tunnel, now has a flow of about 2000 gal. of water per minute. The Honerine concentrating mill, belonging to this company, and built several years ago, is not in operation.

Stockton, April 20.

WASHINGTON

FERRY COUNTY

(Special Correspondence.)—The North Washington Power & Reduction Co.'s mill building is so near completion that some of the machinery is being erected. The last of it is expected to be delivered within a week. Estimates are being made of the ore tonnage likely to become available from the leading mines of the district, on which to base an enlargement of the mill. In the Quilp mine most of the work is at present confined to driving the Surprise drift from the 400-ft. level and shipping ore from the Callahan stope, above the adit-level. Ore assaying $35.86 per ton, of which $33.60 is in gold and $2.26 silver, is being shipped from the 500-ft. level from a stope 4½ to 5 ft. wide. The Republic Mines Corporation has sunk a winze 75 ft. below the 300-ft. level of the Lone Pine mine and is getting out $30 ore from a stope over 7 ft. wide. The Surprise continues to produce ore from the 210-ft. level and has a working face of $50 ore. A raise has been completed to the intermediate level, 40 ft. below the Jim Clark adit. The drift on the 600-ft. level from the Quilp 400 has reached a point under the cross-cut from the main incline, and a raise has been started in $30 ore, supposed to be identical with the orebody on the cross-cut, but there is a difference in elevation of 360 ft. between the two points. The company is awaiting smelter returns from 40 carloads of ore shipped last month. According to the last report of the superintendent, the Lone Pine assays have run up to $125 per ton in the past few days. The Knob Hill mine will probably make one of the best records in the camp, from the way it is opening up. In the No. 3 stope on the No. 2 level, a vein 6 ft. wide, 3 ft. of it on the hanging-wall side at the face, assays $96 gold and $8.50 silver, total $104.50 per ton. On the foot-wall it assays $328 gold and $15.50 silver, total $343.50 per ton. Back from the face 15 ft., the back of the stope assays $508 gold and $22 silver, total $530 per ton. The north drift is in 35 ft. on the pay-shoot. A general sample from the last 10 ft. driven assays $38.40 gold and $2.34 silver, total $40.74 per ton. During the past week the company has sent to the smelter 30 tons per day. The north drift continues running on a full face of ore. On the No. 4 level the north drift is being pushed ahead, and it will require 20 days longer to get under the orebody on the No. 2 level. The smelter returns from four cars of ore amount to $7506.65 gross value, as follows: two cars, about 30 tons each, assayed $61.25 per ton. The gross value was $3320.70 gold and $286.20 silver, total $3606.90. The other two carloads assayed $65.35 per ton, and the gross value was $3579.84 gold and $319.91 silver, total $3899.75.

Republic, April 14.

SPOKANE COUNTY

Announcement is made in Spokane that the Gold Nugget mines, including the Nugget, Coyote, and Bonanza claims in the Nelson district in British Columbia, have been acquired by J. T. Hillis and A. E. Baker of Vancouver, who will organize a new company, capitalized at $500,000, to build a cyanide plant and stamp-mill of 100 tons daily capacity. It is reported that Messrs. Hillis and Baker purchased the treasury stock, amounting to 142,000 shares, on which they had an option, and thus came into control.

The Factor Mining Co. has decided to expend $10,000 on the exploration of its property in the Orient district at Washington. The plans include a shaft of 250 ft. and a 300-ft. extension of the tunnel. The company expended $7555 in exploring 344 ft. of its property in 1910, and the results so far are highly satisfactory. G. A. Horley is president of the company, the secretary being M. E. Poole.

The San Poil Consolidated company, of which Robert A. Koontz of Spokane is president, will being installing machinery on its property at Republic, Washington, in a short time. The equipment consists of a 60-hp. engine and a compressor to drive two stope and three piston-drills. The claims to be developed are the Trade Dollar, the South San Poil, and the North San Poil. The Trade Dollar tunnel on the 300-ft. level will be driven 800 ft. J. L. Harper, general manager for the North Washington Power & Reduction Co., the Republic Mines Corporation, and the Imperator-Quilp Mining Co., announced in Spokane that the first unit of 250 tons of the mill at Republic, Washington, will be in operation by June 1. The plant will be enlarged to treat 1000 tons daily. Mr. Harper says that work is progressing on all the properties controlled by his companies.

There is much agitation over the proposal that the Dominion of Canada should buy Alaska from the United States. The mining districts which are along the international boundary meet a great deal of inconvenience from what amounts practically to being subject to two governments, and individuals who chafe under the restrictions of the Federal Forest Service hail the proposal with delight.

Spokane, April 20.

COLOMBIA, SOUTH AMERICA

The Concordia mine, which has recently been purchased by R. A. Linton for New York and London interests, has made a very large production, and with modern machinery will develop into one of the principal gold mines of Colombia.

MEXICO

SONORA

(Special Correspondence.)—M. H. Perry, who has been general manager for the Creston Colorada for the past four years and in a like position with the Chas. Butters company for 12 years, has gone to Salvador to take the managership of the Butters Salvador mines, held by the late H. P. Garthwaite.

La Colorada, April 14.

The San Lorenzo mine has been sold for $50,000 to the owners of adjacent property. It is reported that it is proposed to consolidate this and the Washington. In the San Lorenzo there is 80,000 tons of ore of 4% copper blocked out. This property was developed by Martin Hickinson, who will remain as superintendent.

A notice from the Department of Fomento under date of March 31 states that no more acquisitions of mining lands may be made by foreigners within a 60-mile zone along the international boundary. This will cause much trouble to foreigners who have denounced lands and then proceeded to form companies while waiting to obtain title.

ZACATECAS

Volney D. Williamson announced on April 12 that the Exploration Company of London has taken over the properties of the Santa Rosa de Mazapil Mining Co. and the Santa Rosa Development Co., situated in the State of Zacatecas, Mexico, eight miles from Concepcion del Oro. A corporation, known as the Santa Rosa Exploration Co., which is capitalized at $750,000, has been organized to acquire and develop the holdings.

Personal

Professional men are invited to send news of their engagements and travels. Such news is interesting to friends.

W. H. Wiley is at Butte.

D. C. Jackling is in New York.

A. F. Sherman is at San Francisco.

C. W. Purington has returned to London.

H. W. MacFarren is at Seattle, Washington.

John B. Keating has returned from Arizona.

E. B. Kirby was at Kingman, Arizona, last week.

Edmund Juessen was at Chaffee, Nevada, this week.

Charles Janin has returned from southern California.

Wilbur A. Hendryx left New York for London, April 19.

Otto Sussmann passed through Salt Lake last week on his way East.

O. H. Packer is examining placer mines in Butte county, California.

J. Malcolm Maclaren is expected in San Francisco from New Zealand.

Ernest H. Simonds has returned to San Francisco from Trinity county.

E. R. Haggin is now with the Candelaria Consolidated Mexican M. Co., San Dimas, Durango.

Owen Letcher is on his way to London from South Africa, traveling by way of the East Coast.

H. T. Durant has severed his connection with the firm of Hommel, Durant & Co., 6 Broad Street Place, London.

Lu C. Tyler has opened an office at 156 South West Temple street, Salt Lake, for assaying and chemical analyses.

Victor C. Heikes, statistician for the U. S. Geological Survey, stationed at Salt Lake, spent last week in Nevada.

Thomas L. Chadbourne, who died recently at Palm Beach, Florida, was for many years counsel for the Calumet & Hecla.

C. Colcock Jones returned to Los Angeles from the Santa Maria oilfields and left April 22 for mine examinations near Nogales, Arizona.

William Seward Mann is building a stamp-mill and cyanide plant for the Pilones Mining Co. at La Portilla, Durango, Mexico.

J. M. Callow has been appointed consulting mill engineer for the Inspiration Copper Co., with C. H. Repath as constructing engineer.

The San Francisco Section of the Mining and Metallurgical Society will meet following dinner at Techau's Tavern, Monday, May 1.

William R. Jewell has returned to Bakersfield from Arizona, where he has been engaged in making a geological examination of oil land.

E. R. Buckley addressed the Mining Club of the Missouri School of Mines on March 28, on 'Importance of Geology to Mining Engineers.'

Joseph H. Playter has returned from examination work in Sinaloa and Sonora, Mexico, to the management of the Nevada Crown Mining Co., Golconda, Nevada.

Lewis A. Parsons and John I. Kane have formed a partnership under the firm name of Parsons & Kane, and have opened offices at Coles building, El Paso, Texas.

B. F. Bush, who has just been made president of the Missouri Pacific railway, is an experienced and capable mining engineer who made an excellent record in handling coal mines in Washington, Illinois, and Missouri.

W. H. Landers has resigned as superintendent for the Standard Con. M. Co., Bodie, Mono county, California, and will be succeeded by J. R. Buchanan, the present assistant superintendent. Mr. Landers will devote most of his time to opening up the Reward mine near Independence, California, in which he is interested with A. J. McCone.

Market Reports

LOCAL METAL PRICES.

San Francisco, April 27.

Antimony	12—12¾c	Quicksilver (flask)	47
Electrolytic Copper	14—15¼c	Tin	45—46½c
Pig Lead	4.75—5.70c	Spelter	7—7¾c

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

METAL PRICES.

By wire from New York.
Average daily prices in cents per pound.

Date.	Electrolytic Copper.	Lead.	Spelter.	Silver, per oz.
Apr. 20	12.00	4.41	5.40	53¾
" 21	12.00	4.41	5.40	53⅝
" 22	12.03	4.41	5.40	53⅞
" 23	Sunday.	No market.		
" 24	12.08	4.40	5.40	54⅛
" 25	12.08	4.40	5.40	54⅛
" 26	12.08	4.40	5.40	53⅞

ANGLO-AMERICAN SHARES.

Cabled from London.

	Apr. 20. £ s. d.	Apr. 27. £ s. d.
Camp Bird	1 11 0	1 12 1½
El Oro	1 4 3	1 4 6
Esperanza	1 13 9	1 12 6
Dolores	1 5 0	1 5 0
Oroville Dredging	0 5 9	0 5 9
Mexico Mines	7 7 6	7 8 9
Tomboy	0 15 0	0 15 3

(By courtesy of W. P. Bonbright & Co., 24 Broad St., N. Y.)

MINING STOCK QUOTATIONS—NEW YORK.

(By wire from Catlin & Powell Co., New York.)

	Closing prices. Apr 27.		Closing prices. Apr. 27.
Amalgamated Copper	$ 63⅛	La Rose	$ 4½
A. S. & R. Co.	74⅜	Mason Valley	8½
Braden Copper	4	Miami Copper	20¼
B. C. Copper Co.	5¼	Mines Co. of America	4⅞
Butte Coalition	16¼	Nevada Con	18¼
Chino	23½	Nevada Utah	⅝
Davis Daly	1⅜	Nipissing	10⅜
Dobie	3	Ohio Copper	1⅜
Dolores	5½	Ray Central	1½
First National	1½	Ray Con	17⅛
Foley O'Brien	1⅜	South Utah	¾
Giroux	6⅛	Superior & Pittsburg	13⅜
Goldfield Con	6¼	Tenn. Copper	36⅜
Greene-Cananea	6½	Trinity	3¾
Guanajuato Con	½	Tuolumne Copper	4⅞
Hollinger	10	United Copper	3⅞
Inspiration	7⅝	Utah Copper	41¼
Kerr Lake	6⅛	Yukon Gold	3⅞

COPPER SHARES—BOSTON.

	Closing prices. Apr. 27.		Closing prices. Apr. 27.
Adventure	$ 4½	Mohawk	$ 38¼
Allouez	31	North Butte	27½
Atlantic	4½	Old Dominion	37
Calumet & Arizona	49	Osceola	99
Calumet & Hecla	481	Parrot	11
Centennial	11½	Santa Fe	¾
Copper Range	60¼	Shannon	10
Daly West	4½	Superior & Pittsburg	13⅞
Franklin	9¼	Tamarack	36
Granby	30½	Trinity	3¾
Greene Cananea, ctf.	6⅜	Utah Con.	14
Isle Royale	13	Victoria	1⅝
La Salle	3¾	Winona	6½
Mass Copper	5¾	Wolverine	107

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

SOUTHERN NEVADA AND COMSTOCK SHARES

San Francisco, April 27.

Atlanta	$ .10	Montana Tonopah	$ .75
Belmont	6.10	Nevada Hills	2.95
Booth	.08	Pittsburg Silver Peak	.70
Columbia Mtn	.03	Round Mountain	.55
Combination Fraction	.11	Sandstorm Kendall	.08
Florence	1.55	Silver Pick	.04
Goldfield Con	6.20	Tonopah Extension	1 05
Gold Kewenas	.05	Tonopah of Nevada	6.70
Jim Butler	.25	West End	.59
Jumbo Extension	.27	Belcher	.90
MacNamara	.11	Con Virginia	1.40
Mayflower	.04	Mexican	4.70
Midway	.33	Ophir	1.75

(By courtesy of San Francisco Stock Exchange.)

Decisions Relating to Mining

Specially reported for the Mining and Scientific Press.

INJURY TO MINER—CONTRIBUTORY NEGLIGENCE

The question of contributory negligence in an action for the death of a miner, killed by the sudden starting of machinery about which he was making repairs, is one of fact to be determined by the jury.

Janoski *v.* Northwestern Improvement Co., 176 Federal 215. Feb. 1910.

INJURY TO MINER—ASSUMPTION OF RISK

A coal miner employed in the operation of a mine was directed by his superior to operate an electrical engine used to draw coal cars up an incline. He had had no experience in running the engine and was given no instruction. In operating the engine he was required to keep his foot upon a brake which vibrated with the action of the engine, and while thus engaged his foot slipped from the brake and he fell against unguarded gearing and was injured. The operator of the mine was chargeable with a breach of duty in directing the inexperienced miner to run the engine without proper instruction, and the fact that the danger of the unguarded gearing was apparent if a person fell into it, made the question of the assumption of the risk and of contributory negligence questions of fact for the jury to determine.

Montana Coal & Coke Co. *v.* Kovec, 176 Federal 211. Feb. 1910.

INJURY TO MINER—ASSUMPTION OF RISK

James Bateman, a miner, sued his employer, the Utah Consolidated Mining Co., for damages as the result of burns caused by an explosion in a converter which threw molten metal out of its mouth as he stood in front of it to skim the slag from the metal. He alleged that the presence of moisture in the parts of the converter subjected to contact with the molten metal rendered them liable to explode and to throw the metal out of the converter, and that the employer was negligent in the preparation and inspection of the converter in this, that there was moisture in the clay with which it was lined where it was liable to come in contact with the molten metal, and that such moisture did come in contact with the metal and caused the explosion which injured him. The plaintiff had for two years been a skimmer, one of whose duties was to skim or rake the slag from the molten metal into the converter, and the explosion, resulting in the injury, occurred in the clay lining of the converter which threw the molten metal out of the mouth of the converter and burned him. For three months before the accident he had used converters dried with the mixed fuel and had subjected them to the test of the molten metal; he knew that if moisture remained in the clay lining and the molten metal came in contact with it there might be an explosion. He had used this mixed fuel to dry the converters and knew that there had been explosions in converters dried by the use of this fuel and that such an explosion might throw molten metal out of the mouth of the converter, yet with this knowledge he remained in the employment and continued the work without complaint. On this evidence the United States Circuit Court for the district of Utah held on appeal that the plaintiff assumed the risk and danger from the use of the mixed fuel used in drying the converters and that a servant assumed all the ordinary risks and dangers of the employment upon which he entered and in which he continued without complaint, including those resulting from the negligence of his master which are known and appreciated by him and those which would have been known and appreciated by a person of ordinary prudence and care in his situation; and a servant will not be heard to say that he did not appreciate the danger where the defect from the negligence of the master was obvious and the danger from it would have been apparent to an ordinarily prudent person.

Utah Consolidated Mining Co. *v.* Bateman, 176 Federal 57. Feb. 1910.

Recent Publications

Biennial Report of the State Geologist. By J. H. Pratt. North Carolina Geol. and Econ. Surv. Pp. 152. Raleigh, 1911. Covering operations for 1909-1910.

High Terraces and Abandoned Valleys in Western Pennsylvania. By W. E. Shaw. From *Jour. Geol.*, Vol. XIX, No. 2, Pp. 139-156. Chicago, 1911. A brief study of the development of these puzzling physiographic features.

Preliminary Results of Tests with Explosives in the Field. By Clarence Hall. Pamphlet. Pp. 11. A paper read before the Mine Inspectors Institute of the United States at the Chicago meeting of 1910 and giving results of work done by the U. S. Bureau of Mines.

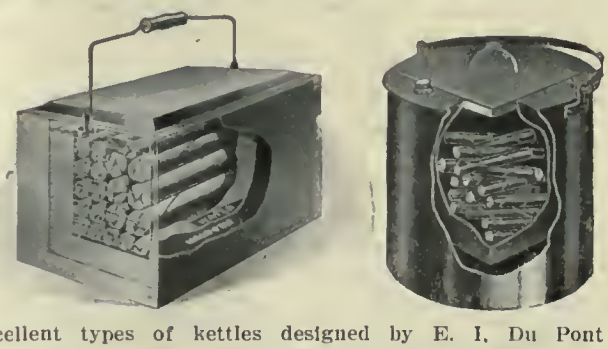
Geology of the Pegmatites and Associated Rocks of Maine. By E. S. Basten. U. S. Geol. Surv. Bull. 445. Pp. 152. Ill., index, map. Washington, 1911. A careful study of these interesting rocks with résumé of theories of genesis. The economic importance of the bulletin lies in the relations of pegmatites to ore genesis in general and to the occurrence of feldspar, quartz, mica, and gems locally.

The following advance chapters from the Mineral Resources of the United States, 1909, have recently been issued:

'Production of Iron Ore, Pig Iron, and Steel in 1909,' by Ernest F. Burchard; 1911; 30 pp. 'Production of Phosphate Rock in 1909,' by F. B. Van Horn; 1911; 7 pp. 'Production of Chromic Iron Ore in 1909,' by Ernest F. Burchard; 1911; 5 pp. 'Production of Bauxite and Aluminum in 1909,' by W. C. Phalen; 1911; 14 pp. 'Production of Manganese Ore in 1909,' by Ernest F. Burchard; 1911; 15 pp. 'Production of Barytes and Strontium in 1909,' by Ernest F. Burchard; 1911; 6 pp. 'Production of Mica in 1909,' by Douglas B. Sterrett; 1911; 14 pp. 'Lithium in 1909,' by Frank L. Hess; 1910; 7 pp. 'Production of Magnesite in 1909,' by Charles G. Yale; 1911; 5 pp.

THAWING DYNAMITE

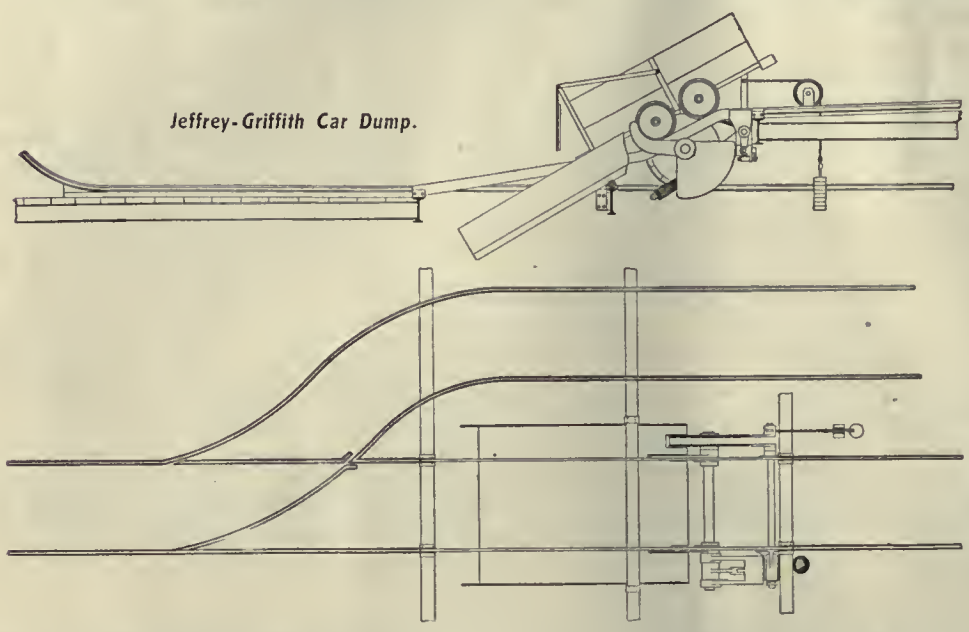
Thawing dynamite is an operation requiring much care. Nearly everyone recognizes the danger of the improper methods formerly employed, such as toasting before a fire, frying on a boiler, and roasting in an oven, but a number of users of explosives do not yet appreciate the loss incurred in improper methods of thawing which may be perfectly safe. For instance, it is fairly safe to plunge a lot of powder into tepid water, provided that the nitroglycerine which leaks out is taken care of so that it does not explode at some unexpected time, but the loss in efficiency of the dynamite in a work where any considerable quantity is used, would pay for an efficient thawing apparatus many times over. The illustrations show two



excellent types of kettles designed by E. I. Du Pont de Nemours Powder Company for thawing small quantities of dynamite. Anyone with a piece of paper and a pencil can readily figure out what loss of efficiency, say, 40% dynamite incurs when it is soaked with water so that it will only do the work of a 30% dynamite. In addition to this, the hazard of having a quantity of free nitroglycerine around is very great.

JEFFREY-GRIFFITH CAR DUMP

The Jeffrey-Griffith patented dump shown herewith, recently developed, is said by the makers as a cross-over dump to possess features which make the dumping or flow of the coal almost continuous in its movement over the dump. While it is guaranteed to have greater capacity than is possible to obtain from other cross-over dumps, it is also a fact that it has 50% fewer parts. It consists of two continuous rails to which are attached substantial horns, securely fastened to a heavy shaft; this shaft has a bell crank and quadrant with spring device securely attached to the one end, while at the other end is situated a brake-wheel and lever device for releasing the car after discharging its coal. In operation, the cars pass over the knuckle, the jar being absorbed by the spring. Automatically the car assumes the dumping position. After the coal is discharged the car is released by means of a lever (the only work of the operator), which allows the car to pass over the track by depressing the horns which automatically resume position for the next car. This is done by means of the spring, which is of sufficient strength to bring the horns into receiving position, together with the rotating action of quadrant by gravity. Ten cars may be discharged over this dump per minute so that its capacity is only limited by the activity of the man required in its operation. Its continuous rails make stoppage of operation due to derailment of cars an impossibility and also insure less breakage of coal and less wear and tear on cars; its simplicity of design and operation and its capacity make it most desirable for large as well as small mines. Its large dumping capacity is due to the quick and continuous action of the dump, shorter movement of the cars, and the increased safety in bringing loaded cars close to the dumping position. This is the only dump where the car maintains continuously its natural position throughout the operation. There is no break or hinge in the tracks to cause derailment of cars and blocking of the coal consequent thereto. As this dump occupies less space than other cross-over dumps, the cost of tipple building for housing is correspondingly reduced; less help is required because of simplicity and ease of control. A full working dump may be seen in operation at the plant of the Jeffrey Manufacturing Co., Columbus, Ohio; the Pruden Coal & Coke Co., Pruden, Tennessee; or the Pursglove Coal Mining Co., Stewartsville, Ohio. Further details may be had from the manufacturers, the Jeffrey Manufacturing Co., Columbus, Ohio.



Jeffrey-Griffith Car Dump.

ASPHALT, like most other products of petroleum, is increasing in importance. Oil asphaltum, which is the asphaltum residue, derived mainly from the oils of California and Texas, made up more than half of the 208,655 tons of asphaltum products in 1909, according to the U. S. Geological Survey.

BRISTOL'S COMPENSATED GAS-FILLED RECORDING THERMOMETERS

A new compensated gas-filled Bristol recording thermometer has recently been developed for recording the lower ranges of temperature, and found satisfactory in numerous tests. These thermometers are equipped with a patented compensating device which automatically corrects for changes of temperatnre at the recording instrument. Bristol's gas-filled, class III. recording thermometers are equipped with sensitive bulb and flexible capillary connecting tube and a patented pressure-tube, the sensitive bulb and flexible connecting-tube and spiral pressure-tube all being filled with an inert gas under pressure. Changes of temperature at the sensitive bulb cause corresponding changes in the pressure of the confined gas and these changes in pressure are measured and recorded by the instrument. The sensitive bulb is usually about 10 in. long and ¾ in. diam., and the volume of gas contained is very large in proportion to the volume in the fine capillary connecting-tube between the sensitive bulb and the recording instrument, this making the error due to changes of temperature along the connecting tube negligible.

COMMERCIAL PARAGRAPHS

F. G. MUDGETT, manager of the Horse Shoe and Diana mines of Coulterville, California, has been appointed field representative and salesman for the Pierce Amalgamator with the Pacific Coast as exclusive territory.

The MINE & SMELTER SUPPLY CO. announces the appointment of John P. Cosgro, formerly manager for Allis-Chalmers Co. for the Republic of Mexico, as resident manager of the Mexico Mine & Smelter Supply Co., Mexico City, D. F.

The KELLY FILTER PRESS CO. has installed eight of its presses in the new mill of the Veta Colorada Mining & Smelting Co., at Villa Escobedo, near Parral, Chihuahua, Mexico. There are now 20 of the Kelly filter-presses in service in Mexico.

The F. MAYER BOOT & SHOE CO., of Milwaukee, Wisconsin, reports a continuation of their excellent business of the past on their line of boots for miners and prospectors. For many years this company has made a specialty of this grade of footwear and now has facilities for making 9000 pairs of boots and shoes per day. They are prosecuting dealers who have unlawfully used their trade-mark of 'Martha Washington.' A Western branch is established with the Washington Shoe Mfg. Co., Seattle, Washington.

The GEO. E. DOW PUMPING ENGINE CO., of San Francisco, reports the following recent sales: Plumas Amalgamated Mines Co., San Francisco, one 12 by 20 by 12 horizontal simplex steam-driven air-compressor. Cia. de Aguas de Santa Ana, Santa Ana, Salvador, C. A., two 11 by 12 horizontal duplex piston pumps direct connected to two 40-hp. electric motors. Union Hollywood Water Co., Los Angeles, one 12 and 22 by 12 and 20 by 18 horizontal two-stage air-compressors, cross-compound. California Oilfields Ltd., San Francisco, one complete fuel oil-burning set, one 500 sq. ft. surface condensor, one 6½ by 9 by 10 horizontal air-pump, two 140-hp. water-tube boilers, one 12 and 22 by 10 and 18½ by 18, two-stage, cross-compound, steam-driven air-compressor, with Meyer cut-off valve gear, two 5¼ by 3½ by 5 boiler feed pumps, and one 16 and 24 by 5½ by 18 horizontal compound duplex crank and fly-wheel pumping engine.

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EDITORIAL

A HEAD-LINE in a contemporary reads "Gary Coke Ovens Fired". The natural question is, what for?

CHICAGO headquarters of the *Mining and Scientific Press* and *The Mining Magazine* are now at 734 Monadnock Building, where Mr. A. J. Bamford will be glad to welcome old and new friends.

ADDITIONAL competition in the oil business of the Pacific Coast is promised by entrance of Dutch interests closely affiliated with Shell Transportation. The Dutch have done well in the East India oilfields and will bring experience as well as capital to California.

SALE of the Risdon Iron Works to the United States Steel Corporation has been rumored in San Francisco this week. Additional building by the Steel Corporation would be heartily welcomed in the West, and acquirement of the plant and good-will of the Risdon company would introduce the new enterprise under the best of auspices.

COAL-LAND cases in Alaska are now up for final hearing in the Department of Interior at Washington before the Secretary, Mr. Walter L. Fisher. It is impossible to forecast the decision. We note with interest and approval that in event the case is decided against the claimants a bill is likely to be introduced into Congress reimbursing them for the money they have expended.

IN ELECTING James Furman Kemp a member at its meeting on April 20, the National Academy of Sciences honored itself as well as the new member. As a patient investigator whose lucid writings are illumined by the use of scientific imagination and brightened by a ready wit, no less than as a teacher with the priceless gift of inspiring others, his renown, like a good wine, "needs no bush."

EXACT DETAILS are the items most helpful in any description of a technical process, and in the account of the operation of the mill of the Goldfield Consolidated Mines Company, of which we print the first part in this issue, Mr. J. W. Hutchinson, the capable superintendent, is generous in supplying them. The article will, we are sure, be widely read, and with much interest.

ARREST of the alleged Los Angeles dynamiters has attracted wide attention. We regret to see that persistent efforts are evidently being made to try the case in the newspapers. The defense has employed an authorized publicity agent, and on the other side there has been no hesitation to come within the light of the calcium. We commend the reported statement of the prosecuting officers to the effect that he is not concerned with what public opinion in the case may be: "If we have the evidence, the men will be convicted. If not, they won't." It would

be well to remember that this is a trial, not of organized labor, but of dynamiters.

EASTERN members of the American Mining Congress are enthusiastically preparing for the fourteenth annual session, which is to be held in Chicago, October 23 to 28 inclusive. Mr. Charles M. Moderwell has been made chairman of the local committee, and the new directors of the Congress itself are Messrs. Carl Scholz, James Douglas, George W. E. Dorsey, and B. F. Bush. An earnest effort is to be made to bring together on a common platform the metal miners of the West and the coal men of the East. Among the latter Messrs. Moderwell, Scholz, and Bush are well known and influential, so that there is a substantial prospect of success.

ANNEXATION of Canada by the United States is occasionally proposed by some oratorical mischief-maker. A fair retort is the suggestion that Canada will solve Alaskan problems for us by buying that Territory. Fortunately there is the best of good feeling between Canadians and Americans, and when the reciprocity agreement now being debated goes into effect, the ties between the two countries will be even stronger. The United States is not likely ever to annex Canada, but we have already annexed a number of excellent Canadian mining engineers, and have a hearty welcome in reserve for any others who may prefer to come south.

MINING speculation is discussed informingly in a letter signed by 'A Director' in *The Mining Magazine* for April. The writer points out the real economic service performed by the brokers and exchanges, and the difficulties that lie in the way of those who would reduce the speculative element in mining. Probably honest speculation, if we may use the term, would find few to condemn it. But in America, at least, the rank frauds that have been perpetrated, and the palpable cases of 'rigging the market' that are tolerated even on the best exchanges, are what has led to general disapproval. The public has learned to doubt its ability to discriminate between honest optimism and purposeful obfuscation. Therefore business on the big exchanges is dull. Money piles up in the banks and is going into bonds, but stocks and speculative ventures find no support. Honesty is not only the best, but the necessary policy, if speculation is to become popular.

BURIED TREASURE, lost ships, lost wills, the golden fleece, the mythical pot of gold at the end of the rainbow, romance and mystery in whatever form, are forces of compelling power that never lose their interest. That this is true was shown again in the columns of the daily press recently, where were chronicled the operations of the Pieces of Eight Syndicate, formed at Glasgow to search for the treasure of the Spanish galleon *Florencia*, sunk in Torbermory bay in 1588, and of another party which has sailed on the *Stanley Dollar* to search for the Peruvian millions in gold and jewels buried by the perfidious Thompson on Cocos Island in 1835. The hard-headed man of business may perhaps sniff at such visionaries, but to us there is cheer in the thought that though these may fail in their quest there will be a never-ending succession of dreamers, with undaunted hearts, to search for the unknown, for it is to such that we owe the greatest achievements in science, art, literature—all that makes life really worth while.

> "Each stroke aright of toil and fight,
> That was, and that shall be,
> And hope too high wherefore we die
> Has birth and worth in thee."
>
> *(To the True Romance.)*

ORGANIZATION of a new technical society of mining engineers appears at first glance unwarranted, there being already a number of excellent institutions soliciting their support. A few brave spirits have remained undaunted and the American Metallurgical Society therefore starts out freighted with high ideals and good purposes. With Mr. Ernest A. Hersam as president, the organization is sure to accomplish good. Just how wide and permanent its influence will be remains to be seen. Like all human institutions, the Metallurgical Society will need to justify itself by its works. With the general purpose, the strengthening of the bond between Western engineers, we are in full sympathy; as to the need and the probable effectiveness of the agency chosen, there is room for difference of opinion. The Western Association of Technical Chemists and Metallurgists, after some years of able effort, recently withdrew from the field of publication. The excellent work done by the Denver society was widely recognized, but the effort failed to enlist general support. Whether our San Francisco friends, even with somewhat different methods, will be more successful, is at least doubtful.

THE ANGLO-AMERICAN arbitration treaty, though it has evoked but little comment, is without doubt the most significant event of the year. Providing, as it does, that for a period of five years all matters in dispute between Great Britain and the United States, without any exception, shall be submitted to The Hague tribunal for settlement, it exemplifies a change in international sentiment the importance of which can scarcely be overestimated. It is the first time that nations have agreed in advance to arbitrate disputes that may even involve points of national honor, and it is a startling proof that two of the peoples of the earth believe war to be fundamentally unnecessary. Not that there has been any probability or even possibility of war between the two nations, but there has been an unwillingness on the part of both, but more especially on the English side, to definitely disclaim the possibility of recourse to arms. The relations of the two nations have always been most friendly, so that the changed attitude marks a clearer recognition of the essential harmony of interests rather than any increase of goodwill. And it is to be hoped that better co-operation in Far Eastern polities may exemplify this harmony.

MEXICAN conditions continue bad. We publish elsewhere a review of the situation written by Mr. Alvin R. Kenner, who but recently returned from Mexico. Since his account was written, there have been disturbances at Mazatlan, Cuernavaca, Durango, and elsewhere. It is extremely difficult to say to what extent these represent the acts of organized revolutionists such as those with whom Mr. Kenner came into contact, and how much they reflect merely the brigandage that is always ready to develop when the power of government relaxes. Accounts from Mexico are conflicting. Another engineer, one long resident in the country and a particularly competent observer, writes us that he has but recently traveled the whole of Sinaloa and Sonora without inconvenience, and he imputes the trouble to unpreparedness of the Federal Government lulled to a feeling of security by long years of peace. The quarrel is, of course, for the Mexicans to settle. The concern of the United States is with keeping its own citizens in order. Negotiations looking toward peace are now being conducted by the Mexican Government and Madero, with excellent prospects of a satisfactory basis being reached. That peace and prosperity may soon return to our southern neighbors is our own most earnest wish. Mexico is a fair land, and the Mexican people have made great strides under a heavy handicap. That progress should be checked even temporarily is a matter of universal

regret, but the world's confidence in the ability of the Mexicans to solve their own problems remains unshaken.

COLORADO legislators are considering a bill amending the present law relating to mine inspection and especially designed to increase safety in coal mines. Following the serious accidents of last fall, the Governor appointed a commission to frame a bill, which, after material amendment, has now passed the lower house and is before the Senate. While requirements are made more rigorous, the act will need extensive revision before becoming a law if it is to accomplish its purpose. It is faulty in permitting employment in the mines of children twelve years of age, provided they can read and write the English language. The day for child labor in mines has passed, and it is particularly surprising to find a progressive State such as Colorado, maintaining such a provision. The bill also provides for safety appliances and rescue crews 'when convenient,' which, of course, makes the provision meaningless. Either such things are necessary and should be required, or they are merely advisable and the matter should be left to the discretion of the mine managers. In other particulars the bill is equally defective. Colorado would do better to pay more, secure the most competent inspectors possible, and give them a freer hand.

Copper and Zinc Mining

Copper and zinc have many uses in common and are often thought of together. As metals in the market, they are closely related, but contrast could scarcely be more striking than that between the copper-mining and zinc-mining industries, characteristic sketches of which appear in the Joplin letter, and the Arizona, Utah, and New York mining news of this issue. On the one hand is the story of the miner, who with home-made machinery impelled by a decrepit horse, has single-handed developed a profitable zinc mine; on the other, bits of description of mills handling 10,000 tons per day, others in which 1000 tons is treated by a single unit, and finally, of the refusal of a bid for a 50,000,000-pound lot of copper. There would seem to be no *a priori* reason why the mining of one metal should remain in the hands of the individual small-scale producer, while that of the other has steadily and now almost completely passed into the control of the large producers. How complete this transformation now is, in the case of copper, appears from a mere recital of the names of the more recent mines, Nevada Consolidated, Utah Copper, Ray Consolidated, Miami, Chino, Braden, and Cerro de Pasco. On the other hand, the great bulk of the zinc ore produced in the United States, and hence in the world, comes from small mines operated by men, many of whom began by taking a lease on a single acre, and gathering together such equipment as could best be assembled at night. The reason for this contrast lies deep, and exists in the fundamental characteristics of the two metals. Copper sells for two to four times the price of spelter, and as price in both metals is governed by supply and demand, copper must accordingly be either scarcer or more useful than zinc. There is little evidence that there is less of copper in the crust of the earth than there is of zinc. Indeed, the balance of evidence, slight as it admittedly is, would seem to point in the opposite direction. Copper, however, is capable of many uses denied zinc. Indeed, the latter is a metal of limited usefulness, and zinc smelters have had always the problem of creating a demand for their product. It can not be doubted, for example, that if zinc were equally as useful as copper in transmitting electric current, the price of copper would fall and that of zinc would rise. Taking conditions as they are, it is evident that in the case of a high-priced metal it is possible to make a profit from ores of a grade so low as to be unworkable in the case of a low-priced metal. Assuming equally perfect extraction, and in the case of copper and zinc the difference in efficiency of treatment processes is not nearly so important as it was formerly, it should be possible to handle five tons of rock to get the same weight of one metal as from one ton of rock in the other case, if the selling price of the first metal is five times that of the second. In a word, the higher price of copper makes it possible to work lower-grade ores. As is well known, lean ores are more common than rich, and occur in larger bodies. As a general rule, exceptions to which in case of copper and zinc are unimportant, rich ores characteristically shade by degrees into barren rock. Every increase in the price of metal or decrease in working costs, adds to the ore reserve in an ordinary copper mine. The great porphyry deposits at Bingham now mined with steam-shovels, were formerly worked for the copper found in much smaller and richer streaks running through the main deposit. Rock containing from 1½ to 2½ per cent copper has become an ore, whereas rock containing that much zinc is worthless except for concrete or road ballast. Considering especially the Joplin deposits, which are worked only for zinc and lead, and in which there is no gold and silver, there are, broadly, two types of deposits: (1) the rich irregular 'runs', and (2) the lean but regular sheet-ground. It was the 'runs' that made the district, and they still are the mainstay of its prosperity. The majority of these deposits lie near the surface, and once found, mining costs are surprisingly low. They contain 5 to 12 per cent of blende that is of high grade and is recoverable by simple processes in cheap plants. The leasing system, while it imposes a burden, makes it possible for men to take up mining who can command little or no capital. It is entirely possible for three or four men working on a simple 'grub-stake' to discover a deposit and develop a profitable mine. We have known $120,000 in dividends to be paid within eighteen months on an investment of less than $10,000. The risk, however, is large, for here, as always, rich ores are irregular; perplexing to find and difficult to follow. The sheet-ground deposits are much more regular, though even in mining them managers have their troubles. The grade is low, the content of the great horizontal beds of chert so far explored averaging 2 to 4 per cent. Mining costs in sheet-ground, because large-scale operations are possible, may be kept low, but the ore is difficult to mill, and the metallurgical losses are high. So far the sheet-ground mines, while contributing largely to the output and offering much encouragement for the future, have not been conspicuously profitable. There is a widespread feeling that the future of the Joplin district lies in the sheet-ground, and that it is to be a future of large-scale operations, low costs, and steady production. If so, it will inevitably be a future in which corporations representing many stockholders replace small partnerships and individual operators. Zinc mining will then become more like copper mining, but this is contingent upon a satisfactory price for spelter. In the long run this means that new uses must be found for the metal, since consumption *per capita* must be increased if zinc is to gain in price on other metals. Temporarily prices will be influenced by such incidents as the withdrawal of American buyers from Mexico because of the insurrection, but in the long run the price of ore will be governed by the demand for metal, and only those mines may work in which the grade of ore is sufficiently high to insure or promise profit. Improvement in technology gradually lowers the line that marks off ore from rock, but in zinc the possibilities in the direction of improvement have been discounted to an extent not generally recognized.

Operation of the Goldfield Consolidated Mill

By J. W. Hutchinson

CONSTRUCTION

As this article will be confined strictly to the operations at the plant, those interested in general conditions at Goldfield, Nevada, are referred to J. R. Finlay's 'Cost of Mining', T. A. Rickard's articles on Goldfield which appeared in the *Mining and Scientific Press* during 1908, and the report on the geology of the district by F. L. Ransome published by the U. S. Geological Survey. The details of construction of the 100-stamp mill and cyanide plant of this company have received publicity through Bulletin 1438 of the Allis-Chalmers Co., which is substantially correct. However, in this bulletin due credit is not given J. B. Fleming, of San Francisco, who was employed by the Goldfield Consolidated Mines Co. as mechanical engineer, and who drew up the specifications and general plans. On these specifications the Allis-Chalmers Co. bid and secured the contract for the crushing and transmission machinery and electrical apparatus. The engineers of the Allis-Chalmers Co. were not employed by the Mines company until the general plans were out and the contract had been let. This is mentioned for the sole purpose of rendering to Mr. Fleming publicly the credit which this company gives him.

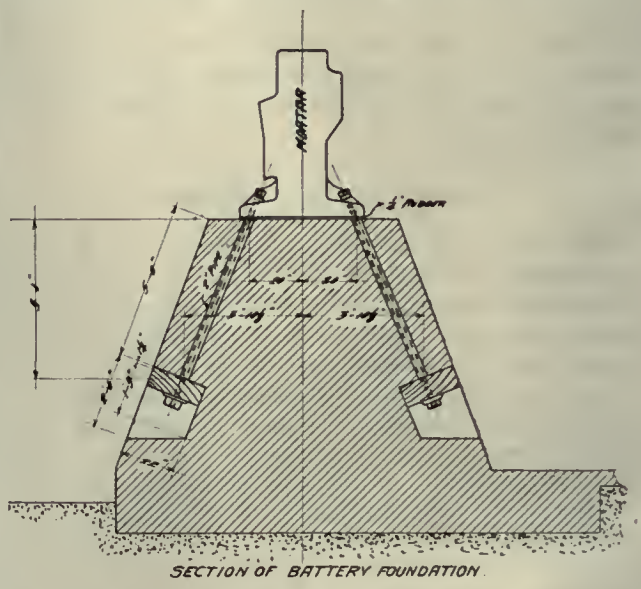
During the first year's operation, from December 26, 1908, to December 26, 1909, the stamps crushed through 12-mesh; the product, after classification, going to tube-mills. After the 20-stamp mill of this company, known as the Combination mill, was abandoned in September 1909, it was decided to increase the capacity of the 100-stamp mill from 600 to 850 tons per day.

The installation of 40 additional stamps, three tube-mills, and 25 concentrators was at first considered. This would have largely increased the floor space required, the structural steel for building, and, because of the contour of the hill, enormous concrete foundations for ore-bins and battery-block would have been needed. In addition, the increased tonnage could not have been handled for six months. The estimated cost of such construction was $175,000. As an alternate scheme, I proposed the using of six 6-ft. Chilean mills to be placed between the stamps and tube-mills. My idea was that 4-mesh screens could be used on the batteries, and a duty of 8.5 tons per stamp be obtained, followed by classification of the product, feeding oversize to the Chileans, crushing through 16-mesh, and finally, grinding this product in tube-mills after classification. This method was adopted and was in operation 90 days after the decision was reached. The total cost of the reconstruction, including 24 concentrating tables and many minor changes, was $75,000. No additional building was required. At the beginning of operations the ore was amalgamated at the batteries and below the tube-mills. With increasing depth in the mine the baseness of the ore rendered this operation unprofitable, and it was abandoned in September 1909 in favor of amalgamation of the concentrate prior to cyaniding. The floor-space occupied by the secondary amalgamating tables was used for the Chileans and concentrators and could not have been used for additional stamps and tube-mills. Doubtless a natural question here will be why the South African practice of using 4-mesh screens on the batteries and additional tube-mills was not adopted. This will be answered later.

To summarize: Through the expenditure of $75,000 the capacity of the plant was increased approximately 40%. To have accomplished the same result with stamps and tube-mills would have necessitated the expenditure of $175,000. To have added the requisite number of tube-mills to pulverize the 850 tons of 4-mesh product to 200-mesh would have increased the cost of construction over the Chilean-mill installation, and would have increased the cost of operation decidedly. Had 40 stamps and three tube-mills been put in, the cost of stamping and tube-milling would have remained the same on the increased tonnage; since the power, labor, and supplies would have increased in direct proportion. With the Chilean mills the additional labor for operating was five men. These would have been necessary in either case. For the Chilean mills 200 hp. is required. Stamps and tube-mills would have required 300 hp. The cost of supplies is approximately 2c. less per ton than for stamping and 3c. per ton for tube-milling. The total cost of pulverizing 80% of the mill-feed through 200-mesh is considerably less with three-stage reduction, as the following figures will show:

Two-Stage Reduction.	Cents.	*Three-Stage Reduction.*	Cents.
Stamping	22.1	Stamping	13.4
Tube-milling	20.6	Chilean-milling ...	10.0
		Tube-milling	16.6
Total	42.7	Total	40.0

I have gone into detail for the benefit of the 'doubting Thomases', many of whom have visited the plant and who have been unwilling to believe that Chilean mills could be operated at a cost even approximating 10c. per ton milled.



SECTION OF BATTERY FOUNDATION

In order to avoid controversy, it may be mentioned here that the above costs per ton will be masked in the yearly figures by the damage to the plant by fire. For three months of the year ended October 31, 1910, the plant operated with 70 stamps and three Chilean mills. However, the above figures are representative of normal conditions. The low cost of operating Chileans is accounted for by several factors: (1) The design and construction of the mills, which were furnished by the Trent Engineering Co. of Reno; they have been most satisfactory in every respect, both as to operation and repairs. Nothing wears out or breaks except the crushing-steel. The horse-power required is 35 each. The capacity in tons pulverized is approximately 75 tons each. (2) The size of the feed to, and discharge from, the mills. Chilean mills fed with 4-mesh and discharging 16-mesh product, work most satisfactorily and produce, even at this mesh, approximately 30% of −200 slime. (3) The character of the ore, which is fairly soft.

The third proposal was to install a sufficient number of tube-mills to handle 850 tons of ¼-in.-mesh battery-product. As above stated, the cost would have been more, since the mill building would have had to be enlarged, and, from the contour of the hill, much grading and filling necessitated. In addition, experience here has not corroborated that of the 'Mines Trials Committee' at Johannesburg which found that a tube-mill is most efficient when operating on three or four-mesh feed. I do not want to be misunderstood. I believe this to be true on the Rand, where a large percentage of the tube-mill produced is leached, and the difference in the ores doubtless accounts for the difference in results. None the less, I have not been able to produce a satisfactory tonnage of −200 slime from one 5 by 22-ft. tube-mill fed with 4-mesh product and operating under con-

ditions similar to the South African recommendations, nor have I been able to secure enough additional tonnage to compensate the increased horse-power when operating one mill at 32 instead of 27 revolutions per minute.

Conclusions based upon working tests on the Goldfield ore are: (1) 100 stamps, crushing through 4-mesh (0.18-in.) screens, yielding a tonnage of 8.5 tons per stamp, must be followed by ten 5 by 22-ft. tube-mills in order to obtain a −200 product; (2) 100 stamps, operated under above conditions and followed by six 6-ft. Chilean mills, crushing to 16-mesh will require five 5 by 22-ft. tube-mills to deliver a −200 product. This leaves the problem: Can six 6-ft. Chilean mills be operated more economically than five 5 by 22-ft. tube-mills? Operations here make me think so. The following figures may be of interest: In stamping Goldfield ore to 4-mesh, 20% of the discharge passes 200-mesh; of the remaining 80%, the Chilean mills will 'slime' 30%, or 24% of the whole. This leaves 56% to be handled by five tube-mills; all of which has passed a 16-mesh screen, and 80% of which will pass a 30-mesh. Expressed in tons, each mill is fed with 95 tons of this product. Now, by feeding 10 tube-mills direct from the battery with 4-mesh feed, 20% of which will pass a 200-mesh screen, each mill is required to handle 68 tons of 4-mesh feed. Based on figures derived from working tests, the comparative cost is as follows:

Two-Stage Reduction. 100 stamps followed by 10 tube-mills fed with 4-mesh battery-feed:	Cents.	*Three-Stage Reduction.* 100 stamps followed by 5 tube-mills fed with 16-mesh Chilean-mill product:	Cents.
Stamping	13.4	Stamping	13.4
Tube-milling	30.0	Chilean-milling	10.6
		Tube-milling	16.6
Total (per ton)	43.4	Total (per ton)	40.6

From this the deductions may be made that: (1) Ore may be reduced to 4-mesh in the stamp-battery more economically than to 12-mesh; (2) for the reduction of ore particles to 16-mesh, where 'all slime' is required, stamps, followed by Chilean mills are more efficient than stamps alone; (3) ore may be reduced to −200 mesh in the tube-mills more economically when the mill is fed with 16-mesh than when fed with 4-mesh.

There is one more point to be considered. On referring to the cost of installation, it will be seen that there was a saving of $103,000 in favor of putting in the Chilean mills. Assuming that the future cost of operating these mills will be 15c., an increase of 3c. per ton of ore milled over the cost of operating 140 stamps and 9 tube-mills, and assuming a yearly tonnage of 300,000 tons, it will take ten years operation, or the milling of 3,000,000 tons of ore, to offset this original saving. It is not believed that the cost will increase to this extent. Rolls and Chilean mills or other methods of comminution were not considered, for the simple reason that the problem was to increase the capacity of a 100-stamp mill, designed to deliver an 'all-slime' product to the cyanide plant. If this article invites discussion, I shall be glad to go into details more freely at some future time.

ELEMENTS OF COST IN OPERATION

Before passing to the detail of operations it may be well to enumerate the factors governing costs and efficiency.

Water.—Water for milling was supplied during the first two years operation entirely by the local water company, coming from the Palmetto range at Lida, nearly 30 miles distant. Recently the mine-water has been conserved and neutralized, and about one-fourth of that consumed is now supplied from the mines. The local company charges at the rate of 50c. per thousand gallons; the total water consumption per ton milled is 220 gallons, or 11c. per ton. This is a lower consumption of water than any wet-crushing mill on record so far as known. This item of cost is included in supplies.

Labor.—With the exception of two or three Slavs employed in roustabout work, the entire mill crew is American. The wage-scale is $3.50 per day of eight hours for ordinary labor; $4 to $4.50 for mill-men; $5 for machinists, electricians, and carpenters. Each man makes out his own time on a distribution slip, stating hours worked, department, and whether on operation or repairs, which slip, after being checked by the foreman on shift, is delivered to the timekeeper's office, where a daily distribution of labor is made after the following form:

GOLDFIELD CONSOLIDATED MILLING & TRANSPORTATION CO.

DAILY MILL REPORT

Tons—	Assay Oz. Au.	Oz. in Heads.	Oz. in Tails.	Oz. Produced.
Per cent time run				
Ore received				
Ore milled				
Mill residues				
Conc. plant residues				
Conc. plant solutions				
Mill solutions				
Oz. amalgam				
Totals				

CONSOLIDATED MILL

Labor Distribution

Department.	Shifts Operating.	Amount.	Shifts Repairs.	Amount.
Crushing-conveying				
Sampling				
Stamping				
Amalgamation				
Chilean-milling				
Elevating-separating				
Tube-milling				
Concentration				
Neutralizing				
Settling				
Agitation				
Filtering-discharging				
Assaying				
Precipitation				
Refining				
Steam heat				
Surface and plant				
Warehouse-office				
Watchmen				
Salaries				
Total mill labor				
Concentrate plant				
Total labor				

The entire crew, under normal conditions, including all the superintendence, men on current construction, foremen, and others, consists of approximately 90 men. The average daily pay-roll is approximately $400, and the average daily wage, including superintendence, foremen, master mechanic, electricians, etc., $4.44. Labor per ton of ore milled is $0.46; tons milled per man on shift, 9.65.

Power.—Power is supplied by the Nevada-California Power Co. at a cost of $6 per horse-power month, based on 90% of the peak load.

The average power load at present is 1500 hp., equivalent to 1.73 hp. or 32c. per ton of ore milled. A segregation of this load for the first year is shown on a chart that will be printed in the continuation of this article. The campaign of construction which has been waged has left no time to devote to bring this up to date.

Supplies.—Supplies, as usual, constitute slightly more than 60% of the total mill-costs. Naturally the distance from bases of supplies, combined with discriminating freight rates, would make this cost higher than is usual for cyanide plants in the United States. In addition to

these factors is the exceeding baseness of the ore, which, during the second year's run has shown an increase of nearly two pounds of KCN per ton of ore milled. Had the cyanide consumption remained as low for the second year as for the first, the total cost for milling and cyaniding would have been $1.85 per ton instead of $2.12. The following table showing costs for the first three months of this fiscal year and for 1910 may be of interest:

	Nov. 1910.	Dec. 1910.	Jan. 1911.	1910 Average.
Labor	$0.46	$0.476	$0.445	$0.56
Supplies	1.24	1.285	1.263	1.25
Power	0.276	0.325	0.311	0.31
Total	$1.976	$2.086	$2.019	$2.12

In this connection it will not be amiss to note that $40 mill-heads warrant considerably higher costs than does the ore usually sent to a stamp-mill and cyanide plant, and in judging these costs the fact that the ore has averaged approximately $40 for two years, should be taken into consideration.

OPERATION

Storage and Crushing.—The plant is situated about two and one-third miles from the various working shafts, from which the ore is transported over the company's railroad to the crusher-bins in steel hopper-bottom cars of 50 tons capacity each. Originally a Blake-Dennison automatic inclined weighing machine was used. It was destroyed in the fire and replaced by a Fairbanks-Morse railroad scale, over which the cars pass en route to the crusher. The operation of weighing cars has added nothing to the working cost, and has been decidedly more satisfactory than the automatic machine in this situation, where there are such decided and sudden changes in temperature. The transportation of the ore does not come under the head of mill operations, but I shall give the cost for the benefit of those interested. These costs are based on the actual dry tons milled, which normally will average approximately 25,500 tons per month. The figures include all labor, supplies, and other items incident to transporting the ore, and mine and mill supplies, as well as the maintenance of rolling stock and roadbed.

	Nov. 1910. Cents.	Dec. 1910. Cents.	Jan. 1911. Cents.
Operation	10	6	3
Maintenance	5	5	7
Total	15	11	10

The crusher-bins, as well as the entire crusher-house and belt-way are built of wood and have a storage capacity of 800 tons. A shaker-feeder of the suspended type, driven from the main motor (150 hp.) feeds the primary crusher through rack-and-pinion ore-bin gates. The crusher is a 7½-K Gates. Set for 2½-in. product, it delivers the ore to a 48 by 14-ft. Gates type revolving trommel, with 1½-in. apertures, which delivers the undersize to a 26-in. inclined conveyor (Stephens-Adamson type) and the oversize to two No. 4K short-head crushers, set for 1½-in. product, from which the ore gravitates to above-mentioned 26-in. conveyor. Concave plates of manganese steel for the crushers last approximately seven months and crush 175,000 tons of ore. Maganese-steel screen-plates for the trommel lasted 27 months and screened 504,000 tons. The Stephens-Adamson inclined conveyor, set at an angle of 19° 54′ and 369 ft. between centres, delivers the ore to a horizontal conveyor and tripper which distributes the product to a battery storage-bin. This bin is flat bottomed and has a capacity of 4000 tons. The fire of April 8, 1910, destroyed the inclined conveyor, so it is not known what life the belt would have given. The horizontal conveyor has handled 500,000 tons, and will doubtless accomplish half that much more before it is discarded. The entire crushing and conveying system is operated for eight hours by three men, two in the crusher-house and one on the conveyors. They handle 850 to 900 tons.

The cost of crushing and conveying is as follows:

Tons per day	First 3 months 1911. 850	Year 1910. 850	Year 1909. 600
Labor (cents per ton)	2.1	4.3	3.0
Supplies	0.1	1.3	0.5
Power	1.6	1.5	1.8
Total	3.8	7.1	5.3

The high cost for 1910 is accounted for by the fire, which destroyed the conveyor system and necessitated the building of an inclined tramway from the battery-bin to crusher-house, and its operation for three months, during which time it was necessary to tram the ore in cars over the battery-bin. The 70 stamps which were not destroyed by fire, were dropping on ore supplied by this tramway in seven days and nine hours from the beginning of the fire.

Stamping.—As stated in the beginning, all details of construction have been published in Bulletin 1438 of the Allis-Chalmers Co., and in this article no attempt will be made to give such details except on new construction. Through rack-and-pinion ore-bin gates, from battery-bin, *via* Challenge feeders, the ore is fed to ten 10-stamp batteries, five right, and five left, with 1050-lb. stamps, dropping 108 times per minute through 7 inches. The stamp-weight is distributed as follows: boss, 252; shoe, 185; tappet, 169; stem (3½-in.), 444; total, 1050 lb. The 20 mortars (10,200 lb. weight, 14 in. thick through base) are of the narrow, rapid-discharge, improved Homestake type designed for this company by J. B. Fleming and built by the Allis-Chalmers Co. on his specifications. The cam-shaft for each ten stamps (of hammered iron) is of 6½-in. diameter. During the 27 months operation, not one cam-shaft has been broken. The guides originally furnished have been discarded in favor of the 'Conture' guide, designed and patented by A. F. Couture, the master mechanic at the plant. This guide consists of one piece cast-iron (or steel) sole-plate, with tapered sockets for receiving the taper-cored wedges through which the stems operate. The distinguishing feature of the guide is the four-side taper of the sockets and wedges, and the method of dovetailing which permits of the wedges being reversed when worn. The use of these guides has materially reduced the cost of operation and increased the efficiency of the stamps.

The one-piece mortar block of concrete (mixture 1:3:3) contains 850 cu. yd. Anchor bolts for mortar and post shoes are arranged as shown in the following sketch. It may be of interest to note that the concrete withstood the fire of April 8, which destroyed the refinery, store-house, conveyor-way, and twenty stamps. The heat at the mortars was so intense that when the stamps fell, the wrought-iron anchor bolts were drawn out to a fine point. The new equipment was erected on the same foundations with no repairs. There is no sign of serious cracking in the concrete.

One man on each shift feeds the stamps, and one head batteryman on day shift, with a helper, sets all tappets, turns stems, changes shoes and dies, and does all the repair work incident to operating. As amalgamation at the battery has been abandoned, the battery-feeder is alone on his floor, and under such conditions, it seems that 100 stamps is the economic unit for operation. By this it is not meant that total costs for a 140 or 150-stamp mill will not be less, but the actual operation of the stamps will be more, for the reason that while power and supplies will increase in direct proportion to the increased tonnage, labor for 140 or 150 stamps will increase abnormally. Power is supplied for each 20 stamps by one 50-hp. Bullock motor, belted to a counter-shaft underneath the floor. A rack-and-pinion belt-tightener between the bull-wheel (built-up wood pulley) and this line-shaft controls the power for each 10 stamps.

Chrome-steel cams, bosses, and shoes, and Pennington dies have proved the most satisfactory here. In 27 months only two chrome cams have been replaced. The following comparison of wear of battery-steel may be of interest:

Make.	Days wear.	Price per lb., cents.	Cost per ton ore, cents.
Shoes.			
Chrome (8-in.)	58	5.43	1.88
Midvale (10-in.)	73	6.00	2.00
Pennington (8-in)	57	5.97	1.91
Dies.			
Chrome (7-in.)	83	5.43	1.25
Midvale (7-in.)	78	6.00	1.30
Pennington (7-in.)	104	5.97	1.06
Tonopah (7-in.)	49	4.00	1.70

The total consumption of steel (shoes and dies) per ton of ore milled in 1909 was 0.98 lb. with a stamp-duty of six tons per stamp through 12-mesh (0.048-in.) screen; in 1910, 0.604 lb.; stamp-duty, 8.46 tons, through 4-mesh (0.18-inch).

The following is a record of time lost and causes thereof for the year 1910, and for three months of the present fiscal year:

Total time lost on account of	1911. Per cent.	1910. Per cent.
Power	0.84	0.70
Water	0.08	1.43
Shoes and dies	0.28	0.20
Screens	0.01	0.08
Stems	0.17	0.11
Chilean mills	0.17	0.55
Tube-mills	0.08	0.63
Cyanide plant	0.11	0.21
Miscellaneous	1.40	0.91
Cleaning bat. tank	...	0.55
Fire loss	...	7.91
Total	3.14	13.28

A comparison of sizing tests of the 12-mesh (1909) and 4-mesh (1910) product from the stamps is given below, but is of little value owing to the increasing softness of the ore with depth.

Battery discharge through 12-mesh 0.048-in. screen. Duty 6 tons per stamp.			Battery discharge through 4-mesh 0.18-in. screen. Duty 8.46 tons per stamp.	
	Mesh.	Per cent.	Mesh.	Per cent.
Remaining on	20	15.6	10	15.0
" "	40	28.2	30	34.0
" "	60	18.1	50	10.0
" "	80	5.3	80	10.0
" "	100	5.4	100	3.0
" "	200	6.4	150	3.0
Through	200	20.0	on 200	4.0
Through	200			20.0

Originally one 24-in. cone-classifier received the 12-mesh pulp from each battery of five stamps, the spigot product from it gravitating to Dorr classifiers, the overflow to concentrators. These 20 cones were discarded in favor of two 8-ft. cones, each taking the pulp from 50 stamps. The following is a comparison of the cost of stamping through 12-mesh and 4-mesh screens:

Table 1. Stamping through 12-mesh 0.048-in. screens. Duty 6 tons.	Cents.	Table 2. Normal Conditions.	Cents.	Table 3. Stamping through 4-mesh 0.18-in. screens. Duty 8.46 tons.	Cents.
Labor	8.9	Labor	6.6	Labor	3.9
Supplies	6.8	Supplies	7.5	Supplies	4.1
Power	6.4	Power	8.0	Power	5.4
Total	22.1	Total	22.1	Total	13.4

The first and third tables have been taken from the yearly mill-records, and while the various items do not show the proportionate decrease, the total reduction in cost of operating is approximately what would be expected from a 40% increase in tonnage. Several factors besides the coarser crushing have reduced the labor cost in table 1 to the figure in table 3, such as the improved guides, completion of current construction work, etc. Likewise, supplies for 12-mesh stamping in table 1 are not exact, as 200 extra shoes and 200 extra dies, furnished with the plant, did not have to be charged to cost of operation. This is stated merely to avoid confusion, as the sum of the various items in table 1 checks table 2, which is an estimate of the cost of stamping through 12-mesh under normal conditions. The discrepancy between power costs in table 1 and tables 2 and 3 is due to the recent installation of a storage battery which absorbs the mine peaks and virtually puts the mill on a meter reading.

Regrinding.—The second aisle of the mill proper contains the regrinding apparatus, which is divided into two sections, each taking the pulp from 50 stamps. Each section consists of one 7-ft. spitzkasten, three L. C. Trent Chilean mills, one bucket elevator (originally one 54-in. Frenier sand pump), one 8-ft. cone classifier, one 4-ft. spitzkasten, three Dorr classifiers, three 5 by 22-ft. tube-mills, and nine No. 3 Deister concentrators. Each section is run by one man on shift and the entire floor is kept in repair by one machinist and one helper on the day shift. This, of course, does not include the re-lining of the tube-mills. The total pulp from the 50 stamps feeding each section, gravitates through wooden launders, lined with 1-in. cast plate (grade 1¾ to 12 in.), to the 7-ft. spitzkasten, overflow from which passes to the main concentrator floor, and spigot product to three 6-ft. Chilean mills. Power for driving these mills is supplied by one 100-hp. Bullock motor belted to an overhead line-shaft. Actual meter readings show that each mill requires 35 hp. to operate when pulverizing 75 tons per day through 30-mesh, and producing 30% of −200 slime from its total feed. When the capacity of the plant was increased to 850 tons, no additional settlers or dewaterers were put in, and for this reason it is impossible to attempt close classification ahead of the Chilean mills, as the additional water required for grinding in them would prohibit economic dewatering in the cyanide plant; hence a great deal of −30-mesh product is sent to the Chilean mills, but as they have proved to be fairly efficient 'slimers,' the work of the tube-mills is materially reduced, and the apparently poor practice is in reality good. The following is a typical sizing test of the product from the Chilean mills:

	Per cent.
Remaining on 10 mesh	Trace
" " 30 "	4.0
" " 50 "	10.0
" " 80 "	16.0
" " 100 "	9.0
" " 150 "	6.0
" " 200 "	6.0
Through 200 "	48.0
Loss	1.0
	100.0

Midvale rolled forged steel has demonstrated its superiority for use in the mills. The dies, 5¼ in. thick, last approximately 125 days; the roller shells, 4 in. thick, average 165 days. Total steel consumed per ton ore milled, 0.32 lb. Screens for a time threatened to become an item of serious expense, as it was impossible to obtain a life of more than six days from the best screens on the market. However, by inserting a strip of 4-mesh screen in the screen frame where the hardest wear fell, thus protecting the screens from unnecessary wear, their life has been doubled.

The cost per ton of operating the Chilean mills, including all repairs and upkeep, is as follows: Labor, 1.8; supplies, 4.1; power, 4.7; total, 10.6 cents.

The pulp from the Chilean mills gravitates to one 18-in. bucket elevator with 28-ft. centres, where it is joined by the tube-mill product, all of which is fed to one 8-ft. cone-classifier, in which partial dewatering is accomplished before passing to the Dorr classifiers. The overflow from this cone passes to the two-compartment 4-ft. spitzkasten, and the spigot product from the cone joins the spigot product from the first compartment en route to the Dorr classifiers. The spigot product from the second compartment feeds the nine No. 3 Deister concentrators put on this floor when the Chileans were added. The overflow from this spitzkasten, together with the overflow from the Dorr classifiers gravi-

tates through pipes to the main concentrator floor. Each Dorr machine handles approximately 110 tons of dry ore at a dilution of 3:1, delivering a slime product, 80% of which passes a 200-mesh screen, and a feed to the tube-mills as follows:

	Per cent.
Remaining on 10 mesh	8
" " 30 "	13
" " 50 "	12
" " 80 "	23
" " 100 "	18
" " 150 "	11
" " 200 "	7
Through 200 "	7
Loss	1
Total	100

The contained moisture is 30%, which is increased to 40% as it enters the mills. The cost of elevating and classifying is as follows, in cents per ton: Labor, 1.2; supplies, 0.5 power, 0.6; total, 2.3. Revere Rubber Co.'s 'Granite' elevator belt and malleable iron bucket lasted 14 months and elevated approximately 400,000 tons dry ore.

Tube-milling.—As stated, each regrinding section contains three 5 by 22-ft. tube-mills (Gates) of the spiral-scoop feed, trunnion-discharge, type. Each battery of three mills is supplied with power from one 200-hp. Bullock motor, belted to the line-shaft. Two of the three mills are belted from this line-shaft and controlled by friction clutches. The third is geared direct from the main shaft, and controlled by cut-off clutch coupling. There is no doubt that individual drives for each mill would be more satisfactory. With the present arrangement, the repairing of one clutch hangs up 50 stamps during the operation. Silex lining has been used since the beginning of operations. This lining lasts seven months and is renewed with the following items of expense:

LABOR

Removing and replacing manhole, removing end-liners	$11.88
Removing pebbles	3.75
Removing old lining	11.25
Re-lining	63.76
Replacing pebbles	7.50
Total labor	$98.14

SUPPLIES

Cast end-liners	$92.48
Silex, 17,710 lb. at 2.634c. per lb.	466.48
31 sacks cement at $1.10 per cwt.	34.10
Total supplies	593.06
Total cost	$691.20

The time involved is: Hours re-lining, 68; hours setting cement, 72; total hours lost, 140. While this is less time than is customary at other plants to allow the cement to set, there has never been any trouble on account of starting too soon. The silex consumed per ton of ore amounts to 6 lb.; the cost of re-lining per ton of ore milled is 2.3c.; the amount of Danish flint per ton of ore milled is 1.8 pounds.

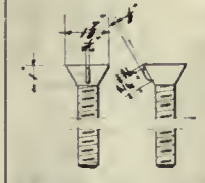
TOTAL COST OF TUBE-MILLING PER TON MILLED

Tonnage	850	850	600
Year	1911	1910	1909
	Cents.	Cents.	Cents.
Labor	1.4	2.1	2.6
Supplies	6.5	6.8	7.0
Power	8.7	9.7	11.0
Total	16.6	18.6	20.6

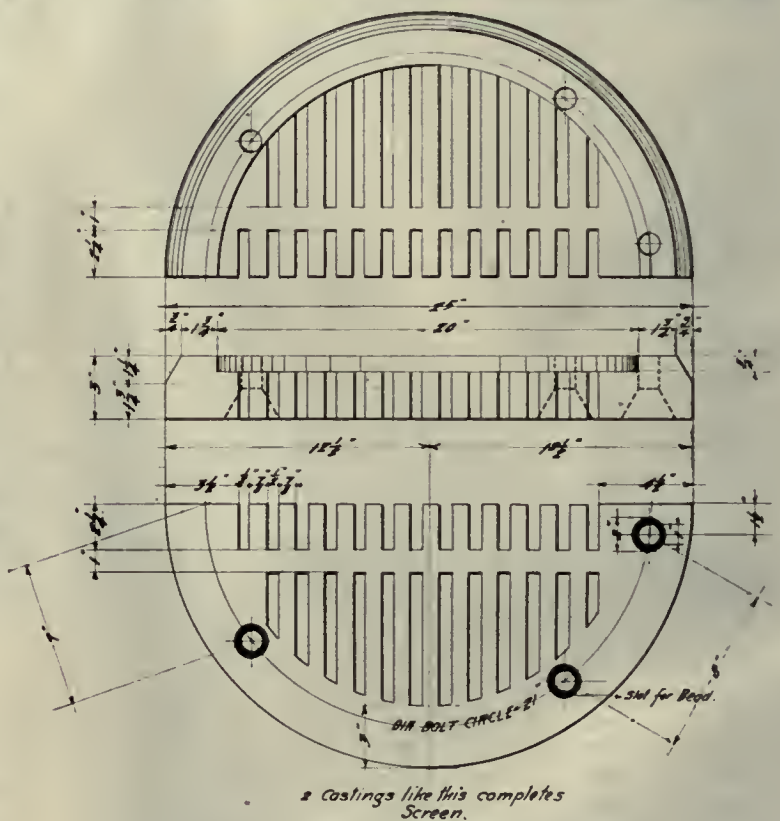
The design of the discharge screens on the tube-mill has been changed according to the following sketch, and the screens now last six months. The gears and pinions of manganese steel originally furnished with the mills are still in use after 27 months operation and will propably wear 12 months longer.

The product from the tube-mills is graded as follows:

	Per cent.
Plus 80 mesh	5.8
100 "	13.2
150 Mesh	11.6
200 "	17.8
Minus 200 "	50.6
Loss	11.0



Although the ore is classed as 'soft' ore, 40% of the product fed to the tube-mills is extremely hard quartz and is reduced to minus 200 product with difficulty. This was very noticeable when testing the mills with 4-mesh product from the batteries. The pulp discharged from the mills contains large quantities of coarse, rounded particles, which so accumulate after a few hours run that it becomes necessary to shut off the feed and grind the mills out.



CAST-IRON SCREEN FOR DISCHARGE END OF TUBE-MILLS.

After classification, the final product, which, as can be seen from the flow-sheet, is produced from two sources, the Dorr classifiers and spitzkasten, shows the following analysis:

	Per cent.
Plus 80 mesh	0.4
100 "	2.2
150 "	8.1
200 "	9.2
Minus 200 "	79.1
Loss	1.0
Concentration	100.0

(To be Continued)

NO CHROME IRON ORE has been produced in the Eastern States for many years, almost the entire production since 1880 coming from California. In 1909 the production of chrome ore, amounting to 598 long tons, came from California and Wyoming, the larger part being obtained from the latter State.

The Mexican Revolution

By Alvin R. Kenner

The first disturbances in Mexico, warnings of the present condition of affairs, began attracting attention in the early part of November, 1910. For the past four months foreign mining interests in Mexico have been making light of the revolution; influenced by 'things as they ought to be', rather than 'things as they are', they have minimized the trouble until the seriousness of the disorder has forced them to accept the situation as it exists and await the settlement of the trouble. Practically all the mines in the State of Chihuahua depending upon other than a local fuel supply, have suspended operations, and this is also true of a large portion of the mines in the State of Sonora. Farther south mining operations have not been interfered with enough to necessitate suspending operations, but should the Mexican Government refuse to recognize the demands of the *insurrectos* it is more than probable that within a short time mining will be as seriously inconvenienced in the south as it is at present in the north.

A Portion of General Blanco's Command; Insurgents.

Federal Troops, Tenth Cavalry, in Camp Near San Pedro, Chihuahua.

CAUSE OF THE REVOLUTION

It has long been an accepted fact that elections in Mexico are unfairly conducted. Following the re-election of Porfirio Diaz as president at the last general election, the Anti-Electionist party headed by Francisco I. Madero, protested the result and requested a new election. The proper legal steps were taken and the matter submitted to the Mexican Congress, but the report was never read, being dismissed with the comment that it was "too long." The action caused the present insurrection, and upon the inauguration of Diaz as president in September active preparations were secretly made by the Anti-Electionist party to obtain recognition by force of arms. Underneath this sequence of events that led to an actual crisis, was the general feeling of discontent in Mexico, an unrest that has been brewing for years, becoming stronger and more apparent as the people became more enlightened and alive to their own interests. A strong factor in awakening the people has been their contact with foreigners, noticeably Americans. The old story of taxation without representation is the underlying reason for this discontent. The bulk of the land in Mexico is owned by less than a hundred families. In Chihuahua the land is principally owned by the Del Rio and Terrazas families. Enrique Creel alone, a member of the latter family, is said to have owned at one time some 15,000,000 acres. These large estates or *haciendas* bear but a comparatively small proportion of the government taxes. If this land were subdivided and made productive, taxes on every-day necessities used by the average Mexican would be greatly lessened. It would ultimately mean greater independence, closely followed by a more intelligent people and a better class of citizens. At present the lower classes have little or no voice in the government.

No important objections are raised against the Mexican constitution. It is considered to be as fair and liberal as our own, but it has been grossly violated in the past, and, as stated by Madero, it is for "the constitution, general and free education, and poll rights" that the present rebellion is being waged. In addition to these demands, the insurgents hope to do away with the selection of governors by appointment and the *jefe politico* system. Under the Diaz administration very few governors or *jefes politicos* have

been residents of the districts they preside over, except in smaller and unimportant places. There are other grievances, local in character, which can only be remedied by striking at the government which permits them to exist. The words most frequently used by the revolutionists, those found in their speeches and printed matter, their slogan, as it were, are, "A Free Mexico and a Fair Election."

STRENGTH OF THE INSURRECTION

Although the date of the general uprising throughout the Republic was set for early in the fall, only a feeble and disappointing response rewarded the efforts of the leaders. This was due chiefly to three reasons: (1) The Government agents obtained information of the uprising several weeks before it was to be launched, and adopted severe measures with those whom it could connect with the movement. This created a reluctance among the Anti-Electionists to join an uprising the success of which seemed doubtful. (2) The plans of Madero were not widely known. Every endeavor was made to keep the plans secret, and only those known to be loyal to the cause were trusted. (3) The people were not sure of the sincerity of Madero. A member of an old, wealthy, feudal family, connected by blood and business relations with those high in the councils of the present administration, it is small wonder that many doubted the singleness of Madero's motives. Furthermore, many believe that Madero has not the qualifications of a leader. The worst that has been said of him, however, is that he is "a dreamer and a vegetarian" — perhaps his dreams are of a Free Mexico. As for being a vegetarian, it is a distinct asset in Mexican war times—many lower class Mexicans are vegetarians, more through force of circumstances than by choice, however.

Taking into consideration the unfavorable beginning due to the foregoing reasons, the armed force of 3000 men in northern Mexico, with possibly an equal number thoroughly prepared in the south, is an indication of what the future will bring in case the Government persists in trying to end the matter by force of arms. Recruits are slowly being added to the rebel force. The lack of education and absence of a free press in Mexico hinders the obtaining of recruits except by explaining to them in person the meaning of the insurrection and showing the probabilities of the success of the movement. The presence of an armed troop carries greater weight than hours of exhortation, and for this reason recruits have been mostly obtained from districts frequented by the *insurrectos*. Their success in the State of Chihuahua may be attributed to the higher order of intelligence of the people, who there receive better wages, dress according to American customs, and are decidedly different from the *waurache* type of peon found farther south. Great influence has also been wielded by Mexicans migrating from the American side of the border; their presence and assistance brought the insurrection from a feeble beginning to its present strength. Americans, also, of whom there are two hundred or more, have played a not unimportant part.

While the majority of Mexicans in arms are fighting for the principles advanced by Madero, many are actuated by personal grievances, the enumeration of which would fill a book. The foreigners, principally Americans, but a few Germans, come under two classes—one class including those of a socialistic turn of mind, to which the Germans mostly belong; the other class consisting of those who are out "just for the hell of it," as one American expressed the matter. The extreme and hopeful views of one socialist was evidenced in the remark, made by a German-American in a speech in front of the Candelaria Mining Co.: "We want all you Americans to join us; we are going to down the capitalists in Mexico, and then we'll cross the border and whip them in the States."

Putting aside the incentives that have brought these men together, it must be admitted that they are much in earnest, and that they will not be easily conquered. A fair degree of authority and organization is becoming apparent in their ranks, and as a whole they are by far the superior of any force, equal in number, that the Government will ever be able to put in the field against them. The Government troops are poorly fed. If there is a commissary department maintained, it is not in evidence, and no attempt is made to supply rations with any regularity. They usually depend upon the provisions to be obtained along the line of march. The Tenth Cavalry stopped at the Leon Camp of the Candelaria Mining Co. over night, and asked for food for the men and horses. They were given a feed of beans, rice, and a little bread, and ate ravenously. The men admitted that it was the best meal they had partaken of since leaving Guadalajara several months before. The *revoltosos*, on the other hand, have no trouble in getting sufficient supplies, being better acquainted with the country and having friends on every side; besides, they never miss an opportunity, when in the vicinity of any of Terraza's *haciendas*, to help themselves to the best of his cattle. The only Federal troops that can compare with the *insurrectos* are the pick of the Government *rurales*, and it remains to be seen whether they will equal them. Madero has shown one attribute of a leader—he is willing to consider the suggestions of others, and has an advisory staff composed of Col. Jose de la Luz Soto, Guiseppe Garibaldi (grandson of the great patriot Garibaldi), Eduardo Hay (a graduate in engineering at Notre Dame University), Capt. Alvarez Morales (a graduate of the Mexican Military School), and Capt. Manuel Vigil (a former Mexican Army officer). It is generally conceded that Madero is fighting for principles, regardless of what position he may obtain in the event of victory, and this is one cause of his strength.

BATTLES FOUGHT

In the beginning, the revolutionists avoided engagements with the Government troops on account of their lack of numbers; however, as they have gained strength they have adopted a more aggressive plan of campaign and have attacked the Federal troops, when not too completely outnumbered. Up to the present time most of the fighting has been confined to the border and along the line of the Mexico-Northwestern railroad which connects Juarez and Casas Grandes. A body of rebels, under the leadership of Blanco, was sent into Sonora for the purpose of obtaining recruits and getting in touch with the small bands existing there; a number of skirmishes took place, but of little importance. The *insurrectos* under leaders Orozco, Sanchez, Casillas, and Francisco Madero have confined their activities principally to that part of the country lying between Juarez, the city of Chihuahua, and Casas Grandes. Late in February Orozco threatened Juarez and demanded its surrender for the purpose, it is said, of misleading the Federals as to the real point of attack—the town of Casas Grandes. Much sport was made at Orozco's expense by the American press, because of his failure to do more than fire a few shots into Juarez. However, it is probable that he did not care to take Juarez then, as the Government would ultimately have concentrated a sufficient force to retake the city, which would have proved a serious setback to the cause.

On March 6 at daybreak the *insurrectos* under Madero attacked the town of Casas Grandes. The attacking rebels were about equal in number to the Federal garrison, but having reached some outlying adobe buildings under cover of darkness, the rebels more than held their own, and after several hours of fighting forced the garrison to hoist the white flag. At this crisis Colonel Cuellar arrived from La Ascension with 600 Federals and attacked the rebel forces in the rear; caught thus between two fires, the rebels retreated as quickly as possible. In this battle, which up to the recent fighting near Agua Prieta and Juarez, was the most important engagement during the insurrection, the rebel loss totaled 60, including those killed, captured, and unaccounted for. In this 60 are included the 16 foreigners, principally Americans, who were taken as prisoners to Casas Grandes. These sixteen men were well inside the town when the Federal reinforcements arrived and were unable to make their escape. The Federal losses were between two and three hundred. The exact number cannot be given. An American residing near Casas Grandes, and eye-witnesses of the battle, and the Mexicans who hauled out the dead, state that at least 250 Federals were killed.

The official Government report as given out stated their losses at 26 killed and the rebel loss at 100 killed and captured.

With the exception of the battle at Casas Grandes, the ambushing of the Federals at Galeana and Ojinaga, the engagement at Ures, Sonora, and the fighting near Agua Prieta, the other skirmishes have been of small importance. The rebels have practically cut off all communication and traffic on the Mexican Central and Mexican-Northwestern railroads, since early in February. Whenever an attempt was made to re-open either road the bridges were again burned, consequently no effort is now being made to run trains. The *insurrectos*, for the sake of foreign interests, agreed to permit railroads to run trains, providing they did not attempt to carry Federal troops. However, the Mexican Central is controlled by the Government, and the Northwestern, owned by the Pearson interests, was unable to prevent troops from riding on its trains, the Government taking matters into its own hands in spite of the protests of the Northwestern officials. Whether the *insurrectos* would have kept their promise or not is a question, as it is greatly to their advantage to cut off railroad communication, and by inconveniencing foreign interests makes an unpleasant situation for the Government. The result of hostilities up to the present is distinctly in favor of the revolutionists. Although many people still believe or rather hope that the trouble will yet be controlled by the Government, they are only those whose interests are suffering and who believe victory by the Government the quickest way to peace. Over 700 men, more than were killed on the American side during the Spanish-American war, have been killed in this insurrection, and this certainly makes it more than a guerrilla warfare.

EMPLOYEES OF THE CANDELARIA MINING CO., LEAVING THE MINE.

MINING OPERATIONS HINDERED

Mining has been more seriously interfered with than any other industry. The lack of railroad communication in that part of the country north of the city of Chihuahua has prevented the shipment of fuel, machinery, or supplies, and has stopped ore shipments. Express companies will not forward money for pay-rolls, nor will they assume the risk of handling bullion. Although many mine employees have joined the revolutionists, labor shortage has not so far proved a serious problem except in a few instances. The American Smelting & Refining Co. has suffered greatly—the smelter at El Paso drew a large part of its ore supply from mines on or adjacent to the Mexican Central and Northwestern railroads. This supply is now entirely shut off, and the smelter is running only four of its nine furnaces. Should the insurrection continue much longer, it is possible that the prices of lead and silver will be affected, although not materially unless hostilities extend to the south. Construction is being continued on the Pearson line between Pearson and Madero as long as provisions and supplies hold out. Ranching is being interfered with to the extent that the *insurrectos* will not allow, if they know it, cattle to be taken across the border, as is usually done for shipment.

The arrival of wagon-trains bringing Americans and Mexicans to the United States is a common sight in towns along the western division of the El Paso & Southwestern railroad where it follows the Mexican border. The first wagon-train sent to the border from the Candelaria mines on March 13 carried about 18 Americans and 75 Mexicans. It required four days to cover the distance of 130 miles, and although the trip was a rough one, the noise and laughter emanating from the American wagons gave no indication of the discomforts of the journey. The last camp was made near a watering place known as the 'three windmills' *(Tres Papalotes)*. During the night a child was born, but the mother and baby continued the trip and arrived in Columbus, New Mexico, with the rest of the caravan. The Americans argued that the child should be named 'Papalote'—or 'Papy' for short—but its parents will probably choose Francisco I. Madero Garcia, influenced more by the time than the place.

Both Insurrectionists and Federals have shown the utmost consideration for foreign property and foreign privileges. Mexicans are somewhat jealous of Americans as a class, but their jealousy is not so pronounced as to be the cause of violence to individuals. When it is remembered that some Americans merit shooting in times of peace for their attitude toward Mexican laborers, it is more surprising that in times of war there has been so little complaint. Americans, as individuals, are as well liked in Mexico as at home, but no better. In two instances a demand has been made on Americans for money. These instances were probably the acts of lawless Mexicans taking advantage of the unsettled condition of affairs. All supplies or provisions taken from foreign companies are paid for—often in cash by the Federals, and in the case of the *insurrectos* by means of a receipt which is to be eventually made good by the Government. Neither side would be likely to take supplies or provisions that were badly needed by any mining company. At the Candelaria mines the *insurrectos* helped themselves to ammunition, provisions, kerosene (the latter for burning bridges), and a supply of pipe fittings

for the purpose of making bombs; while the Federals took provisions only. Receipts were given or cash was paid for everything taken.

THE ATTITUDE OF THE U. S. GOVERNMENT

Much space has been given, in the American press, to the sending of U. S. troops to the border. Probably no one reason could be given as an explanation of the move. The desire to prepare for whatever might happen; the need to preserve the neutrality laws; the opportunity to test the new field-service regulations; the influence exerted by American capital interested in Mexico—all these, perhaps, had their influence in some degree. One explanation given by a disgusted cavalry lieutenant from an Eastern barracks to a very persistent Texas editor, was that "they came down to force Mexico to take back Texas."

Mistaken impressions exist as to how far the United States is warranted in interfering in Mexican affairs. The Monroe doctrine, in which many persons have been trying hard to find some excuse for interference, reads as follows: "The occasion has been judged proper for asserting as a principle in which the rights and interests of the United States are involved, that the American continents, by the free and independent position which they have assumed and maintain, are henceforth not to be considered as subjects for future colonization by any European power." How can anyone possibly find in these words the vestige of an excuse for hindering a revolution carried on in so fair a manner? The insurrection in Mexico is not to be considered in the same light as the intermittent disturbances in Central American republics. The latter are mere scrambles for power, fights are preferred to elections; but the *insurrectos* of Mexico are fighting for just principles and have more provocation than did the Southern States in our own Civil War. The United States did not undertake to protect foreign interests on the American continents when the Monroe doctrine was announced. It was merely a warning to foreign powers to allow the weak American Republics a chance to live. Many have gone so far as to say that we must settle the disorder in Mexico; that foreign powers expect it on account of the Monroe doctrine; that intervention in Cuba was a precedent which must be followed. The cases, however, are not parallel. The Monroe doctrine has no more to do with the Mexican situation than the ten commandments or the twelve principles of efficiency—in fact, not as much as the tenth commandment and the fifth principle. Should this false reasoning cause our Government to interfere in Mexican affairs other than as an arbitrator when so requested, it will be the rankest injustice to the people of Mexico. Peace commissioners would accomplish as much as armed intervention, and the results would be more lasting. Neutrality laws, as adopted at the second Hague peace conference, do not require the United States to prohibit "shipments of arms and ammunition" across the border, and only necessitate the detention of any "armed force" in the nature of "a military expedition." Nor are the Government troops prohibiting the "shipments of arms and ammunition," though they regard one armed man as a "military expedition" and are enforcing this interpretation of the neutrality laws with a severity that would hurt were the circumstances reversed.

THE FUTURE OUTCOME

The insurrection has brought to light much antagonism to President Diaz, and statements derogatory to the administration have been frequent and convincing. In spite of all that has been said, one cannot refrain from admiring him, and great credit is due him for all he has done for Mexico. Nearly three-fourths of Mexico's 16,000,000 inhabitants are of the peon class and can neither read nor write. It is not to this class the revolutionists or the Government can look for effective assistance. They will stand idly by, almost indifferent to the outcome; they apparently have no desire to better their condition and seem possessed of so deadly an indifference to their own welfare that the task of overcoming this inertia is grave and baffling. The most progressive modern reformer would throw up his hands in despair, and it is small wonder that so little has been accomplished by a man over 80 years of age, a warrior gaining his position by force of arms. Weighing the possibility and probability of graft were the ruling power in our own land in the hands of one faction for 35 years, it is remarkable that the Diaz administration has been apparently so free from it. Diaz, however, has been in power too long; his policies have served their purpose, and a newer, younger viewpoint is needed.

It is always difficult to generalize about Mexico. Under the present circumstances it is dangerous. A week may chronicle events contradictory to any specific prediction. However, barring internal wrangling and disagreements among the *insurrectos* themselves, the chances for peace in Mexico, except through arbitration or outside intervention, seem exceedingly remote. So far the *revoltosos* have had the best of the struggle, and they were never better prepared to carry it on than at present. As the insurrection grows older they are gaining in numbers and organization.

The invasion of Mexico by foreign capital undoubtedly had much to do with delaying the present crisis. The remunerative employment given to thousands of laborers has relieved conditions that would otherwise, years ago, have been felt too severely to have been endured. Intelligent Mexicans, who would otherwise be heart and soul with the revolution, are against it for no other reason than that they bid fair to lose most remunerative positions due to the closing down of foreign properties by the insurrection. It has been hinted that American capital financed the revolution. It does not seem plausible, and no proof has been given. However, it is likely that American capital will have much to do with putting an end to it. Many of the officials high in the Diaz administration are closely associated in a financial way with American capitalists interested in Mexico. Great pressure can be brought to bear on the Government and the rebels will agree to any fair proposals. Consequently we may look to Eastern financial interests to bring about peace, if Mr. Dooley is right when he says: "The capital in Mexico, me boy, isn't Mexico City. It's just south of Canal street in th' city of New York."

Feldspar for Fertilizer

Much interest has recently been aroused in the use of potash feldspar as a fertilizer. Potash is an important plant food, which, in fertilizers, has usually been supplied in the form of wood ashes or imported from Germany in easily soluble potash salts (sulphate, carbonate, or chloride). The Department of Agriculture has recently made experiments to determine the availability of finely ground potash feldspar as a substitute for the more soluble potash salts. The evidence so far obtained appears to indicate that under certain conditions and with certain crops feldspar can be made useful if it is ground sufficiently fine. On the other hand, it is highly probable that under other conditions the addition of ground feldspar to the land would be a useless waste of money. At the present stage of the investigation it would be extremely unwise for anyone to attempt to use ground rock, except on an experimental scale that would not entail great financial loss.

If further experiment shows that ground feldspar can be used as a fertilizer, it will undoubtedly lead to the utilization of much pegmatite which, because of too fine grain or too large a percentage of quartz or of iron-bearing minerals, is not valuable as a source of pottery material. Many deposits of this kind are near railroads. An equally important result will be the utilization of much material that is now discarded at feldspar quarries.

A number of processes have been patented in this country for the dissociation of potash feldspar to obtain the more readily soluble potash salts, but none of these have yet been applied on a commercial scale.—*U. S. Geol. Survey.*

A NEW EMERALD locality has been discovered in North Carolina, where promising gems have been found on the surface in a cotton field. The crystals are rather large and are of a deep green color.

Orange Free State Goldfields

By Rowland Gascoyne

During the last twelve months the interest in the Orange Free State goldfields has been revived on account of the Consolidated Gold Fields of South Africa, the Free State Development Co. Ltd., and others acquiring considerable areas of ground on option, carrying the outcrops of the Witwatersrand system, accompanied by several outcropping auriferous reefs.

The interest was materially increased when it was made known that G. S. Corstorphine, one of the leading geologists on the Rand, had reported to the effect that past prospecting operations on these Free State properties had not been conducted in such a manner as to be of any convincing value, so there was still a possibility of finding the Main Reef series, and if that proved to be barren or lean there was still a prospect that some of the other outcropping reefs might yield a mine. He had no difficulty in recognizing practically all the markers so well known on the Rand, and the hopes of those interested in these Free State farms encircling the town of Parys went up considerably by virtue of this encouraging report. On his advice the Consolidated Gold Fields of South Africa took options on a number of farms and in company with the Free State Development Ltd. engaged Mr. Corstorphine to superintend the prospecting operations.

Now this goldfield, known as the Venterskroon goldfield, has a remarkable history, extending over a period of twenty years. It is the only place due south of the richest section of the well known Witwatersrand goldfields where the Rand rocks, after disappearing beneath the newer formations, come again to the surface. At this particular spot the Witwatersrand system is remarkably well developed, carries all the well known divisions characteristic of the Rand, and likewise several reefs. The beds of the Witwatersrand system are in places tilted beyond the vertical and all around the granite boss the beds outcrop concentrically in proper geological sequence. Molengraaf, Draper, and every geologist who has inspected this area have been much struck by the above facts and the remarkable and well developed manner in which the whole of the Witwatersrand system appears to have been reproduced here. Almost ever since the discovery of the Rand this field has attracted geologists and prospectors, but the reefs when followed prove patchy and where carrying good ore seem soon to pinch out at depth. The fact, however, that Mr. Corstorphine was fairly sanguine of success and was prepared to attempt the finding of ore on what he considered new and proper grounds, gave rise to considerable hope and confidence. Had he sought counsel from those who had experienced disappointment in this goldfield, Mr. Corstorphine might perhaps have hesitated somewhat in preparing such an encouraging report. However, about a year ago prospecting operations were commenced in earnest with the primary object of establishing the existence of the Main Reef series, and, failing that, to discover some other conglomerate reef carrying sufficient gold to justify the commencement of mining operations. Recently, under date of March 4, a report on the work done was published. In trenching across what Mr. Corstorphine regarded as the Main Reef zone, he came across an unexpected igneous intrusion and a deposit of Karoo sandstone overlying the Witwatersrand beds. In fact, the whole area where the Main Reef series might be expected to occur, was occupied by such an extensive deposit of diabase as to make it impossible for any conglomerate reef to exist there. Trenches cut on either side of supposed Main Reef series horizon also showed nothing of value, and inspection of other reefs showed them to be so poorly developed that it was not considered prudent to spend money ascertaining their value. Boring was then undertaken in order to intersect the Main Reef horizon in depth, but again diabase intrusions were found, and Mr. Corstorphine came to the conclusion that in what he considered the geological horizon of the Main Reef series no profitable reefs are present and among the other reefs outcropping in the goldfield there is little hope of finding one that is profitable. He has confirmed the opinion of other geologists and engineers who had preceded him in the same task, although they may not have prospected on the same scientific and geological lines. His assistant, however, reports that these diabase intrusions rapidly thin toward the south, and it may be that in a southerly direction they disappear altogether. Whether the Main Reef series reappears again in its supposed horizon to the south, remains to be seen. It must not be forgotten, however, that at the outset Mr. Corstorphine has only prospected less than one-half of the Venterskroon goldfield. There still remains the westerly portion upon which the Free State Rand Ltd. is just commencing active prospecting operations.

This failure of the extension due south of the richest section of the Witwatersrand goldfield throws but little additional light of any value upon the behavior of the Rand bankets in depth, on account of its distance of nearly forty miles from the best Rand outcrop mines, a distance sufficient under the varying conditions of the banket reefs to allow several goldfields to reappear and as quickly disappear again.

For the last five years the New Rand Ltd. has also been looking for the Main Reef series in the Free State about thirty miles to the east of the operations carried on by the Free State Development Co., and the Consolidated Gold Fields of South Africa. Here the conditions are somewhat different from those surrounding the Vredefort granite boss, the Witwatersrand system dipping south at an angle of 30°, apparently as the result of an east to west antiecline running between the Heidelberg and Free State Witwatersrand deposits. The New Rand Ltd., with boring operations, has followed the Lower Rand beds to the south until the consulting geologist has arrived at the opinion that he has struck, in No. 9 bore-hole, the red bar marker so well known on the Central Rand as the indicator to the position of the Main Reef horizon. Since that indicator was struck, four other holes have been put down without striking the Main Reef series, so that the value of the alleged marker may be considered as at a considerable discount. The sites of these four bore-holes do not seem to be well chosen and little new ground has been proved.

Briefly, then, it may be said that in the Orange Free State, which offers the most inducement to prospectors in looking for the extension of the great Rand goldfield, nothing but disappointment has yet been met, and the opinion is gaining ground that the prospects of finding another Rand in South Africa are decidedly unpromising.

Magnetic Concentration and Briquetting

The low-grade magnetite ores of central Sweden are now being concentrated on a considerable scale, according to H. V. Winchell. The process most favored in that country is called the Gröndal process, from its inventor. The raw ore, containing from 27 to 55% of iron, is broken in a crusher, and ground to sand in a ball-mill. The magnetite sand or concentrate, containing 67 to 71% iron, is taken out by magnetic separation, moistened and molded into bricks about 6 in. square and 2½ thick. No binder is used. The bricks are simply pressed and moved slowly on iron conveyors through a furnace heated with generator and furnace gases and subjected to an oxidizing flame at the temperature of about 1400°C., or considerably above the sintering heat. In these furnaces the magnetite is changed to hematite, the percentage of sulphur is lowered, and a hard porous briquette is made, suitable for the blast-furnace. By this process, at a cost of about 80c. per ton, some 27 Gröndal furnaces are turning out about 300,000 tons of briquettes per annum. Since magnetite briquettes require about 300 lb. of charcoal per ton of pig iron more than those made of hematite, the expense of the briquetting is justified in a region of high sulphur magnetite ores. This process is of special interest in Minnesota because of the large quantity of low-grade magnetite ores on the eastern end of the Mesabi range, at present unmerchantable.

Developments in Illinois Oilfields

By H. A. Wheeler

THE EASTERN FIELDS

*The eastern Illinois oilfield extends southwest from Westfield, in the northern part of Clark county, through Crawford and Lawrence counties, Illinois, to Princeton and Oakland in Gibson county, Indiana. There are slight lateral extensions to the westward in Coles, Cumberland, and Jasper counties. It has a length of 90 miles and a width that varies from one to ten miles and averages three to four miles. A few gaps still break the continuity, although these have steadily diminished in size and number as the field is re-drilled. Such a remarkable length and width, coupled with the richness and number of oil-producing sands already found, without considering deeper sands that geology almost assures, makes this the richest oilfield ever opened in the history of the industry. While individual wells and local enrichment in other fields have exceeded the Illinois record, no other field has shown such a high average

Map Showing Position of Eastern Illinois Oilfields.

richness over such a remarkably large area, nor have others ever reached an output of 35,000,000 bbl. in six years.

At the northern end, or Casey district, there are two producing sands at about 400 and 600 ft., and the belt is two to five miles wide. While the wells have not been large, the drilling is so inexpensive that it has proved highly profitable. Like most shallow sands, they are not proving long-lived, and little development was going on until a recent discovery was made at 2900 ft. The latter is the deepest production in Illinois, but it is too early to determine its magnitude. The shallow wells cost $800 to $1200 complete, which includes the drilling, casing, shooting, tubing, tankage, pumps, and so forth.

The central portion of the field is in Crawford county, with Robinson as the centre, where there are three sands at 750 to 1100 ft., although most of the production is obtained from about 950 ft. This has been an exceedingly rich district and has made many fortunes, as the field has a width of three to ten miles, and it attained a daily output of 100,000 bbl. by its third year. Like the Casey district, the drilling can be done with portable rigs at a large saving over the use of derricks, and the contract prices of $1.25 to $1.50 that formerly prevailed have been reduced to the very reasonable rates of 70 to 80c. per foot. The cost of a well, complete and put to pumping, ranges from $1200 to $2500.

The southern portion of the field is in Lawrence county, with Bridgeport as its centre, and while this is the deepest part of the field, it yields by far the richest and has the best grades of oil. The belt is two to six miles wide, and to date seven pay-sands have been found that range from 800 to 1950 ft. in depth. The McCloskey or 1950-ft. sand that was discovered last year is the deepest and richest thus far found, as it produces wells up to 3000 bbl. daily output. While the growth of this district has been slower, from the greater depth and expense of the wells, the daily output exceeds 60,000 bbl. and the older wells are holding up remarkably well. Drilling costs from $1 to $1.50 per foot, as caving ground requires more or less under-reaming. The cost of a well, complete, ranges from $2500 to $3500 in the shallower sands, and from $4000 to $7000 in the deeper sands.

MARKET CONDITIONS

An 8-in. pipe-line was built into the field in 1906, and there are now five pipe-lines; three, 8-in.; one, 12-in.; and one, 6-in. These have a combined capacity of about 110,000 bbl. and transport the oil to the large refining centres at Wood river, near St. Louis, 140 miles; to Whiting, Indiana, 200 miles; and to the Atlantic seaboard, 900 miles. About 900 steel tanks, of 35,000 bbl. capacity, are scattered through the field, which provide storage for about 30,000,000, and which have enabled the buyers to take care of production without the usual slaughtering of prices.

The oil has sold at 60c. per barrel, except a small amount under 30°B. that brings 52c. While this is a low price for such a high-grade refining oil, it is a much higher price than any other field ever enjoyed during its development or flush stage, when production always greatly outstrips the shipping facilities. Other fields have had to accept 3 to 25c. per barrel during the early stage while awaiting the advent of the costly pipe-lines that are required to handle and economically transport a large production. As the pipe-line facilities are now able to care for the output and are drawing on the surplus at the rate of 250,000 bbl. per month, higher prices should soon rule, and recover not only the former price of 82c., but eventually reach $1 to $1.10 per barrel, which the paraffine base and excellent gravity of the oil warrants. The oil ranges from 32 to 39°B. in gravity, except a small amount of shallow oil that is 28 to 30° Beaumé.

While ample gas occurs with the oil to operate the drills and pumps and furnish the adjoining towns, no large quantities have been found thus far that are commensurate with its importance as an oilfield. That larger and stronger gas wells will be found in the deeper sands that have not yet been prospected is quite probable, and gas lines from this field may yet supply St. Louis and Chicago.

WESTERN ILLINOIS

In its early history, western Illinois was of considerably greater importance than eastern Illinois. Gas was found in commercial quantities at Litchfield in 1882 and lubricating oil was produced there for about twenty years. Sparta enjoyed gas for several years after its discovery in 1887, and since 1907 it has produced some excellent refining oil; while the Pike county gasfield has supplied the local farmers since 1890. The present production of western Illinois, however, is scarcely over a year old, and started from the accidental discovery of oil in a new coal shaft at Centralia in the autumn of 1908. Subsequent drilling developed a few small wells at a depth of 600 ft. in the immediate neighborhood. In prospecting 4½ miles north for the extension of this sand in 1909, at Sandoval (60 miles east of St. Louis) it was found dry; but on continuing the drilling to 140 ft., a 40-bbl. well (Fox No. 1) was brought in. On drilling (Fox No. 2) on the adjoining farm, the 1400-ft. or Stein sand, was found dry; but on continuing the drilling, a 350-bbl. gusher was struck at 1525 ft. in the Benoist sand that also yielded 5,000,000 cu. ft. of gas daily. A dry season prevented much drilling that year, but in 1910 a rich oil pool was opened that today is two miles long by a

*Read at the St. Louis Engineers Club.

mile wide, and on which there are 40 wells that had an average initial output of 118 bbl. daily. This is the highest average yield of any pool in the State, according to the Illinois Geological Survey. The oil is obtained from the base of the coal measures. The Stein or 1400-ft. sand is found to yield 40 to 60-bbl. wells over much of the area, but at present this is cased off to go 150 ft. deeper to the richer Benoist sand. Field pipe-lines convey the oil to loading racks of the Indian Refining Co. (independent) on the Baltimore & Ohio Southwestern railroad, or to that of the Ohio Oil Co.'s (Standard) on the Illinois Central railroad. Last fall a 6-in. pipe-line was built into the field, so that adequate shipping facilities are now afforded the output. The grade of oil is about the same as in Lawrence county (gravity about 36°B.) and sells for 60c. per barrel at the wells.

The work of the Illinois Geological Survey shows that the Sandoval field is on an uplift that extends south to DuQuoin and considerable prospecting is now going on along this promising zone, which passes through Centralia. Further drilling into the deeper sands at Centralia brought in several wells recently in the Benoist sand; but as it is not so thick, they have not thus far proved as rich as at Sandoval. Drilling in the latter part of 1909 discovered gas at a depth of about 400 ft. near Carlinville, 55 miles northeast of St. Louis, that is being used at that town for lighting and heating. Drilling at Greenville, 50 miles east of St. Louis, in Bond county, in December 1909 discovered a good gas-sand at 950 ft. There are now several wells yielding 1,000,000 to 2,000,000 cu. ft. of gas daily, that supply Greenville (5000) with gas for heating and lighting at 25c. per 1000 ft. This sand is at or near the base of the coal measures. Drilling last autumn at Old Ripley, in the western part of Bond county, discovered oil at a depth of about 2000 ft. that is of good grade, having a gravity of 39°B. It has been difficult to get reliable information about this well, as the company that made the discovery is absorbing all the leases in the neighborhood, but the well seems to have a capacity of 25 to 50 bbl. Other wells are drilling in the neighborhood and the oil horizon seems to be in the Devonian horizon, or below the coal measure.

In prospecting this winter for a lower vein of coal with a diamond-drill at Livingstone, 35 miles northeast of St. Louis, in Madison county, a strong flow of gas was struck in a thick sand at 581 ft. To the fact that the drillers were badly burned and the outfit set on fire was due the publication of this discovery. The gas is issuing with a roar from a 3-in. hole and the open pressure is at least 80 to 100 lb.; if closed in, it would probably show a rock-pressure of over 200 lb., but the fear of the gas getting into the mine has prevented its utilization and it is allowed to blow off and burn as a huge torch that can be seen for miles at night. The attention of the oil-men has not yet been directed to this accidental discovery, which is quite as important in pointing to an oilfield, as it proves the occurrence of a valuable gas sand, while the deeper sands are likely to be much richer. While this paper is being written, a paying oil well is reported near Carlyle, in Clinton county and directly south of Greenville. A little oil was found there last summer at about 1000 ft., and if the above proves correct, it was probably an edge well and the pool has now been found.

Dredging Costs

Part of the main canal of the Los Angeles aqueduct through Owens valley is being excavated by means of a dredge. This consists of the working part of a Marion No. 60 electric shovel, with a dipper of 1½-cu. yd. capacity, mounted on a scow. The dredge was built on specifications furnished by engineers of the aqueduct, and cost, exclusive of freight, $19,897. The material handled is valley soil, and the work is easy. In many particulars it differs from that involved in gold-dredging, but the following costs, for the month of February 1911, and totals to date, are of interest. The engineer in immediate charge is A. Swanson. H. A. Van Norman is in charge of the division.

DREDGING COSTS, FEBRUARY 1911, LOS ANGELES AQUEDUCT

CLASSIFICATION.	NO. DAYS LABOR.		STATIONS.		QUANTITY.		COSTS FOR MONTH.					UNIT COSTS.		
	Men.	Live Stock.	From	To	Lineal Ft.	Cubic Yards.*	Labor.	Live Stock.	Material and Supplies.	Power.	Freight and Handling.	Total.	Lineal Ft.	Cuble Yd.
													Cents.	Cents.
A. Teams and men	10		31 + 70	5 + 45	2,625	38,876	34.29					34.29	1.3	0.01
B. Operation	205	56					727.39	50.40	1.75	408.51	0.35	1,188.40	45.3	3.06
C. Renewals and repairs	241	12					888.81	10.80	120.32	9.79	24.06	1,003.78	38.2	2.58
D. Miscellaneous	3						17.85					17.85	0.7	
Totals	459	68					1,618.34	61.20	122.07	418.30	24.41	2,244.32	85.5	5.65

TOTAL TO DATE FOR DREDGE NO. 4.

Totals to February 28, 1911						36,100	532,641*	19,425.01	1,959.30	7,212.24	5,199.74	1,716.17	35,512.46	98.0	6.7

* Yardage based on theoretical section of 14.81 cubic yards per foot. The section is somewhat exceeded in places on account of excess cut.

Air-Lift Agitation of Slime Pulp

It may not be generally known, but the air-lift for agitation of slime has been in use in the Transvaal for some time, and perhaps it may be of interest to give a brief account of the progress made on the Rand with this process, where, however, the decantation system continues largely in vogue. At a recent meeting of the Chemical and Metallurgical Society of South Africa, Robert Allan dealt with the subject and related the experience and results of trials in several countries and also the progress made during the last thirteen years on the Rand.

It was W. A. Caldecott, writing upon the chemical condition existing in accumulated slime, who showed how the neutralization of cyanicides would be effected by their gradual oxidation through exposure to air, and in March 1898, in conjunction with John Kelly, he took out a Transvaal patent, No. 1559, for an air-lift apparatus for the agitation and aeration of slime pulp or other gold-bearing material. This method of sweetening accumulated slime by means of atmospheric oxygen is utilized on the Geldenhuis Deep G. M. Co.'s plant and also on that of the Luipaard's Vlei Estate & G. M. Company.

The first company in the Transvaal on record as using the air-lift in the treatment of accumulated slime was the Nourse Mines, Ltd.; a flat-bottomed tank 30 ft. diam. and 12 ft. deep being used. The Geldenhuis Deep G. M. Co. uses two conical-bottomed vats, each 20 ft. diam. and 20 ft. deep, to oxidize accumulated slime, the vertical depth of the cone being 5 ft. These vats have air-lift pipes 16 in. diam. in the lower portions of the vat, of one-half the depth only. Pipes were formerly used in length equal to the full depth of the vat, and afterward shorter lengths were tried with much more satisfactory results. The slime was pulped with two parts of water in a knife-box mixer and then pumped into the air-lift vats, a charge for each tank being 50 tons of dry slime.

Each vat requires 50 ft. of free air, compressed to 10-lb. pressure, per minute. At the plant of the Luipaard's Vlei Estate Co. the accumulated slime after being suitably pulped (lime and lead acetate being then added) is pumped into a conical-bottom vat of 30 ft. diam., fitted with an air-lift pipe 18 in. diam, 26 ft. high, and 22 in. above the bottom of the vat. The air supply to the air-lift is delivered through a ¾-in. air-pipe, centrally placed inside the lift pipe. This supply is utilized only when the vat is full and its contents are in agitation, but when the vat is being filled or discharged the air-lift is not operated, the pulp being agitated by air supplied through four ½-in. air-pipes outside the air-lift tube. The pulp receives a total aeration of 22 hours as follows: Filling 9 hours (incomplete aeration), air-lift agitation 6½ hours, discharging (incomplete aeration) 7 hours. The charge of the vat is 150 tons of slime and 300 tons of water and this charge is probably the largest single charge of slime that is agitated anywhere. The vat requires about 85 cu. ft. of free air, compressed to between 25 and 30 lb. per square inch. The small amount of sand, which is always present in accumulated slime, is drawn off from the bottom of the cone, as in the separating cone of the laboratory, and sent to the tailing wheel of the cyanide plant. One of the most useful parts of the treatment vat is a conical diaphragm surrounding the air-lift pipe, whose horizontal base is 3 ft. 4½ in. above the bottom of the vat. This leaves an annular space about 9 in. wide between the diaphragm and the sloping side of the vat, through which the pulp passes to the air-lift. This arrangement entirely prevents the banking up of material around the mouth of the air-lift, and reduces the chance of fine sand collecting on the sloping side of the vat above the diaphragm. In general it enables a vat of larger diameter, and consequently of less capital cost per ton treated, to be used than is otherwise possible.

The accumulated slime, after aeration treatment, is pumped to current slime plant for cyanide treatment. The following average figures from a three month's run show such highly satisfactory results as to warrant more attention being paid to this method of treating accumulated slime:

Value of charge	2.460 dwt.
Value of residue	0.278 dwt.
Extraction	77.7%
Lime consumed per ton (50% CaO)	18.079 lb.
Potassium cyanide per ton	0.233 lb.
Lead acetate per ton	0.121 lb.

The total working cost in connection with the treatment of this slime is 3s. 8.1d., which includes 1s. 5.3d. for collecting and pulping.

The Brown vat is also successfully used for the treatment of sand. At the plant of the Simmer & Jack Proprietary Mines, Ltd., an air-lift vat, 13 ft. diam. and 18 ft. deep, with a central pipe 16 ft. 6 in. long and 10 in. diam., is used for treating 12-ton charges of black sand. The black sand is previously finely ground in a small tube-mill. After the pulp of sand and water is in circulation, lime is added, and later on lead acetate also. Agitation is continued until all soluble sulphides are decomposed, a period of about 16 hours. Cyanide solution is then introduced under pressure into the bottom of the charge, and the solution of the gold commenced, periods of agitation, settlement, and decantation following one another alternately until the value of the decanted solution indicates complete treatment. After each decantation, a centrifugal pump, connected with the bottom of the vat, and discharging externally into the top of the vat, is used to withdraw any sand which may have settled at the bottom of the cone below the air-lift and put into general circulation again. The head samples assay about 10 oz. gold per ton, and over 97% extraction is obtained with a cyanide consumption of only 2 lb. per ton.

The air-lift has been in use for the elevation of various liquid materials since 1892; in Western Australia it was used for pumping battery tailing in 1902; and though F. C. Brown, as mentioned before, introduced the central air-lift tube into his tall agitators in 1904, A. F. Crosse actually used the air-lift on the Rand for the experimental agitation of slime in 1903. Mr. Crosse's method of decanting an overflow from an agitation-vat seems to have been useful to inventors. In the Paterson vat this principle is made use of as well as that of the Brown vat, decanted solution, free from sand, being passed outside the vat and drawn through a centrifugal pump. This delivers the pulp again to the bottom of the lift-pipe, taking the place of the air of the Brown vat. The makers give 4½ hp. as the probable power required to agitate 50 tons of (dry) slime in a 15 by 45-ft. vat. By way of comparison it may be noted that in a Brown vat of the same size at the Hacienda San Francisco, at Pachuca, 112 short tons of (dry) 'slime' are agitated with about 2 hp. Vertical circulation pipes in a Brown vat, with their upper orifices, which are protected by goosenecks, just below the surface of the pulp and lower orifices near the mouth of the air-lift were suggested by W. M. Brodie. Their use was mainly the prevention of choking by heavy sand around the opening of the air-lift.

Well-Drilling Methods

The history of well drilling from its earliest practice in China down to date is traced by Isaiah Bowman in a recently issued Water Supply Paper, No. 257, of the U. S. Geological Survey. The report also contains descriptions of the many methods of drilling now in use in the United States, including not ony drilling for water but for oil and other resources. The credit of reducing well drilling to a science belongs to the Chinese, but in this, as in many other things, the Chinese engineers have made but slight improvement during the last century, which has witnessed so remarkable an advance in mechanical development in the United States. Mr. Bowman regards the use of well casing as the greatest improvement yet devised for oil drilling and notes that holes can now be sunk safely and rapidly to a depth of 5000 ft. He describes the various tools and rigs required for different kinds of drilling, ranging from those used in the shallow hand-driven well of perhaps 20 ft. to those used in drilling wells of maximum depth.

Gold Nuggets of California

By Alexander Del Mar

Below is given a list of the gold nuggets known to have been found in California. Of necessity, the list is inaccurate and incomplete, and it would be of historical interest if those who know of other finds of nuggets, say of 30 ounces or over, would put on record the date, locality, name, weight, and value.

Year. Locality and Finder.	Oz.	Value.
1848—January 18. Date of the most celebrated discovery of gold in California. Scene, the American river near Colima, Eldorado county. From this place Tom Marshall brought into Sutter's Fort, near Sacramento, a small sackful of nuggets, the first one of which had been picked up by his little daughter. This nugget is preserved by the Pioneers' Society of San Francisco. Marshall's sack contained approximately	50	$ 1,000
1848—Wood creek, SW. of Sonora, Tuolumne county	900	15,000
1848—Knapp's ranch, E. of Columbia, Tuolumne county; Mr. Strain	396	8,500
1849—Illinois canyon, near Georgetown, Eldorado county	50	1,000
1849—Sullivan's creek, Tuolumne county, weighed 28 lb	408	7,168
1849—Gold Hill, near Columbia, Tuolumne county; Mr. Virgin	380	6,500
1849—Spring Gulch, near Columbia; a Frenchman	250	5,000
1850—French Ravine, Sierra county, three nuggets	935	18,000
1850—Quartz nuggets, Tuolumne county (a pocket of $360,000)	1500	28,000
1850—French Ravine, Sierra county, one quartz nugget	263	4,890
1850—Georgia Slide, Hudson gulch, Eldorado county	50	1,000
1850—Oregon canyon, Eldorado county, Fay nugget	62	1,250
1850—Kelsey, Eldorado county	195	4,700
1850—Holden's Garden, Sonora, Tuolumne county	1500	30,000
1851—Camp Corona, Grizzly mountains; Oliver Martin	1818	22,750
1851—Morgan mine, Carson Hill, Calaveras county (pocket of $3,000,000)	350	6,500
1851—French Ravine, Sierra county	426	8,000
1853—Columbia placers, Eldorado county, six nuggets	1755	35,000
1853—Same place, one nugget	105	1,800
1853—Columbus, Tuolumne county, 283 oz., clean	360	5,265
1854—Carson hill, Calaveras county, several nuggets, one of	2340	37,400
1854—Nevada county, nugget	780	17,500
1854—Camp Seco, Stone Cabin gulch; Frank Russworm	93	1,760
1854—Live Yankee, Forest City, Sierra county, from 1854 to 1862 yielded 12 nuggets, 30 to 170 oz	1000	20,000
1854—Spanish Dry Diggings, Grit seam; Texas & Jacobs	60	1,000
1855—French Ravine, Sierra county	532	10,000
1855—Remington hill, Nevada county	186	3,500
1857—Manhattan creek, Georgetown, Eldorado county	62	1,200
1857—Garden Valley, Eldorado county; Samuel Treeworgee	28	525
1859—Magalia, Butte county; Ira A. Willard.	533	10,690
1859—Butcher Ranch, Auburn, Placer county, twin nuggets	240	3,264
1860—Same place, same finder (Ed. Gilbert).	147	2,852
1860—French Ravine, Sierra county	93	1,755
1860—Monumental Quartz, Sierra Buttes; W. A. Farrish. This nugget sold for $23,637, more than its value as gold.	1596	17,655
1860—Sierra county, nugget, probably same as last	1146	20,000
1860—Spanish Dry Diggings, Pennsylvania seam	36	500
1861—Smith's Flat, Sierra county	80	1,505
1861—Oregon claim, Forest City, 12 nuggets, 30 to 100 oz	750	15,000
1862—West branch, Feather river near Magalia; Morrison	80	1,605
1864—Michigan Bluff, Placer county	226	4,205
1864—Smith's Flat, Sierra county	140	2,605
1865—West branch, Feather river near Magalia	90	1,760
1865—Lowell hill, Nevada county	58	1,100
1865—Spanish Dry Diggings, Dendritic gold, Fricot's specimen	101	3,500
1866—Smith's Flat, Sierra county	146	2,715
1867—Remington hill, Nevada county	128	2,460
1867—Gibsonville, Sierra county; G. H. Norman and Frank Aman	100	1,700
1867—Pilot hill, Eldorado county, Bowlder Gravel Claim	426	8,000
1869—Little Grizzly, Sierra county	107	2,000
1869—Hope claim, Sierra county	94	1,770
1870—Little Mule creek, Trinity county, two nuggets	277	4,700
1870—Spring creek, near Redding, Shasta county	185	3,200
1870—Same place; Oliver Longchamp and Fred Rochon	310	6,200
1870—Rainbow mine, Alleghany, Sierra county	1200	23,000
1873—Buckeye mountain, Trinity county, two nuggets	190	3,500
1876—Polar Star mine, Dutch Flat, quartz; J. B. Colgrove	285	5,760
1877—Mohave desert, San Bernardino county, 'Delmar's Luck' nugget	108	2,000
1880—Groot's Ferry, Siskiyou county	110	2,000
1880—Flat creek, near Redding, Shasta county; Dent Young	30	520
1882—Holloway hydraulic 'Christmas Pudding' nuggets	100	2,000
1891—Goler district, Mohave desert, two nuggets, $2120, $975	156	3,095
1894—Canyon, San Jacinto mountain, San Bernardino county; Jerseyman	70	1,400
No date—Nelson Creek, 140 oz.; Elizabethtown, 134 oz.; Mohawk Valley, Plumas county, Hays & Stedman, 420 oz.; Minnesota, Sierra county 206 oz.; together	960	18,000

Gold Fields American Development Co., Ltd.

It is announced by the management of the Consolidated Gold Fields of South Africa, Ltd., that it is proposed to register an American company with a capital of £2,500,000 in a like number of shares of £1 each. In exchange for its interests in Natomas Con., Oroville Dredging, Ltd., Yuba Con. Gold Fields, and the Sierra Pacific Electric Co., 1,000,000 of these shares will be issued as fully paid to the old company, and in order to provide additional capital for the extension of business it is proposed that a further 1,000,000 shares of the new company shall be subscribed for by the old "company at par, the balance that 500,000 shares remaining in reserve. In addition to the skilled attention given by H. H. Webb and Baron von der Ropp to opportunities for investment in America, an arrangement has been made with John Hays Hammond, who was for many years consulting engineer to this company, by which he undertakes to give to the new company the best of his experience and advice, the advantage of preferential rights over new business which may reach him

through his wide and influential connections in America, and also his assistance on the committee which it is proposed to establish in New York, on which it is intended to also secure the presence of other gentlemen of eminent financial position."

One of the first steps taken by the new company will be the extensive exploration of valuable placer ground on the west coast of Colombia.

West Australian Gold Production

The value of the gold production of Western Australia for February 1911, was $1,818,000. The individual production of the leading mines is given below:

Name.	Tonnage.	Value.	Profit.
Associated	1,099	.....	.....
*Associated Northern Blocks..	1,439	$14,500	.....
†Bullfinch Proprietary.....	237	46,000	.....
Burbank's Main Lode.....	1,576	22,500	.....
Chaffers	3,360	23,000	$650
Golden Horse-Shoe	25,071	165,000	11,500
Golden Ridge	2,473	31,000	15,000
Great Boulder Perseverance..	18,205	119,000	22,000
Great Boulder Proprietary...	16,218	215,000	116,000
Great Fingall	9,534	71,000	12,000
Hainault	4,367	31,500	3,600
Ivanhoe	18,229	195,000	90,000
Kalgurli	10,040	116,000	57,500
‡Lake View Consols.....	8,740	8,400	2,500
Lake View & Star.....	12,035	75,000	2,000
‡Oroya Exploration	19,295	15,000	3,500
Oroya Black Range	4,210	42,000	10,500
Oroya Links	6,798	41,000	950
Sons of Gwalia.....	13,498	118,000	46,000
Sons of Gwalia South.....	2,202	18,500	5,600
South Kalgurli	9,013	59,000	12,200

*No clean-up, as new mill had just run for a week.

†Profits not published.

‡Residue treatment.

The production of gold since 1886 has amounted to 714 tons.

	Fine oz.	
1886	270	£1,148
1896	251,619	1,068,808
1903	2,064,801	8,770,719
1908	1,647,911	6,999,882
1909	1,595,269	6,776,274
1910	1,470,632	6,246,848

The value of the gold produced per man employed was £413 in 1910. For every 100 oz. of gold produced in Australia in 1910 the respective contribution was:

Western Australia	46
Victoria	19
Queensland	13
New Zealand	14
New South Wales	6
Tasmania, South Australia, Northern Territory, and Papua	2

The following table shows the total value of the mineral production of Western Australia to January 31, 1911:

Gold (to 28/2/11)	£98,989,676
Copper	979,357
Tin	926,808
Coal	829,735
Lead	364,756
Silver	247,147
Ironstone	36,695
Limestone	18,290
Tantalite	13,486
Pig lead	13,306
Silver-lead ore	10,863
Asbestos	1,754
Wolfram	546
Sundry minerals	12,832
	£102,445,251

Resignation of Dr. R. W. Raymond

The special committee appointed by the Council of the American Institute of Mining Engineers to consider the resignation of Dr. Raymond has issued the following statement:

At the meeting of the Board of Directors, and of the Council of the American Institute of Mining Engineers, February 21, 1911, Dr. R. W. Raymond asked for the appointment of a joint committee to receive and consider a communication (which was duly sent by him under date of March 16) tendering his resignation as member and secretary of each body. On March 31, the Board of Directors and the Council accepted the resignation of Dr. Raymond, and on the recommendation of the Council, the Board authorized and directed his appointment as Secretary Emeritus, upon whom the Council may call for special editorial and other services in connection with the publications of the Institute. Dr. Raymond's desire is thus met, since he will be entirely relieved of the executive and administrative duties at a time when they will be greatly increased by many suggested extensions of the activities of the Institute. At the same time, the Council retains his active co-operation in much of the special work for which he is so exceptionally qualified by training and experience, and also secures his valuable advice based upon his intimate knowledge of the history of the Institute, and his wide acquaintance with the membership at home and abroad.

Dr. Raymond was one of the founders of the Institute in 1871; he was elected first vice-president, and became president the same year. He was annually re-elected in 1872, 1873, and 1874, and was formally and informally connected with the management until 1883, when he was appointed secretary to succeed Dr. Thomas M. Drown. Dr. Raymond was elected secretary in February 1884, and since then he has been annually re-elected by unanimous vote. Our *Transactions* bear eloquent testimony, in the accuracy of technical statement and literary finish, to Dr. Raymond's wide expert knowledge and editorial genius. He has enriched the literature of the profession by his translation, in 1893, of Posepny's great treatise on Ore Deposits, and he has contributed to our *Transactions* very valuable original papers on Mining Law, the Divining-Rod, Ore Deposits, etc. Through his knowledge of foreign languages, and his acquaintance with foreign experts and American engineers, he has done a great deal in building up the Institute, and securing for it an international as well as a national standing. Dr. Raymond has given to the Institute his entire professional library; he has sacrificed private practice, and he has contributed from his private means, to its success.

At the same meeting the Board of Directors elected Dr. Joseph Struthers a member of the board, secretary to the board, and a member of the Library Committee to fill the vacancies created by the resignation of Dr. Raymond. The Council appointed Dr. Joseph Struthers secretary of the Council for the unexpired term, and member of the Committee on Membership, his duties to include also those of editor and assistant treasurer. Dr. Struthers began his service with the Institute in 1903 by appointment as assistant editor. In February 1906 he was appointed assistant secretary and editor, and a few months later there were added to his duties those of assistant treasurer, so that he has had years of experience in all branches of the work of the Institute. Dr. Struthers has been identified in recent years with the management of the building of the United Engineering Society, as chairman of the House Committee, secretary of the Library Conference Committee, and since 1910 as trustee and treasurer of the United Engineering Society.

Prior to Dr. Struthers' connection with the Institute, he was, for fifteen years, a member of the teaching staff of the department of metallurgy, School of Mines, Columbia University, and later, for four years, was editor of 'Mineral Industry.' Dr. Struthers, therefore, through his long service with the Institute, and through his work in cognate lines, brings to it the necessary equipment in training and experience, for his duties as secretary.

Discussion

Readers of the MINING AND SCIENTIFIC PRESS are invited to use this department for the discussion of technical and other matters pertaining to mining and metallurgy. The Editor welcomes the expression of views contrary to his own, believing that careful criticism is more valuable than casual compliment. Insertion of any contribution is determined by its probable interest to the readers of this journal.

Weight and Volume of Ore

The Editor:

Sir—In your issues of April 1 and 22, A. E. Robinson and A. L. Gerry comment on my article on 'Weight and Volume of Ore.' I would again warn the writers of the fact that ores are more or less porous, even when 'compact,' and that large pieces may contain cavities. The object of using wheat was that such cavities or pores should not be filled. I might add that in the test referred to, to prevent entrance of water, individual sample pieces were paraffined.

L. S. AUSTIN.

Salt Lake, Utah, April 26.

Tank Versus Vat

The Editor:

Sir—KCN's remarks upon 'Tank Versus Vat' recalls that in *Hampton's Magazine*, illustrating Eugene P. Lyle's article on the 'Smelter Trust,' was a picture of a copper matte smelting furnace, the descriptive note below the picture stating that the 'copper' passed through the large 'vat' in front of the furnace. Now is a furnace fore-hearth not also a vat? I vote with KCN on that, as also on his feeling that the present generation of metallurgists, at least, will balk at the term 'smeltery,' even if the lexicographer does sustain the Editor of *The Engineering and Mining Journal*. Somehow I always felt that if the 'Trust' had brought suit against *Hampton's Magazine*, that use of the word vat would in itself almost have proved the contention of the prosecution, that the writer was not sufficiently informed on his subject.

R. C. C.

El Paso, Texas, April 5.

Arizona Copper Belt M. Company

The Editor:

Sir—I note in your issue of April 8 a letter from R. W. Groo, Bingham Canyon, Utah. In regard to the letter to which Mr. Groo refers, I wish to say that through an error by the printer this was inserted, but that as soon as the mistake was discovered the prospectus was corrected. Apologies and explanation were tendered Mr. Groo by myself, and I wish to again apologize through the medium of your paper. The error was not intentional, and I am doing all in my power to right whatever wrong was done. I wish to exonerate the Arizona Copper Belt Mining Co. in regard to this letter, as its officers knew absolutely nothing about it until a short time ago. They have invited Mr. Groo to examine the property, and feel sure that upon examination he will feel satisfied that his reputation is in no wise jeopardized.

The explanation of printing the letter is this: I had written Mr. Groo, who was an old friend, to write a letter for me, enclosing with my request a draft of what I wished him to say. This, however, contained nothing in regard to his having examined the mines. A copy of this as I would have had it reproduced was given the printer, who took the liberty of making additions. I let the matter go, not having heard from Mr. Groo (subsequently my letters were returned), and when the booklets came from the printer the letter was included. As I said before, the error was corrected as soon as possible and no stock was sold through the mails by their use. I would further say that the mines of the Arizona Copper Belt Mining Co. are not of a 'wild-cat' nature and they are being financed only among friends of the officers. I trust that as a result of the explanation tendered Mr. Groo personally as well as this one, Mr. Groo will be convinced that no intentional misuse of his name was intended. I will deem it a favor if you will publish this in answer to Mr. Groo, and thank you in advance for assisting me to right an unintentional wrong.

F. A. CRAMPTON.
(General Manager.)

New York, April 19.

Positions Wanted

The Editor:

Sir—In a recent issue of *The Engineering and Mining Journal* a letter, by Mark R. Lamb, on the difficulty of securing employment by members of the mining engineering profession, has caused considerable comment. This discussion is well timed and would result in much good to many members of the profession, if it should prove possible to put into practice any plan which would obviate the difficulties and expense of each man getting the place he is best fitted for and the corporation getting just the man needed for each place. There are many who, without doubt, have had the experience of not being able to find the right job when wanted. Aside from the men who are unavoidably out of employment and those who are just making a start in life and trying to get a foothold, there are those who, although they are 'holding down their jobs,' are unsuited for them in many ways and who, if they could get the right employment could make a change to the advantage of all concerned. In still other cases there are many who are capable of doing more than they have the opportunity for, in the present location, and are looking for new fields to conquer. For these, there is special injustice, as a change in many cases, is almost impossible to make.

I should be glad to hear from those interested, as it has been suggested to me by Mr. Lamb, that, as he will necessarily be absent in South America for some time, I should continue the work started by him until, as proposed by Mr. Herty, this important matter can be taken up by some such organization as the American Institute of Mining Engineers. In the meantime I shall be glad to offer the use of my letter-files to those looking for men, as well as for those seeking employment.

RAYMOND C. BENNER.

University of Arizona, Tucson, April 17.

A B C of Empire Drilling

The Editor:

Sir—I note in your issue of April 1 a letter from R. B. McGinnis, as also a letter from Fred J. Siegel in your issue of February 25, both in relation to the Empire hand-drill, which is manufactured by the New York Engineering Co. The point in question between these two gentlemen is the matter of keeping the casing plumb when drilling in loosely packed gravel as described by Mr. McGinnis. There is a centering device made by the company which keeps the casing plumb during all drilling operations. This should be used when drilling in loosely packed gravel containing large boulders. I believe the Empire drill outfit contains a tool for any and every condition that will be encountered in any placer drilling in the world. I also note Mr. Siegel's criticism on the hardness of the cutting shoes. These cutting shoes are made of nickel steel, quite highly tempered when they leave the works, and they are suitable for drilling in medium gravel. In case the drill encounters large boulders and it is necessary to drive the casing, then the temper should be drawn slightly. This is easily done, and after two or three holes have been drilled, the driver soon learns something of the nature of the deposit, and the temper of the shoe should be regulated accordingly. This shoe does an immense amount of cutting, as it is being constantly rotated during all drilling operations, and, therefore, if it can be used in its hardened condition, it will last much longer than otherwise. It is important that the teeth of the cutting shoe be kept fairly sharp and square, as they will then cut a core of the exact diameter of the outside of the cutting shoe. This enables the engineer to calculate the value of the ground contained in the drill-hole with

great accuracy. This is one of the principal reasons for the great popularity of the Empire drill, and it is important that all operators should appreciate the fact that the cutting shoe should be used as hard as possible. Then the teeth will keep sharp and square and will cut a core that will coincide with the theoretical core. This is most important, as all drilling results are usually figured on the assumption that a core of a certain diameter is obtained, and the nearer this is approached in actual work, the nearer the results will coincide.

A. C. LUDLUM.

New York, April 14.

Mining Method Wanted

The Editor:

Sir—The following are the conditions for which a safe and inexpensive method of mining is sought: An irregular body of ore standing at an inclination approximately 55°, 10 to 50 ft. wide, 175 ft. long on the strike, 140 ft. high, and surrounded by a zone 30 to 60 ft. wide, of friable, shelly limestone which caves in large masses on being slightly disturbed. The ore is but little more firm than the surrounding barren shattered limestone. The high cost of timber at this mine practically prohibits its extended use.

MINER.

Casa Grande, Arizona, March 17.

[The conditions here described certainly present difficulties, whatever the method adopted, and particularly to any without the use of timber. In proposing a method for the safe and cheap extraction of such a mass of ore as that described, such proposal can only be considered in the way of a suggestion, as the method may have to be modified in several particulars as work proceeds, or it may have to be abandoned altogether for some other method better suited to existing conditions. It is not stated, and it is probably unknown, how large a superficial area may be removed without affording support to the back. Much depends upon this, for if only a small area can be mined without timber, or support of some kind, it will be found most difficult to recover all, or nearly all of the ore from this mass. The most feasible method that suggests itself, in view of the limited information given, is top-slicing as practised at Cananea, Mexico, and in the Clifton-Morenci district, Arizona. To adopt this method, a level should be started by running a drift along the foot-wall of the orebody, about 100 ft. below its top, and from this driving a series of cross-cuts to the hanging-wall side of the deposit. These cross-cuts should be 30 ft. apart, centre to centre. Raises should then be run up from the cross-cuts to within 15 or 20 ft. of the top of the orebody. The centres of these raises should not be over 30 ft. apart, and they should each be divided into two compartments, one for ore, the other for manway and ventilation. When the raises have been finished a stope should be started at the top of them, the ground being supported by square sets. This stope should be carried up three sets high, the ore being sent down through the raises. The width of this stope may be anywhere from 30 to 60 ft., depending on the way the ground stands. This is the only level in which square sets need be employed. Probably in this case the square-set stope should not be cut wider than 30 ft., that is, 15 ft. on each side of the line of raises from one of the cross-cuts below, preferably that nearest one end of the orebody. When the ore has been mined three sets high and over a good sized area, a floor should be laid on the sills of the lowest sets. These sills at Cananea are of 5 by 10-in. timbers each 10 ft. long, being the length of two sets. The sills are laid from foot to hanging, that is, across the strike of the vein. The floor consists of 2-in. plank and any old timber available. It may be possible to remove a portion of the square-set timbers. If they can not be taken down without danger to the men, they must be started caving by blasting some of them on the hanging-wall side, so that the hanging-wall country will cave, covering the floor of the stope. The first slice beneath this floor is then started on the hanging-wall side, and if possible at one end of the orebody. The slice should be 10 or 11 ft. high and carried as wide as the square-set stope above it. A drift is run some distance in advance of each slice heading, extending as far at least as the next raise. Mining proceeds backward toward the foot-wall, the sills of the square sets overhead being temporarily propped up by means of caps and stulls, or by stulls alone, which holds the floor and its burden of waste until the miners can blast out a few feet of the ore of the slice and send it down to the chutes in the main level below, through the raises cut for this purpose. As the face of the slice advances the stulls are pulled or shot down by the miners. At least one raise must always be accessible to the men working on a slice. When the slice is well advanced, work may be commenced on the second slice immediately beneath the first, in the same manner as the first. Stoping may also be continued on the next block of square sets, so that when a slice is completed another may be cut at its side in the same manner as before. In this manner the work proceeds the entire length of the orebody and from level to level. It requires considerable foresight and much preliminary arrangement, but the system is a good one, involving little risk—not more than by other methods, and in the end is less expensive than by the all square-set method. The waste rock that first falls on the floor of the square-set stope follows the miners down as slice after slice is removed, additional waste falling on top of that which first caved, the entire mass settling as work underneath it proceeds. This method of mining was described in considerable detail in the *Mining and Scientific Press*, December 24, 1910, pages 834-835.—EDITOR.]

Recording Mining Locations

The Editor:

Sir—I note with pleasure in the discussion concerning the re-location of mining claims in the *Mining and Scientific Press* for April 22, E. L. Ballou calls attention to the desirability of recording notices of claim locations with the Land Office. In *The Engineering and Mining Journal* for April 27, 1905, I suggested such a change in recording notices of location, recommending that the description include, when the claim lies within the surveyed lands, a statement of the township, range, and section in which it is located; and also suggested that after such a notice is recorded at the Land Office, these sections should not be sold as timber lands, agricultural land, or for any other purpose without notification to the claimant of the mineral location. This proposed amendment to section 2324 of the Revised Statutes also included a recommendation that an affidavit, declaring the annual work to have been done, and all monuments to be in proper condition, should be filed with the Land Office by the first of January, and that failure to file such affidavit should be deemed a notice that the claim is abandoned. This latter provision would be the compelling clause which would require the claim holders to record their proof of labor covering a question raised by Mr. Ballou. No man would wish to lose his claim, and would be just as careful to record proof of annual labor as to record the original notice of location.

Since the above recommendation was made several instances have come to my knowledge of land being taken up as a homestead or as timber land, upon which mineral locations had been made. In one of these instances, I was told that several thousand dollars had been spent on the mineral location, but title passed to the timber claimant, because the owner of the mining location was not aware that the property was being sold as timber land until after the sale was completed. In order to have these notices of location of mining claims placed on file at the Land Office, legislation must be enacted requiring the registrar of the Land Office to receive these notices when sent to him, otherwise the simple sending of a duplicate notice of location, as suggested by Mr. Ballou, will be of no value, and the notices will receive no attention at the Land Office. The question asked of the Commissioner of the Land Office at Washington as to whether there would be any difficulty in having these notices filed at the local Land Office, and the claims entered on the tract book, brought forth the reply that there was no legal provision for doing this at present. It

seems highly desirable that an effort should be made to have legal provision enacted so that the locator of a mining claim may be protected. I note, in going about the country, that there appear to be fewer and fewer prospectors in the mountains every year. Where there are no prospectors very few new mines are found, and the maintenance of the mining industry requires that everything possible should be done to encourage the prospector.

GEO. A. PACKARD.

Butte, Montana, April 27.

A Case for the Stamp-Mill

The Editor:

Sir—The poor old five-stamp battery appears to be getting some hard knocks in the technical journals, as is the case every year when milling progress is reviewed, but in spite of all the other machines tried, it has always 'come back.' I am somewhat partial to my old friend, and I maintain that these criticisms are not justified. The one-stamp advocates declare that in consequence of the large screen-area five individual stamps will crush more ore than one five-stamp battery. Perhaps this is true, as stamps are ordinarily worked, but will five ones with quadruple discharge do more work than one five with a quadruple discharge? I believe not, for the screen area in the single-unit battery is far in excess of the crushing capacity. Close up one side of a single quadruple-discharge mortar, and the capacity for crushing remains the same. Make a quadruple-discharge or a double-discharge five-unit mortar with as little space as possible in the mortar not occupied by crushing surfaces, and I am willing to argue that this battery will not only crush ore as fast as single stamps and break as many screens as the one, but will last as long and be more easily worked. One big feeder is preferable to five small ones; one belt is better than two, and two cam-boxes are easier to grease than four.

Making a special plea for the California ores where amalgamating is of prime importance, the single unit loses outright. Other machines requiring previous drying, such as rolls, or those machines requiring preliminary crushing to about ½-in. mesh, such as Chilean and roller mills, have not made a sufficiently strong case for a verdict in their favor.

The small mine-owner pays for mining experiments. The big mine-owner can afford intelligent advice, but the small man, unheedful of the risk he takes, is willing uncomprehendingly to make the experiment of a new machine which the sellers themselves may have never tried except on paper. The amount of power required in a stamp-mill is easily determined by ordinary arithmetic; not so that for other machines. This leads sellers to underestimate the power required in their 'best sellers.' Here the small mine-owner often gets fooled. He is looking for low power-consumption. He may get it along with small crushing capacity. I do not mean to argue that falling stamp utilizes the full power of its fall in effective crushing. It does much less than this, as do all other crushing machines, some more, some less, according to the physical character of the ore. If it were possible economically to dry ores, crush them with rolls, amalgamate thoroughly in mixers and on plates, it might be feasible to use rolls, but the cost of drying the ore is sufficient argument against this system.

I have heard it remarked that South African engineers do not give sufficient attention to the possibilities of the single-stamp mills. Perhaps the answer is that it is too simple for their conditions. They have done much experimenting, and this subject cannot be new to them. Two men can run 20 five-stamp batteries for at least two shifts without any extra help, but heaven help the two men who try to manage 100 one-stamp batteries. If the ore happens to be a bit sticky, half the stamps would be up, for one man could hardly keep 50 screens repaired or keep 50 small feeders working. In a previous paper, last year, I made out a good case for the single-stamp battery, but I was then only considering it as compared with the ordinary single-discharge five-stamp battery.

Los Angeles, April 8. ALGERNON DEL MAR.

Phosphate Discoveries

The Editor:

Sir—In the *Mining and Scientific Press* of February 11, I notice that Charles Colcock Jones makes a protest concerning the lack of recognition of his pioneer work on the phosphate deposits of Utah, Idaho, and Wyoming. I note your apology to Mr. Jones for having previously neglected to credit him with the discoveries. Nevertheless I take pleasure in adding my note of confirmation to Mr. Jones' statements. During the months of September, October, and November 1906, I made, for private clients, an extensive examination of these phosphate deposits, the true nature of which had been first recognized by Mr. Jones, and the most important of which had been located by him in the previous three years. Mr. Jones was in the field at the time, and rendered me the greatest assistance. A careful search through all the geological literature which I made failed to reveal the fact that any one previously to Mr. Jones' discoveries had recognized the value of the deposits, or indeed that phosphate rock existed in the region. I do not know how much of an economic asset the deposits are at present, as I have not recently followed the developments. But I can testify that all the credit of the first discovery of this extensive field of phosphate-bearing rocks is due to Mr. Jones, and to him only. He would be the first to admit that he used as a guide in his work the structural maps of the Hayden Survey, tracing the geological horizon thereby. But neither in the Hayden reports nor any subsequent reports of the U. S. Geological Survey, previous to Mr. Jones' recognition of the phosphate, was any reference ever made to phosphate rock in the region, so far as I am aware. The work of the geologist, whether he be publicly or privately employed is equally valuable, and the failure to recognize fully the importance of the contribution which Mr. Jones has made to economic geology, and to credit the discovery to its proper source, would be to perpetuate a glaring injustice.

C. W. PURINGTON.

London, April 14.

[We are glad to publish this tribute of one engineer to another. It breathes a spirit we like to see animating the profession. Incidentally it affords opportunity to call attention to pioneer work by another engineer, Lewis T. Wright, to whom the mining industry is indebted for more than one valuable discovery. When trouble over smelter fumes became imminent, Mr. Wright took up the whole matter of disposal of smelter fumes and reached the conclusion that manufacture of acid and fertilizer afforded the most satisfactory solution of the difficulties. At that time the presence of phosphate rock in the West was unrecognized. Mr. Wright, acting for his company, placed advertisements in many country papers offering to test free any material suspected to be phosphate rock. Much worthless material was sent in, but among other specimens were some that showed the presence of phosphate. Mr. Jones, then employed by the Mountain Copper Co. Ltd., was thereupon sent into the field to study the occurrence of the rocks and, first for the company, and later for himself, located and acquired claims. The attention thus attracted to the deposits has already resulted in establishment of important industries, and there can be no doubt that even larger developments will be made.—EDITOR.]

THE APOROMA PLACERS, now being worked by an English company, are in the province of Sandia, Department of Puno, Peru, at an elevation of 7000 ft. The first year's work on the gravel, which averages 21c. per cubic yard, is expected to yield $250,000 in net profits. The estimated amount of gold-bearing gravel at present available for washing, calculating an average depth of 48 ft., is 49,000,000 cu. yd., giving a net profit of $9,000,000. The old ditches and reservoirs, which were constructed by the Incas and Spaniards, have been cleaned out and surveyed. The ditches which were built in smooth slate rock, will be used after straightening and widening in places. It is expected that hydraulic operations will begin by October next.

Concentrates

Most of these are in reply to questions received by mail. Our readers are invited to ask questions and give information dealing with the practice of mining, milling, and smelting.

TURQUOISE DEPOSITS have been worked in Arizona, California, Colorado, Nevada, New Mexico, and Texas. Turquoise is generally found in arid or desert regions, where mining is difficult. New Mexico, California, and Arizona were formerly the chief sources of turquoise, but during the last few years Nevada has been one of the principal producers.

LITHIUM (the metal) has no known practical use. It oxidizes very readily, is soft, not very tenacious, and is not known to have other properties that might make it economically valuable. Of the lithium salts, lithium bromide is used in photography and in medicine, and various other salts are used for lithiasis (gravel), arithritis (inflammation of the joints), chronic rheumatism, and gout.

SAMPLE CRUSHERS that are effective and also particularly useful where specimen ore makes 'mortaring' at times advisable, are easily rigged wherever compressed air is available. All that is necessary is an old drill and a suitable mortar. Such a crusher, seen at the Harvard mine, near Jamestown, California, consists of an air-drill mounted on a post as when such drills are converted into steam-hammers, with a pestle in place of ordinary drill steel, and a mortar set on a block below.

THE FIRST STEEL produced in this country was probably made in Connecticut in 1728 by Samuel Higley and Joseph Dewey. Crucible steel was first successfully produced in the United States in 1832 at the works of William and John H. Garrard, at Cincinnati, Ohio. Bessemer steel was first made in this country in September 1864, by William F. Durfee at an experimental plant at Wyandotte, Michigan, and open-hearth steel in 1864, by the New Jersey Steel & Iron Co., at Trenton, New Jersey.

CRUSHED-STEEL ABRASIVES are manufactured from steel which is heated to nearly white heat and quenched in a bath of cold water. The fragments of steel thus produced are crushed to particles varying from fine powder up to pieces one-sixth of an inch or more in diameter. The crushed product is then classified and tempered, and is known as 'diamond crushed-steel,' 'diamond steel-emery,' and 'steelite.' Crushed steel is used chiefly in the stone, brick, glass, and metal trades, the size of the steel used depending on the character of the stone to be cut, rubbed, ground, or polished.

CHROME ORE is used extensively in the manufacture of ferrochromium, employed for making special steels, alone or in combination with tungsten, manganese, nickel or other steel-hardening metals. It is also used for lining copper, lead, steel, and other furnaces where the corrosive action is very great. For this purpose it is used either in the crude form or as chrome brick. A third use of chromite is in the manufacture of various chromium compounds, such as oxides and metal chromates for use as pigments and as dyes, and alkaline bichromates for use as mordants and as tannages.

WOOD PRESERVATION through chemical treatment has come to be considered perhaps the most important phase of forest conservation, next to checking the waste from forest fires. To lengthen the life of wood will lessen the drain on the forests, and consequently postpone the exhaustion of the country's timber supply. Not only does the preservative treatment of the timber bring about a direct saving to the individual timber user, but the general adoption of such measures means a great saving to the timber sources of the nation as a whole. At the present rate of consumption, the exhaustion of the supply of the better class of structural timbers in the United States is a thing of the near future.

EXTRA LONG cages for handling timbers are used at the Kennedy mine, in California. They are hung, when needed, below the regular skip, being attached by cable and hook. When not in use the cages are swung out over the platform at the collar of the shaft, attached to an overhead trolley, and run to one side just as material is handled in a shop by means of an overhead crane. They are thus immediately available, are easily attached, and are swung into place and out again with little labor. The guide shoes on these cages instead of being fixed, have one side hinged. It is turned into position after the cage is between the guides, securely locked by means of a pin, and the cage is ready.

SCRAP MICA, or mica too small to cut into sheets, and the waste from the manufacture of sheet mica, are used in large quantities commercially. The greater part is ground for the manufacture of wall-papers, lubricants, fancy paints, and molded mica for electrical insulation. Ground mica applied to wall-papers gives them a silvery lustre. When mixed with grease or oils mica forms an excellent lubricant for axles and bearings. Mixed with shellac or special compositions, ground mica is molded into desired forms and is used in insulators. Ground mica so used should be free from metallic minerals. Mica used for lubrication should be free from gritty matter; for this use only pure mica should be ground, or the grit should be eliminated after grinding. For wall-papers and brocade paints a ground mica with a high lustre is required, and such lustre is best obtained by using a clean light-colored mica and grinding it under water.

IGNEOUS ROCKS, as that term is used by the United States Geological Survey, are those that have cooled and consolidated from a state of fusion. Molten material or magma from the bowels of the earth has from time to time been forced upward in fissures or channels of various shapes and sizes through rocks of all ages to or nearly to the surface. Rocks formed by the consolidation of molten material, cool slowly, with the result that intrusive rocks are generally of crystalline texture. Where the channels reach the surface the molten material poured out through them is called lava, and lavas often build up volcanic mountains. Igneous rocks that have solidified at the surface are called extrusive or effusive. Lavas generally cool more rapidly than intrusive rocks, and as a rule contain, especially in their superficial parts, more or less volcanic glass, produced by rapid chilling. The outer parts of lava flows also are usually porous, owing to the expansion of the gases, originally present in the magma. Explosive action, due to these gases, often accompanies volcanic eruptions, causing ejections of dust, ash, lapilli, and larger fragments. These materials, when consolidated, constitute breccias, agglomerates, and tuffs.

UNLOADING TIMBERS from deep skips is usually a long and tedious job. At the Argonaut mine near Jackson, California, the men have a method that is both simple and expeditious. The skip having been lowered until its edge is flush with the station platform, light timbers are lifted out by driving into them with a timberman's axe, one man at the top of the timber is to lift it and a second at the lower end to swing it out. In the case of heavy timbers, and in this mine posts 30 inches in diameter are used, a rope is looped loosely around the upper end of the stick. The rope runs over a pulley fastened in the roof timbers of the station, and down to a 'snubbing-pin' at the side. It being ready the timberman signals the engineer to hoist and the skip is lifted until its bottom is clear of the station platform and stopped there, the assistant meanwhile taking up the slack in the rope. The skip is then lowered and as the bottom of the timber swings free the timberman drives in his axe, the assistant slacks the rope, and the man with the axe guides the falling stick out upon a roller placed conveniently on the station platform. The rope is then loosened and the timber rolled to the waiting truck. The whole operation is completed in less time than it takes to describe it, and the method is as satisfactory as if it had been devised by an efficiency engineer after elaborate motion studies.

Special Correspondence

NEW YORK

IMPROVED OUTLOOK.—THE COPPER MARKET.—DEFLATION OF THE PORCUPINE BOOM.—THE CALUMET & HECLA MERGER.—PIOCHE.—SALE OF GOLD ROAD MINE.

The various stages of a period of depression are fairly well known to students of business conditions. The present stagnation in general business, undoubtedly more acute in Wall Street than elsewhere, has been passing through the stage where discussion and comment have for the most part been confined to a search for language in which to describe adequately the prevailing condition. It is an extremely hopeful sign that men of large affairs are now taking a sanguine tone in pointing out the fundamentally sound basis on which the business of the country really rests.

New York is more largely interested in copper than in any other branch of mining and the state of the copper market is the index of mining activity in Eastern markets. Copper appears to have touched bottom with something of a rebound. Large sales have been made and estimates of the amount of copper so disposed of have been appearing almost hourly. Amalgamated is said to have sold 80,000,000 lb. at 12¼c., while the Guggenheims, the Phelps-Dodge company, and the Lake companies are said to have sold all the copper for early delivery that they desire to sell. There has been as much market capital made of these sales as possible, and the cleaning up of the metal pressing for sale would be a strong uplift, were it not for the fact that the greater part of the metal sold was for export demand. Domestic consumers continue to stand aloof, as they can afford to do in view of the new production that must come to market. There are some shifts worthy of note in copper circles. It is said that the estate of the late Henry R. Rogers has liquidated its last share of copper stock. It has not been long since Mr. Rogers was looked upon as the dominant factor in copper, and he often bought and sold Amalgamated in ten and twenty thousand lots. Closely connected with the selling of the Rogers holdings is the announcement that the United Metals Selling Co. will no longer hold to an upset price for its copper, but will meet the Guggenheims in open market competition, selling as may seem best according to the prevailing demand. Both of these items mark the retirement of Urban H. Broughton from active participation in enterprises with which he has been for many years associated. The policy of the United Metals has been a strong supporting factor in the copper market, in sustaining the price even when competitors appeared to take away business or when buyers refused to come into the market. Now the company declares it will 'hold the umbrella' no longer. It is believed that the Producers' report for April will show considerable improvement.

Next to copper, the possibilities in Porcupine absorb attention. The wave of enthusiasm which sprang up a month or so ago, has been succeeded by a decidedly chilly atmosphere of suspended judgment. The Eastern press has discouraged all incipient booms in Porcupine, and the boomers are evidently shifting their activities to London, where the press encourages the exploitation of the new goldfield, though the caution is repeatedly given to have nothing to do with any venture offered in London by promoters from the United States.

The Calumet & Hecla merger is apparently indefinitely

MAP SHOWING COPPER REGIONS OF AMERICA.

postponed. The obstructions are increasing. Thomas L. Chadbourne, Jr., son of the late Thomas L. Chadbourne who died at Palm Beach April 18, has taken up the fight begun by his father, and it is understood will demand of the directors permission to make an independent examination of the Calumet & Hecla property. If the examination is to be made it will require considerable time. If the demand is refused, such refusal will undoubtedly be made the basis for further litigation. In the meantime the stock market is suffering and most of the subsidiary companies are selling below the parity of the merger basis. In addition to the fight being waged by Mr. Chadbourne and the Hyams litigation, a number of the Osceola stockholders have applied for a restraining order, which has been issued by the Michigan court, and adds another obstacle to the completion of the merger. The Chadbourne bill, providing for the appraisal of Michigan properties about to be consolidated, was erroneously announced as having passed both houses of the Michigan legislature. As a matter of fact the bill did pass the lower house, and was apparently about to go through the upper house without a hitch, when it was recalled and killed. The tonnage-tax bill, which was aimed at the copper producers by the agricultural interests of the State of Michigan was beaten only after a bitter contest.

The Calumet & Hecla people appear to be somewhat discouraged and say that if the merger had not advanced so far it would be dropped without further effort to complete it.

The merger of the principal properties in the camp of Pioche has been declared off. The stockholders in Nevada-Utah have been hoping that the merger would save the situation. The prospects are now that the attempted consolidation would result in a snarl of litigation.

The deal of the United States Smelting, Refining & Mining Co. for the Gold Road property at Kingman, Arizona, is awaiting the action of the foreign stockholders, most of whom reside in Paris. The examination which has been completed is said to show an ore reserve equal to the price which has been named for the property.

JOHANNESBURG, TRANSVAAL

ANNUAL MEETING OF RAND MINES, LTD.—RESULTS FOR YEAR.—LABOR SCARCITY.—STOPE-DRILLS.—METALLURGICAL ADVANCES.—RESIGNATION OF G. E. WEBBER.—FUTURE PROSPECTS.

The annual meeting of the Rand Mines Ltd. was held here on March 22, R. W. Schumacher presiding. The remarks from the chair were full of weight and interest, for the Rand Mines Ltd. has been accurately described as the barometer of the situation on the Witwatersrand, and the yearly oration of the chairman not only reflects the position at the great gold mines under the company's control, but also gives a concise and accurate view of the status of the gold industry of the Transvaal.

Last year Rand Mines Ltd. earned a net profit of £1,133,548, of which £1,030,354 was derived from dividends on shareholdings in subsidiary undertakings. During 1910 the crushing capacity of these subsidiaries was raised from 4,500,000 tons per annum to 5,112,000, the machinery employed at the end of the year aggregating 1915 stamps and 48 tube-mills. The average grade of the ore sent to the mills during the year was 8.01 dwt. per ton before crushing, and the average actual extraction obtained was 95.98%. Average yields, working costs, and profits on the tonnage-milled basis were as follows:

	Dwt.		
Yield from mills	5.347		
Yield from cyanide works	2.344		
Total	7.691	or £1	12s. 3d.
Working costs:		s.	d.
Mining		12	5
Developing		1	5
Ore reduction		4	7
General		1	7
Total		20	0

The profit per ton was thus 12s. 3d., and this on a basis of 3,134,793 tons crushed gave a total working profit of £2,524,035. In addition to this a further profit of £41,068 was obtained from the re-treatment of dumps and accumulated slime. Mr. Schumacher dealt with many questions and problems in the course of his speech. He analyzed the results obtained at subsidiary mines in detail, showed how a scarcity of labor and the work of reorganization had in some cases retarded operations, and also pointed out the necessity of developing further the use of small machine-drills in stoping. With regard to working conditions on the mines, Mr. Schumacher stated that the Rand Mines, Wernher, Beit & Co.'s, have since 1902 spent nearly one million pounds on improvements and extensions of housing and other accommodation of their employees. In regard to metallurgy, the chairman said that investigations showed that tube-mills could deal to advantage with a much larger and coarser product than had hitherto been supplied. It has been found that by crushing through a 3 or 8-mesh screen stamp-duties can be increased to 20 tons or more per day. The limits of the tube-mill as regards the size or coarseness of the feed are not yet known, but the tendency is to have the product as coarse as possible with due regard to efficiency. This raises a series of questions. Is a stamp-mill the most efficient medium for effecting this comparatively coarse crushing? Can this degree of fineness be economically attained with the type of crushers used for breaking the coarsest material? Can the design of the tube-mills be so improved as to crush an even coarser material than at present? These problems are being studied, and important economies in the cost of construction and in the operating expenses of reduction plants is likely to be soon effected.

In concluding his speech, the chairman made a highly appreciative reference to the work carried out by George E. Webber, who has been general manager of Rand Mines Ltd. since 1896. Mr. Webber is resigning the management of the company, as he wishes to retire on account of his health. Mr. Webber leaves the Rand Mines Ltd. with an aggregate ore reserve in the subsidiary undertakings of over seventeen million tons, and it is of interest to read the retiring general manager's opinion of the prospects of this, the premier gold-mining corporation of the world. Mr. Webber writes: "Your general holdings are on such a sound basis that the financial position of the company as regards present dividend obligations seem unassailable, while the outlook for the comparatively near future gives every promise of a still stronger position."

TORONTO, CANADA

OPENING OF NAVIGATION.—PORCUPINE SHARES.—RESULTS OF EXPLORATION.—RESUMPTION OF POWER SUPPLY.—THE TEMISKAMING MINE.—LAKE OF THE WOODS DISTRICT.

Spring floods are seriously interfering with mining at Porcupine. As it will be some time yet before the lakes are sufficiently cleared of ice to allow of navigation an interval of inactivity is anticipated. A recent estimate gave the number of men at work as 1200, and this is certain to be largely increased when navigation opens. The market for Porcupine issues has lately been quiet, and in place of the general advance anticipated some of the stocks have dropped below the figures at which they were underwritten. Apart from the question of intrinsic value, which can only be decided by further development, the market has been glutted of late by new flotations altogether beyond the absorbing capacity of the market. The latest important issue is the Ontario Gold Fields Development Co., a Bewick-Moreing flotation issued at $5 par, and traded in locally at about $6.25. Hollinger continues well in the lead, selling at about $10. Free gold has been found at the Dobie at the depth of 240 ft. Drilling on the West Dome shows free gold at 224 to 240 ft. Another hole down 170 ft. is through a vein approximately 16 ft. wide carrying gold in paying quantities. A working shaft has been started. The Foley-O'Brien has reached a depth of 150 ft. in the working shaft and will start a cross-cut to the main vein. A new 30-ft. vein has been uncovered at the Dome Extension and is proving rich. Three main working shafts are being sunk. At the Preston East Dome two 50-hp. boilers are in place and the air-drills are almost ready for work. Trenching is being done preparatory to sinking. Six large veins have been found on the Richardson-Shillington properties on Pearl lake, operated by the Jupiter company, with good gold content. Water in the shafts caused a suspension of work for ten days on the Pearl Lake. Steam pumps are now unwatering the mine. The Hollinger has 150 men at work. Driving has been done for 60 ft. on the 200-ft. level, where the vein is 10 ft. wide and shows good ore. The two shafts are connected by an adit at the 100-ft. level where about 1400 ft. of driving has been done. In the cross-cut at this level near No. 1 shaft another vein 6 in. wide has been found. The Swastika is installing additional machinery and will develop to 400 feet.

The difficulty arising from power shortage at Cobalt is over with the breaking of the ice blockade on the northern rivers. The larger mines are again taking compressed air from the Ragged Chutes plant on the Montreal river, and the supply will be normal in a short time. The Temiskaming

is now working at a depth of 575 ft., but the latest reports are not reassuring as to the continuance of high-grade ore at that level. The ore now being taken out is not so good as that on the 500-ft. level. The Rochester will be sunk to 400 ft. as soon as power can be obtained. The Provincial has found rich ore in driving on the 271-ft. level about 40 ft. from the shaft. The vein splits into stringers aggregating about 2 in. wide and running 1500 oz. per ton.

Much interest has been aroused by the gold area of the Lake of the Woods district, in northwestern Ontario by recent rich discoveries in the old mines lately reopened, especially the Ophir and the Mikado. On the former a good find of high-grade ore has been made at the 100-ft. level and a large body of low-grade has also been found. The Mikado is working in good ore at a depth of 480 ft. A number of other properties are being developed. The properties in this region at one time yielded well, but operations were discontinued some twenty years ago on account of a dispute between the Canadian and Ontario governments as to jurisdiction. The Canadian Pacific Prospecting & Mining Co., which was operating the Ophir, held its title from the Dominion, and the Ontario Government took legal proceedings against it. A period of protracted and costly litigation followed, terminating with an appeal to the British Privy Council, and the case dragged on until a few years ago, when it was decided in favor of the Ontario Government. Meanwhile mining industry was at a standstill and the confidence in Canadian enterprises of those who had financed the Canadian Pacific Mining Co. was destroyed. The region is just beginning to recover from the blow.

JOPLIN, MISSOURI

EFFECT OF MEXICAN REVOLUTION IN ZINC DISTRICT.—NEW MINING REGION OPENED AT LAWTON, KANSAS.—LARGEST MILL IN MISSOURI-KANSAS-OKLAHOMA DISTRICT PLANNED.—ZINC AND LEAD GOSSIP.

Forced out of the Mexican market because of the rebellion, the Edgar Zinc Co., one of the heaviest purchasers of Mexican zinc ores, has entered the Joplin field with the result that much of the 13,000 tons of unsold surplus in the bins at the beginning of April has been consumed and prices have been raised. In one week's time the Edgar company purchased somewhat over 2000 tons, more than one-third of the total zinc-ore production of the district, in which almost twenty smelting companies are purchasing ores. Zinc ore is now bringing $36 to $41 per ton on the basis of 60% Zn; while calamine is bringing from $20 to $24 per ton on the basis of 40% Zn. April shipments of zincblende and calamine were unusually heavy, but lead-ore shipments showed a falling off, due to the smelters having stocked up early in the year when prices were hovering around $52 and $54. Lead ore now is bringing $58 to $60 per ton.

A promising new zinc-lead region, which is yet in the development stage, has been discovered at Lawton, Kansas, northwest of Joplin and more than ten miles from the nearest producing mines, and scores of prospectors are flocking there. One mill of 300 tons daily capacity is nearing completion, and is to be operated by the Eastern Lead & Zinc Co. Walter Ragland, former mine inspector of southwest Missouri, is manager. Large bodies of disseminated ore are found at depths of 100 to 200 ft. Among the prominent operators who have met success in other camps of the district and who are helping to open the Lawton camp are Chapman & Lennan, and Ball & Gunning, of Webb City; Howard E. Gray, of Joplin, and many others.

On the newly acquired tract of the American Zinc, Lead & Smelting Co., in the north Webb City district, a mill of 1400 tons daily capacity, which will be the largest in the Missouri-Kansas-Oklahoma district, is planned for a strip of ground upon which extensive drilling has been done. Sheet ore, occurring at 180 and 210 ft., is said to have been thoroughly explored and enough ore shown to be present to warrant the erection of so large a plant. Thorndyke & Co., a leasing company, is erecting a 300-ton plant on the American company's latest lease. Extensive improvements are being made by the American company in other fields, the projected zinc smelter at Collinsville, Illinois, being of especial importance.

Among recent finds is that made by Joe Dillon, a pioneer prospector and miner of the district, who, while 'up against' a temporary run of hard luck, constructed a home-made horse-power drill-rig and with this crude device has put one hole down into good ore and is sinking a second. Unable at first to defray the expense of drilling his lease, Dillon now could command enough money to make his holdings look like a pepper-box. His lease is east of Joplin, and at a depth of 80 ft. he found free 'jack' containing more than 60% Zn, while the drillings show the ore to constitute 30% of the dirt taken out. The prospecting apparatus consists of a bit, resurrected from a junk-yard, a badly patched cable, a hickory sapling, a few pulleys, an eccentric, a whim, and a so-called horse which, from appearances, will soon be soap. The peculiar jerking motion of the sapling beam as it works on the eccentric causes the drill-bit to operate with slow but satisfactory results.

Jealousy on the part of rival operators, Tom Coyne of Webb City, and Jess Short of Joplin, has resulted in a friendly production contest, the loser to give the proceeds

A JOPLIN PROSPECTING RIG.

from the sale of the ore on the day of the contest to charitable institutions. This means a donation of at least $1500. Both are in the rejuvenated Thoms Station camp, several miles north of Joplin. The zinc ore, with some lead, occurs in large pockets and at Short's mine, the Sitting Bull, the dirt up to date has averaged 60% ore as it comes from the ground. The concentrate assays only about 55% Zn, because of the presence of iron sulphide. Coyne's mill-dirt, while not as rich as Short's, produces a concentrate that runs better than 63% Zn. Numerous other companies are opening big mines in the Thoms Station camp. This entire district was drilled years ago, as at that time a few shallow mines had been opened. Invariably the drills were stopped at 100 to 125 ft., for deeper mining at that time was not seriously considered. The recent discoveries that have brought this camp into the limelight again have been made at depths ranging from 150 to 200 ft. In some instances the old shafts had been sunk to within a few feet of the richest ore. As a result the output of the Joplin camp, which includes Thoms Station, has been increased by more than 500,000 tons of zincblende weekly.

At Aurora perhaps more shallow operations are in progress than in any other portion of the district, with the possible exception of Galena, Kansas. Calamine is the principal ore, many of the shallow ores being of exceptionally good quality. Some operators produce only the ore in the rough, screen it, and sell it for $3 to $5 per ton. 'Chatters' purchase this product, mill it, and sell it in turn to the smelters, getting regular market rates. Among the producers that are showing up in good form are the Sphalerite, North Pole, No. 4 Drill Co., and Coleman Bros. Originally a heavy producer of lead ore, Aurora is now growing more important as a zinc producer.

DENVER, COLORADO

Another Side of the Educational Campaign.—The Lost Bullion Gold Mine Case.—Reduced Transportation Rates.—Cripple Creek News.

The campaign to educate investors both in and outside of Colorado to the possibilities of mining in this State is meeting with merited success. Colorado has the mineral resources. But when the prospective investor has been interested in a mining venture, the work is far from completed. There must be some economic basis upon which the buyer and seller can get together. The investor takes all the risk, and naturally he is not going into a project unless he can be reasonably sure of success. The investor must be convinced that the seller of the property is giving him a good chance to make sufficient profit to compensate him for the risk he is taking. There are many good prospects lying idle in Colorado today because the owners want so much for them that there is little prospect of a buyer ever realizing a reasonable profit and the return of the invested capital. These remarks are not made with any intention of 'knocking.' The idea expressed has been impressed on me through years of experience in trying to bring buyers and sellers together. It is comparatively easy to figure out the value of developed ore, and a fair estimate can usually be made on future possibilities. Translating these values, actual and prospective, into terms of present worth is the most difficult part of an engineer's work. Having done this work to the best of his ability, it is rather disconcerting to find that the owner looks upon him as a pessimist bent on robbery, but unless the owner has had the idea of present worth brought to his attention from some outside source he is apt to form just this opinion of the engineer. It is to be hoped that this plea for a little home missionary work in sound finance will not be without avail.

The Lost Bullion Gold Mine case has been reversed by the United States Circuit Court of Appeals. This case attracted considerable attention in August 1907, when the officers of the company were convicted of using the mails to defraud. Nearly a dozen of the principals were sentenced to prison or fined. The prospectus of the company told of the finding of a fabulously rich old Spanish mine in New Mexico. The original owners had been driven off by the Indians and had so carefully concealed the mine openings that the mine had been truly lost. The evidence adduced at the trial tended to show that the so-called extensive workings of the old mine were connected caves in limestone formation. What the new trial will show is hard to say, as the post-office inspectors who handled the case originally are out of the service, and many of the defendants are either dead or have moved away.

The Denver & Rio Grande railroad has announced a concession on its freight rate from Silverton to Durango. Last season the minimum rate was $1.25 per ton on $15 ore. This same rate will hold on all ores up to $18 per ton for the coming season and a large tonnage is anticipated. The management of the Newhouse adit, at Idaho Springs, is doing all in its power to stimulate mining in the territory served. A new schedule provides for a decrease of 20c. per ton in the transportation of ores valued at $6 per ton and less, and a cut of 50% in the charge for compressed air. While these new rates barely pay for the cost of the service with the present output it is expected that a large increase in production will follow.

Cripple Creek operators have broken the record production for March, having shipped 77,836, as against 73,125 tons produced in the preceding month. The drainage tunnel is partly responsible for this large tonnage, but another factor is competition between the mills situated at Colorado City. The United States Reduction & Refining plant has been closed for repairs for a few days, but has now resumed a full capacity. The treatment rate has been restored to the same figures as last September. The El Paso Consolidated Gold Mining Co. has done over 250 ft. of development work on the Fuller cross-cut and the C. K. & N. fissure without materially increasing the flow in the tunnel. The work is being continued to gain some desired information. Later the heading of the drainage tunnel may be advanced. The old-time case of Paul A. Primeau against H. A. Granfield has been settled. Primeau ran a brokerage office in New York during the boom days in Cripple Creek. Granfield acted as his local agent and invested some surplus arising from buying stock for Primeau. The investment was in what proved to be a profitable lease, on the C. K. & N. mine.

LONDON

Mexico Mines and Libel Suit.—Satisfactory Ending.—Seoul Mining Co.—New Stamp-Mill.—Changes Necessary.—Production for 1910.

In writing some weeks ago I recorded the unfortunate contretemps by which the Pearson interests and the French shareholders secured control of the Mexico Mines of El Oro, thus removing the company from the Exploration company group, and calling for the resignation of the chairman, R. T. Bayliss. The reason for this violent capture of control was the refusal of Mr. Bayliss to be a party to the undue booming of the Mexico shares. He considered the quotation too high and also objected to paying too large dividends at a time when it was obvious that money must be spent on shaft repairs and reorganizing the underground work to suit altered conditions. How he was outvoted has been related. What rankled in his breast more than defeat in fair battle was the imputation that he was acting as a bear of the Mexico shares for his own interests. This allegation was made in a letter addressed by S. Pearson & Son to the secretary of the company. Mr. Bayliss referred to the subject at the meeting of shareholders, and stated that never during the course of his career had he ever dealt in shares of companies he was connected with. Those who know Mr. Bayliss are aware of his principles, and did not require his refutation of such an accusation; and, indeed, on any other subject his word is sufficient. However, in the City of London it is always best to meet these imputations with the strongest weapon possible, and accordingly Mr. Bayliss entered action for libel. Pearsons never intended to defend the case, and in fact their representatives at the meeting of shareholders had publicly stated that their letter was not intended to reflect in any way on his personal honor, apparently holding that the manipulation of the share-market for his own purpose came within the legitimate scope of business enterprise on the part of the chairman of a company. When the case came on, the lawyers on the two sides announced that it had been settled out of court, the defendants stating that they did not consider that the letter contained anything reflecting on the plaintiff's honor, but that if the plaintiff considered that any words in it did so, they unreservedly withdrew them and expressed regret that they were used. To an American this action and its method of conduct in court may seem an unnecessary formality, but an Englishman of integrity wishes to have it put on permanent record in the most public and indisputable way that accusations made of unfair dealing were unwarrantable and indefensible.

The progress of the Seoul Mining Co., an American company owning the Suan copper-gold mine in the province of Hwang-Hai, Korea, is watched with considerable interest in England, for the property was originally owned by an English company called the Korea Syndicate. The operations of the English syndicate were not successful, and three years ago Messrs. Colbran and Bostwick took over the concession, agreeing to pay the syndicate 20% of the profits. They formed the present company with a capital of $400,000, under the laws of Maine. A 20-stamp mill was built in 1909 and started on December 1 of that year. Developments continued to be so satisfactory that another 20 stamps were erected in 1910 and started work on December 1. The metallurgical problem has not yet been completely solved, for bismuth interferes with the gold extraction, and the concentrators which follow the stamps do not recover a high percentage of the copper. During 1910, 32,793 tons of ore was sent to the mill; and 707 tons of hand-picked ore and 389 tons of concentrate were shipped to Tacoma.

General Mining News

ALASKA

COOK INLET

The Kenai Star M. Co. has taken over the Longman placers on Palmer creek, near Hope. J. D. Meenach and Nels Peterson are interested.

KETCHIKAN

Word has been received from the Jumbo mine at Sulzer that all the surface improvements have been swept away by a snowslide. Two men were killed and several injured. A launch has been sent to bring the latter in to the hospital.

PRINCE WILLIAM SOUND

Mike Wagner and partners have found good dirt on Eva creek, a tributary coming in on No. 5 Below Left Limit on Ester creek. The dirt goes $2.50 to the square foot of bedrock at the end of their drift. Ed Nelson has purchased a half interest in the Bay View group of three claims, on the west side of Valdez bay, about one-half mile east of Gold creek. The adit on the property of the Hemple Copper M. Co. at Landlock bay is in 700 ft. and has cut a good body of shipping ore. Another adit has been started at a point 800 ft. to the northwest to cut another ore-shoot on the same vein. The Suessdorf & Devinney mine has a 3-ft. vein of good ore and has 200 tons of ore on the dump ready for treatment. The Valdez-Liseum mine is starting a 200-ft. adit. The Alaska-Gold Hill M. Co. has several veins on its property, and one large one shows assays of $19 per ton. The Beaver Dam mine, on the wagon-road, forty miles from Valdez, has been sold to Seward people for $40,000.

THE TANANA

Congress has made an appropriation of $80,000 to be expended during the coming summer on bridging, grading, and repairing the trail from Valdez to Fairbanks. Fifty thousand dollars will be spent on the Seward-Iditarod trail and $20,000 on the Fairbanks-Nome and other trails.

ARIZONA

COCHISE COUNTY

The Calumet & Arizona and the Superior & Pittsburg were consolidated at the annual meeting of the shareholders on April 25. The consolidation increases the capital to 650,000 shares at $10 each and provides for the exchange of three shares of Superior for each share of Calumet. The board of the latter, including H. R. Rea from the Superior, was elected, and immediately proceeded to make a thorough inspection of the properties. W. E. Corey is a member of the board.

GILA COUNTY

(Special Correspondence.)—The fourth unit of the Miami mill is now in operation and the fifth and sixth are expected to start May 15. The saving in the mill is now almost 80% and the concentrate runs 39% copper; by the middle of the month it is expected to reach 42%. The first shipment of concentrate was two 50-ton cars on April 11, and a car is being shipped daily to Cananea. Half the ore supply of the mill will be taken from the stock-piles until they are used up. The Arizona Commercial is just entering the ore recently discovered by diamond-drills at the 1000-ft. level; the north cross-cut from the station at that depth is now 150 ft. to the breast and has passed through about 30 ft. of vein matter. Considerable copper glance as well as oxidized ore of a good grade has been found. Probably the vein at this point will furnish smelting ore, although the aspect of the vein, so far as it has been cut, gives the impression that the bulk of sulphide ore lies below the 1000-ft. level, as indicated by the yellow sulphide encountered just above the 1200-ft. depth by the drill. The shaft is now 1070 ft. deep in the diabase. The winze being sunk from the 700-ft. level is 55 ft. deep, but although it is passing through well mineralized ground it is not thought that ore in any quantity will be found until the winze reaches the spot where the diamond-drill cut it. One of the pumps on the 1000-ft. station is lifting with ease all the water.

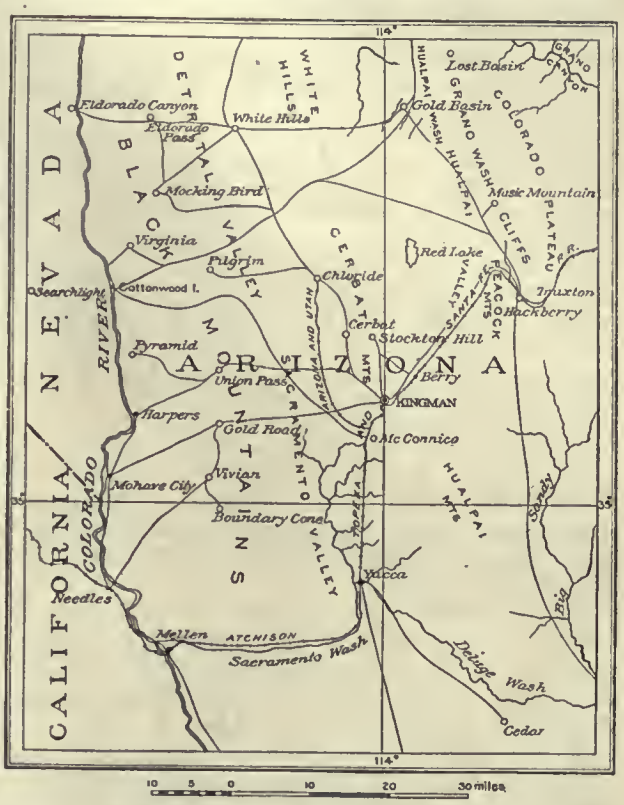
Miami, April 28.

GRAHAM COUNTY

A number of Scotch shareholders in the Arizona Copper Co., whose mines are at Clifton, have made a thorough inspection of the property, and it is reported that extensive improvements will be made.

MOHAVE COUNTY

An 8-day mill-run at the Gold Road mine yielded a bar worth $17,500. It is reported that the sale of this mine is off, but it is actually waiting for the action of the foreign shareholders. The annual meeting of the Tom Reed mine



MOHAVE COUNTY MINING DISTRICTS.

was held recently and the report shows that $250,000 has been distributed to the shareholders and $90,000 is on hand. The new 30-stamp mill has been built from the profits of the operation of the old 10-stamp mill. Charles Grimes is president. The Rainbow mine at Chloride is shipping a small amount of ore. The main shaft is down 240 ft. and it will be sunk 100 ft. more. Plans are being made for the construction of a tramway from the mine to the proposed railway station at Cerbat, near the Tennessee mine. H. M. Bowen has taken an option on the Jamison mine at Layne Springs, and will begin work soon.

YUMA COUNTY

High-grade ore has been found in the bottom of the 196-ft. shaft of the Calzona Mines Co. Two carloads shipped to the Humboldt smelter were said to be worth over $250 per ton. The Hon Mining Co. has been incorporated to work mines in Copper basin. It is reported that a shipment made by the P. & D. Grass Root mines, in the Old Woman mountains, near Milligan, to the Needles smelter, netted $50 per ton.

CALIFORNIA

ELDORADO COUNTY

J. A. Roxburgh has found several nuggets on his fruit ranch near Kelsey and has high hopes of developing a good gold mine. Mr. Chester is putting up a cyanide plant to work the tailing-dump at the old Taylor mine near Georgetown. A large bench deposit has been opened in the Landecker gravel mine that runs $50 to $80 per car.

INYO COUNTY

Keeler is much excited over the rich ore found by R. C.

Troeger in his adit on Cerro Gordo mountain. The ore-zone was found at 3750 ft. and seven veins have been cut, carrying rich stringers of tetrahedrite, the ore assaying as high as $150 per ton. The Cerro Gordo has resumed shipments and 30 tons was sent to the smelter last week, the grade averaging about $40 per ton. Lloyd Skinner, who is in charge, has found a rich lead-silver ore-shoot that is over 5 ft. wide and 50 ft. long, below the 1025-ft. level.

MARIPOSA COUNTY

(Special Correspondence.)—The Merced G. M. Co. of Coulterville will be re-opened by H. P. Dalton, of Oakland, and associates. The property is equipped with a 40-stamp mill of Union Iron Works design, and with hoisting, pumping, and transporting machinery estimated to be worth about $200,000. The consideration for this property is said to be about $500,000. The Malvina mine will be opened first, work to begin about May 15. H. C. Kennedy, of Coulterville, will be manager.

O. R. Morris, of San Francisco, has been awarded the contract to erect the Penon Blanco mill, at a cost, it is said, of $80,000. Grading on the site has been started. The San Joaquin Light & Power Co. has extended its line to Bullion hill. The Quartz mountain and Bullion hill mines will be among those to derive advantage from the cheap power. The Bondurant properties, recently taken over by Stockton capitalists, have been re-opened as the Bondoro group of mines. A 40-hp. boiler is being installed to be in readiness for the starting of the 10-stamp mill on June 1. George H. Gerken is superintendent.

Coulterville, April 26.

MONO COUNTY

The Tri-Metal cyanide plant which was erected to re-work the old Benton mill tailing, will start on May 1. Lessees are finding good ore in the old Borasea mine on Blind Spring hill.

NEVADA COUNTY

The W. F. of M. finds much difficulty in compelling delinquent members to pay their dues, and a meeting was held at Grass Valley on Sunday to consider ways and means of compelling the delinquents to pay up.

(Special Correspondence.)—A. H. Winn, representing the California Title & Insurance Co., is negotiating the purchase of the Pennsylvania-W. Y. O. D. mines. The price asked by the latter is $500,000. The Pennsylvania has been a steady producer for 25 years, averaging $10,000 to $18,000 per month at present, from a 12-in. vein in granodiorite. The W. Y. O. D. passed into the hands of the Pennsylvania company some years ago as the result of a lawsuit.

On the 350-ft. level of the Cassidy Con. the vein has been intersected. It averages 40 in. wide. Assays run $10 to $20 per ton. Sinking will be continued until the 500-ft. point is reached, and it is probable that a mill will be erected before the end of summer. The Cassidy adjoins the Empire and was re-opened about a year ago, after a long period of inactivity. Until the present owners took charge, the property had not been developed to any extent. F. C. Longe is manager. Sinking at the Brunswick is progressing rapidly, and it is expected that the company will be in a position to produce through the new shaft before the close of 1911.

Grass Valley, April 29.

SHASTA COUNTY

The Vulcan Copper Co. has set up a motor compressor and is erecting tanks preparatory to beginning diamond-drilling. The surface work already done has exposed small bodies of high-grade ore. The Vulcan is next to the Balaklala.

SIERRA COUNTY

Twenty stamps are now at work in the Sierra Buttes mill, and most of the ore being crushed is high grade. It is reported that a stamp-mill will be erected on the San Luis property, near Sierra City, during the summer. The Gold Bluff middle fork flume, which was carried away by a snow and earth slide, is being reconstructed.

SUTTER COUNTY

The Natomas Con. has bought 160 acres of the old Jopson place, near Nicolaus, from W. F. Sperry.

TUOLUMNE COUNTY

The Sivori brothers are driving from the bottom of a 50-ft. shaft at their claim at Cherokee, near Tuolumne, and will shortly begin stoping to surface. The vein is 2 ft. wide and it is estimated will mill $50 per ton. It is the intention of the operators to install a hoist and a small mill in the near future. Twenty of the 60 stamps at the Jumper are in operation, and between 80 and 100 tons of ore is milled daily. About 80 men are employed. High-grade ore is being extracted from a new vein on the property of the United Mines Corporation, near Tuolumne, by Richard Rowe, the discoverer, who, since securing a lease, has been driving an adit to open the orebody. The vein is in the Dead Horse claim and is 18 in. wide. Several tons of the ore has been taken to a nearby mill for treatment.

COLORADO

CLEAR CREEK COUNTY

(Special Correspondence.)—Goodale & Co., leasing through raise No. 10 on the Aetna vein at the Capital mine, have found a 2-ft. body of $125 ore, and Eade & Co., leasing through raise No. 6, have sold 40 tons of concentrate that netted $44 per ton, and 85 oz. of amalgam was taken off the plates.——An 8-in. streak of $35 ore has been uncovered in the drift on the Key West vein.——The Gambetta mine on Republican mountain will ship an average of 20 carloads of zinc ore each month.——The compressor plant at the Sidney adit will be started May 1.——An 18-in. streak of $35 ore has been found in the drift on the Welsh vein, Leavenworth mountain.

Georgetown, April 26.

LAKE COUNTY (LEADVILLE)

(Special Correspondence.)—Among our important mills the Leadville District M. & M. Co. is treating 50 tons per day in a wet concentration mill, and the American Zinc Extraction Co. is using magnetic separation preceded by roasting. They are shipping 100 tons of concentrate per day. The sulphide shipments still exceed the carbonate and silicate of zinc in amount and importance. The average daily production of zinc ore at Leadville is about as follows:

	Tons per day.
Zinc carbonate ore	350
Zinc sulphide ore	500
Zinc sulphide concentrate (from mill-ore)	100
Lead ore (over 5% lead)	300
Gold, silver, or copper ore	500

Leadville, April 25.

SAN JUAN DISTRICT

The Camp Bird is working a 12-ft. orebody to the west of the workings on the Coronado vein. The George Crawford companies, formed to take over the Yankee Girl, Genesee-Vanderbilt, Red Mountain, Gold Lion, Blue Bell, and the Joker adit, are to be reorganized with a reduced capital. H. Y. Russel is in charge. The Revenue mine is increasing its output and has 180 men at work in its mine and mill. There are 17,000 sacks of concentrate stored at the mill waiting for the roads to open. The rumor that the Camp Bird will take over the Revenue property persists. It is expected that the Mono-Baltic smelter will be blown in within a few months. Now that the railroad is clear of snow the Gold King at Gladstone has started its 300-ton mill. It is reported that the mill of the Sunnyside will be enlarged.

SUMMIT COUNTY

(Special Correspondence.)—The Shoe Basin mines at Argentine have cut the Peruvian vein at 1036 ft. in their adit and have driven it 30 ft. without finding the hanging wall. In the Colorado-Toledo mine driving is being done in both directions on the vein found at 2650 ft. in the adit, and 6 to 18 in. of good ore is being found. The Penn mill is making good progress and it is expected that the two 6-ft. Chilean mills will be ready in June. It seems likely that this will be a prosperous season in the Montezuma and

Argentine districts; the possibility that the automatic electric railroad may be built soon is doing much to stimulate interest.

Argentine, April 28.

TELLER COUNTY (CRIPPLE CREEK)

The summary of Cripple Creek production for April is as follows:

Plant.	Tons.	Average value.	Gross bullion value.
Golden Cycle (Colorado City)	27,700	$21.25	$588,625.00
U. S. R. & R. (Colorado City)	14,010	21.50	307,215.00
Portland (Colorado City)	10,000	20.00	200,000.00
Portland (Cripple Creek district)	10,504	3.28	34,453.12
Wild Horse	1,000	4.00	4,000.00
Stratton's Independence	10,512	3.08	32,336.96
Smelters (Denver and Pueblo)	4,110	65.00	267,150.00
Totals	77,836	$18.40	$1,433,780.08

The dividends paid during the month amount to $142,500, distributed thus: Portland G. M. Co., $60,000; Vindicator Con. G. M. Co., $45,000; Elkton Con. M. & M. Co., $37,500. Two good ore-shoots have been found by lessees at the 150 and 250-ft. levels of the Beacon shaft. Good ore is being taken out of the Stratton's Independence by lessees. In the South Burns on Bull hill, a new ore-shoot has been found in the northern extension of the Shurtloff vein. A 15-drill belt-driven compressor has been ordered by the Isabella Mines Co. Rich ore has been found in the Peggy, on Gold hill.

IDAHO

BOISE COUNTY

(Special Correspondence.)—The Moline Mining Co., E. F. Blain, manager, began operations on April 1. The 5-ft. Risdon dredge, built in 1905, is handling from 1100 to 1400 yd. per day, at an average cost of a little more than 4c. per yard. Three 8-hour shifts of two men each, together with one dredge-master and a roustabout, constitute the crew. Steam-power is used. The 100-hp. boiler is amply sufficient for operating the driving, pump, and headline engines and the hoisting and swinging winches. Wood is used; the consumption is six cords of 4-ft. material; the cost delivered at the dredge being $3.25 per cord.

W. F. Hiatt and T. Halley have 200 acres of ground from 6 to 40 ft. deep, averaging 19c. per yard, which they are working with one No. 2 Hendy giant. The amount of water available is only 200 in., under moderate head. Their active season began March 20 and will end about June 1. A little more than 15,000 yd. will be handled.

Placerville, April 27.

(Special Correspondence.)—The dredge under construction by the Yuba Construction Co. for the Boston-Idaho Gold Dredging Co. will be put in commission about May 1. Practically everything is completed. This is the largest dredge to be built in Idaho and one of the second largest built by the California company. The actual capacity of the buckets is 14.6 cu. ft., each of which weighs 4200 lb. The rated capacity is 10,000 cu. yd. per day. Power is supplied from the Boston-Idaho plant on the Payette river, the current on the main line having a voltage of 19,000, which is transformed to 2200 volts for use on the boat. A total of 810 hp. is required for the eight meters with which the dredge is equipped. The length of the hull is 125 ft.; its draught is 8 ft. 6 in.; approximately 250,000 ft. of lumber and 330 tons of metal were used in its construction; it will dig 35 ft. below water-level; and the table area is more than 6000 sq. ft. The ground this dredge will work averages 22 ft. in depth, several hundred feet in width, six miles in length, and, according to L. E. Aubrey, 17c. per yard.

Idaho City, April 27.

MONTANA

SILVERBOW COUNTY

(Special Correspondence.)—The Butte mines produced, in April, about 21,156,150 lb. of copper. The output of ore and production of copper daily and for the month, were:

Companies.	Daily, tons ore.	Month, tons ore.	Daily, lb. copper.	Month, lb. copper.
Anaconda	3,525	105,700	215,025	6,450,750
Butte & Boston	430	12,900	25,800	774,000
Parrot	370	11,100	22,940	688,200
Washoe	360	10,800	21,960	658,800
Trenton	400	12,000	23,600	708,000
Original	650	19,500	40,950	1,228,500
North Butte	890	26,700	54,290	1,628,700
Coalition	900	27,000	60,300	1,809,000
Tuolumne	100	3,000	9,000	270,000
Boston & Montana	3,110	93,300	199,040	5,971,200
East Butte	380	11,400	32,300	969,000
Totals	11,115	333,400	705,205	21,156,150

While the Copper Producers Association for the past several months has showed a continued increase in the surplus and at the same time an increase in the consumption, it may be interesting to draw attention to the fact that compared with a year ago the Amalgamated mines produced about 1,000,000 pounds less in March of this year and over 5,000,000 pounds less than in March two years ago. When the production at present is compared with that of two years ago, it will be seen that the curtailment is between 4,000,000 and 5,000,000 pounds per month, which means a big reduction for the mines of the company, but when it is considered that very extensive improvements have been going on for nearly the whole of the two years, it will be readily seen that the payroll has not been cut down to anything like what might appear on the surface. In fact, it would be found, if the books of the company were examined, that the money paid out in improvements, repairs, new machinery, and labor has been much greater by a very considerable amount than any previous two years in the history of the combined mines of the district. A large amount of this money expended will, of course, well repay the company, as it means reduced costs and larger production when the time comes for the operation of the mines to their full capacity.

Mr. Stone, superintendent of the Butte-Alex Scott, is very much elated over the showing the mine has been making since the first of the year, and is confident of even a better showing during the months of April, May, and June than in January, February, and March when the property turned out 1,200,000 pounds of copper which ran 8.75% copper. From the earnings all the operating expenses are being met, and the cost of development, and, besides, a goodly sum is going into the treasury each month. Development work is going ahead on the 500, 1200, 1400, 1500, and 1600-ft. levels, and some good ore is being blocked out. Just now the company is sending on an average of about one car of ore each day to the smelter, and it is expected that in a few weeks this amount will be considerably increased.

The Tuolumne company has a little less than 300 ft. more to go to bring the shaft down to a depth of 2000 ft. A station has been cut at the 1600 and others will be built at the 1800 and 2000-ft. levels. Cross-cutting is now in progress north and south from the 1600-ft. level, and the south vein is expected to be reached in a short time. The shipments of 100 tons per day to the smelter are being maintained in addition to the development work and sinking. The ore averages 9% copper, and from this more than sufficient money is derived to pay all expenses.

Butte, April 28.

NEVADA

ESMERALDA COUNTY

(Special Correspondence.)—The Combination Fraction company's annual report shows a net operating loss for the past fiscal year of $38,447.57, and the company has suspended operations and has leased its ground for a period of 15 months from April 1. The C. O. D. Con. company, under the management of L. K. Koontz, is developing on the 600-ft. level from the Sills shaft on the Gold Bar claim, and two lessees are working from the same point to explore ground north, west, and southwest. It is regarded as certain that the lessees working the original Gold Bar work-

ings and who are now sinking the main shaft to greater depth, will erect a 50-ton reduction plant in the near future. The Yellow Tiger is in good milling ore on the 700-ft. level. A. A. Redmond will begin extensive work on a group in the southern part of the district on June 1. Lessees continue developing on the Atlanta, Blue Bell, Commonwealth, Merger Mines, Booth, Oro, Nighthawk, Daisy, Black Butte, and at other points in the district.

Goldfield, April 25.

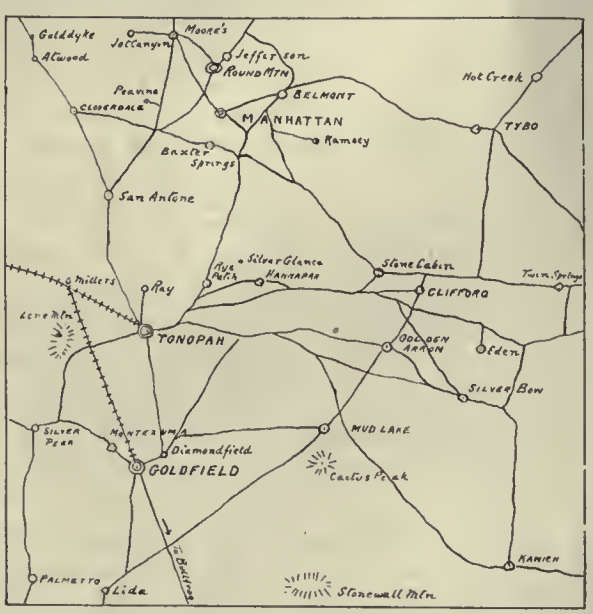
HUMBOLDT COUNTY

(Special Correspondence.)—The Utah National M. Co. has leased 28 acres on the Snowden estate, adjoining the National Mines holdings. A 500-ft. shaft has been started. At the National Mines an approximate depth of 800 ft. has been attained. The orebodies continue to show strength and value. A streak of quartz 1 to 2 in. wide has been opened on the Adamson-Turner property on the north slope of Winnemucca mountain that at times runs 30 to 50% gold, according to the miners. The vein in the Scorpion, Barrett Springs district, has been opened by a crosscut from the 50-ft. level of the shaft. Prospecting in the National and Barret Springs districts is exceptionally active.

Winnemucca, April 21.

NYE COUNTY

(Special Correspondence.)—The Tonopah Mining Co. is preparing to work a portion of its holdings through the



PART OF NEVADA.

Desert Queen shaft, recently abandoned by the Belmont company. The ore-washer at the West End is in operation and teams are hauling shipping ore to the depot. The mill recently purchased from the Midway Milling Co. is being remodeled, and foundations installed for new machinery which has been purchased in San Francisco. The shaft of the North Star is being placed in excellent condition, and work will soon be in progress on the 900 and 1250-ft. levels.

Tonopah, April 25.

WHITE PINE COUNTY

(Special Correspondence.)—During the past few weeks the Ely Consolidated company, through its Zack mine, adjoining the property of the Nevada Con. on the south, has opened what promises to be a large body of good ore. A considerable body of similar ore was opened on the 400-ft. level of the Zack mine last year. The shaft reached the 500-ft. level about January 1 last, when a drift was started to the south and a cross-cut to the west. The cross-cut almost immediately opened ore averaging from 6 to 8% in copper value, and continued through the same grade of ore for a distance of 27 ft., where limestone was struck. The cross-cut was continued in limestone for a distance of 18 ft. where another orebody was encountered. The cross-cut has now been continued in this body of ore for a distance of 55 ft., and is still in ore. The general average of the ore, according to samples taken by James Quinn, the manager of the property, is about 6% copper and 30c. gold per ton, not counting the high-grade ore, of which there is a considerable amount in evidence averaging more than 20%. The south drift on this level has been continued for more than 300 ft., the last half of which is all in porphyry carrying occasional stringers of good ore. From present indications the Ely Consolidated will soon have one of the big copper mines of the camp.

Ely, April 25.

OREGON

(Telegraphic Correspondence.)—The initial payment of $200,000 was made yesterday on the Rainbow mine in Mormon basin, by the U. S. S. & R. Co. The total purchase price is $750,000, the largest amount ever paid for a mine in Oregon.

Baker, May 3.

JACKSON COUNTY

Chicago investors have leased 2100 acres of the holdings of the Cascade Coal Co. between the 401 Ranch and the summit of Roxy Ann, and the work of pumping out the slope has begun. There are three seams, of 9, 7, and 5 ft. The coal has been tested and found of superior quality. Only the 7-ft. seam will be worked at first.

JOSEPHINE COUNTY

Rich ore has been found by the lessees of the Higgins mine, 20 miles northwest of Kerby, on the divide between Rancheria and Baby Foot creeks. The gold is in friable material which is being washed in sluices. Much excitement has been created and exaggerated reports have been given out, but the existence of rich ore is indisputable.

UTAH

TOOELE COUNTY

(Special Correspondence.)—The Gold Chain has taxed its present hoisting plant to the limit during the past two weeks and has sent out 10 carloads each week. The work of sinking the Yankee shaft to the water-level has commenced. The shaft is now down to 1700 ft., and it is expected that the sulphide zone will be reached in about 100 to 300 ft. more. Articles of incorporation have been filed for the Dragon Consolidated, which takes over the Dragon and the Governor. Work on the Utah Con. of Tintic has been resumed, the intention being to extend the new tunnel. The new find on the Eagle and Blue Bell is opening up well. A drift of 80 ft. and a raise of the same length has not found the walls. Indications are that this is the north continuation of the vein from which the Victoria has been shipping some very rich ore recently. So far work has been confined to development and an attempt to explore the deposit and ascertain its extent. The old California mine, which is being operated under lease by the Virginia Mining Co., has cut two veins of good shipping ore and is now stocking, awaiting the time that the roads improve, so that the ore can be hauled out. Indications are that steady shipments can be kept up. During the month of March the South Utah milled 23,972 tons of ore, an average of practically 800 tons per day. From this ore there was produced 2301 tons of concentrate which yielded 300,000 lb. of copper.

Tintic, April 29.

SALT LAKE COUNTY

(Special Correspondence.)—What was expected to be a lively contest for the control of the Utah Consolidated with a strong chance of a change in the management, did not materialize at the annual stockholders' meeting, and the old board is retained in control. U. H. Broughton, the president, has issued a long explanatory statement as to mine conditions, and includes a statement that since the true condition first became known last fall, over 14,000 ft. of development work has been done and new orebodies in unexplored territory opened.

The receiver of the North Utah has mailed to the stock-

holders of the company an announcement of his intention of selling the property at public auction in the latter part of May, unless the stockholders in the meantime take steps to reorganize and pay off certain outstanding debts.

Bingham, April 26.

WASHINGTON

FERRY COUNTY

The First Thought mine at Orient has shipped some ore that averages more than $2000 in gold per ton. The source of this ore is a shoot opened recently in the main workings at a depth of 500 ft. Knowledge of conditions in the locality was obtained by diamond-drill exploration in the eastern part of the property.

CANADA

BRITISH COLUMBIA

The Kootenay Central railway will give an outlet for the iron ores on Fenwick mountain, near Bull River falls, which, though of much promise, are as yet undeveloped. Good ore has been found in the Big Tunnel near Greenwood. The Consolidated M. & S. Co. will increase its shipments to the Trail smelter to 900 to 950 tons per day. The smelter receipts for March from the Le Roi No. 2, Ltd., were $34,289.

DAWSON

The Dawson Power & Light Co. is shipping 300 tons of heavy machinery to its plant at Coal creek, with the expectation of mining coal on a large scale and using it to generate electric power to be used on the Guggenheim dredges as well as in lighting Dawson. Treadgold will employ 1000 men this summer in dredging and hydraulicking on Dominion, Sulphur, and Quartz creeks, and is expending $250,000 in erecting a power and water supply plant on the north fork of the Klondike. It is reported that the Yukon Gold Co. has bought a large part of Gold Run creek. Extensive preparations are being made on all sides for the summer's work.

ONTARIO

The March production of the Nipissing was estimated at a value of $185,332. The Bishop Silver Mines, at Calcite lake, near Gowganda, has cut its vein at 190 ft. The Coniagas M. Co. has declared another dividend of 6% with 3% extra, payable on May 1, making the total paid to date 53%. The Cobalt Provincial has found a rich shoot of ore about 40 ft. from the shaft on the 270-ft. level. The Harris Maxwell M. Co. of Larder Lake is in litigation with the Goldfields of Larder Lake Co. over the option which the latter had on the former. The claims of the Haileybury Silver Co. in Deloro township, near the Philadelphia, have been sold to M. T. Rowland of Arizona.

PORCUPINE

A water-supply for Porcupine is being secured from the Porcupine river to supplement the wells. Excellent progress is being made on the T. & N. O. railroad into Porcupine; steel has been laid as far as the Frederickhouse river and the bridge there completed. Grading has been started north from South Porcupine toward the Dome. The Imperial Porcupine has finished erecting its plant and has begun work again. Work on the Porcupine Apex, adjoining the West Dome, has commenced. The British-American Power Co. will begin construction work in June on its power-plant at Waiwaitan Falls on the Mattagami river. Since power was delivered in Cobalt nine months after beginning construction work there, Porcupine hopes for an equally speedy supply of electric power.

MEXICO

CHIHUAHUA

The Culantrella property, in San Francisco del Oro, has been re-examined by B. V. Gordon, P. B. Butler, and Santiago Cunningham, and it is reported that M. H. Briggs and associates, of London, will re-open this property, which was closed down about four years ago. Juan Almanzan is finding good ore in the new shaft sunk in the foot-wall of Terrenates property, which is next to the Los Muertes on the Veta Colorada vein. High-grade ore has also been found in the Santa Rosalia shaft of the Iguana which has been leased to P. B. Butler. Mr. Butler is also driving a 1200-metre adit along the vein on the San Francisco del Oro. Work has been resumed in the San Cristobal at Parral. The new electric hoist is in operation. The National Mines & Smelter Co. will repair the old mill of the Lustre Mining Co. at Magistral. The Alvarado M. & M. Co. has bought the properties of the Hidalgo Mining Co. for $500,000.

HIDALGO

The new cyanide plant of the Purissima Grande Hacienda Co. has turned out about 40 bars of bullion and is working very well. R. A. Brown has charge of the enlargement of the Guerrero mill of the Real del Monte y Pachuca company, which has just finished constructing Pachuca tanks at its Loreto mill and is now erecting them at the Guerrero plant.

SONORA

(Special Correspondence.)—The Creston Colorada Mining Co. has treated 42,260 tons of ore and 6600 tons of slime since January 1, 1911. The Creston mine produced 34,633 tons of ore; the rest came from the Colorada. Most of the ore is from surface workings. Extensive work is being carried on in both the Creston and the Colorada mines. The company has discontinued exploration on the Verde property, which was under option and was explored by a long cross-cut from the Creston shaft. At the Creston mine new ore-bins are being erected. A pneumatic hoist raises the ore 12 ft. to a landing, where it is dumped over the grizzlies, the fine falling direct to the bin, while the coarse goes to a gyratory-crusher and from that into the bin. Formerly the ore was dumped directly into the crushers, but the fine ore caused much trouble and lessened the capacity of the crusher. Several buildings have been removed and the surface stripped near the Creston shaft to furnish access to several large orebodies near the surface which have recently been disclosed by development. The Butters mill and cyanide plant, leased to the Creston Colorada company, has been connected with the Creston mine by a new tramway and is running satisfactorily. The Creston Colorada Mining Co. is a subsidiary of the Mines Company of America, of New York, and is operated by that company. M. F. Perry is manager; he is also associated with the Charles Butters interests in this camp and other parts of the country, and has recently left Minas Prietas for Salvador, Central America.

Minas Prietas, April 24.

News from Naeozari states that the Moctezuma Copper Co. has continued at work throughout the revolutionary troubles without molestation. A full supply of workmen has always been available, as the employees of the company are not subject to military draft, and the pacifically inclined have sought work for this reason. The Naeozari railroad was shut down for some days while in the hands of the rebels, but is now in operation again. The Agua Buena, 8 miles from the Pilares mine of the Moctezuma company, is shipping 2 cars of 3600-oz. silver ore per month, and W. C. Humphrey is shipping a car per week of 100-oz. ore from his mine 20 miles south of Naeozari.

PERU

A company headed by M. F. Porras, ex-minister of finance, is making a detailed examination of the Sayapullo copper-silver mines and the Huayday coal mines. It is proposed to build a railway, hydraulic power-plant, and a 500-ton smelter. The Montebello Oreeo Mining Co., which is operating 12 miles northeast of the Santo Domingo mine of the Inca Mining Co. in Sandia province, has obtained such good results in its small stamp-mill that it will increase its capital by £20,000 and will build a 30-ton cyanide plant. The San Luis mine in the San Buenventura district in Canta province has shipped copper as good as 50%; the Federico el Grande and La Palanca are also shipping on a smaller scale. The 150-ton blast-furnace erected last autumn at the Fernadini smelting plant at Huaraucaca, has been in successful operation ever since.

Company Reports

ORIENTAL CON. MINING CO.

The report of this company, whose mines are in the Unsan district, north of Seoul, Korea, shows that during 1910 320,707 tons of ore was milled with a gross yield of $1,749,468 worth of gold and a resulting profit of $623,676. Dividends paid during the year represented 11½% on the capital. The company has in its employ 60 Americans and Europeans, 150 Japanese, 500 Chinese, and 5000 Koreans. The ore reserve is 838,250 tons, valued at $3,948,475.

NORTH STAR MINES COMPANY

The report of this company for the year ended December 31, 1910, shows that during that period the company produced gold to the value of $1,232,933.96, at a total cost for operation and development of $555,860.03, leaving a profit on the year's operations of $677,073.93. Of this $7148.08 was applied to the improvement account, $36,485.82 to the purchase of property, and $575,000 was disbursed in the payment of dividends amounting to 23% of the capital stock ($2,500,000). The ore milled amounted to 90,110 tons, of an average value of $13.683 per ton, the total cost for operation and development being $6.169 per ton. The cost of development was $0.556 and the cost of concentration and cyaniding the concentrate was $6.34 per ton. The financial statement for the period since May 1884 shows that $510,770.37 has been expended in the purchase of additional property, $554,526 has been invested, and the cash on hand amounts to $403,471.88. The income from interest and dividends was $44,631.05 during 1910. The dividends which have been paid during the life of the company amount to $3,061,988.90. The development work done during the past year has increased the amount of ore reserve, but the exact tonnage has not been estimated. The sum of $52,500 has been advanced toward the preliminary expense of a hydro-electric power-plant project. The financial position of the company is thus seen to be excellent.

LA ROSE CON. MINES CO.

The report covers a period of seven months from June 1 to December 31, 1910, owing to changing the date of ending fiscal year. It shows that 2,569,905 oz. of silver was produced at a cost of 19.11c. per ounce, and sold at an average price of 53.955c. per ounce, the profit being 65% of the gross value, compared with 56% during the preceding year. Dividends were paid amounting to $449,588, which corresponds to 10.28% per year on the book value of the capital stock. The ore reserve at the end of the period is given as 86,758 tons, estimated to contain silver to the net value of $2,000,000, or $^4/_{15}$ of the authorized capital. The accounts are so presented that it is difficult to obtain any clear understanding of them, beyond that the La Rose Con. Mines Co. has an authorized capital of 1,500,000 shares of a par value of $5 each, of which 1,498,627 shares are outstanding. The assets of the company consist of the entire capital stock of the La Rose Mines, Ltd., The Lawson Mines, Ltd., Violet Mining Co., and 7262 shares of University Mines, Ltd., in which latter company La Rose Mines, Ltd., also holds 89,998 shares. La Rose Mines, Ltd., paid dividends amounting to $475,000 during the period under review and has a surplus on hand of $917,803. University Mines, Ltd., made a loss during the 7-month period of $463, making its total deficit $13,436. No balance sheets are given for The Lawson Mines, Ltd., or the Violet Mining Co. The balance sheet of the La Rose Consolidated Mines Co. shows a surplus of $13,361.

ROUND MOUNTAIN MINING CO.

The report covers a period of eleven months, ended February 28, 1911. During this period 36,252 tons was milled of a value of $9.31 per ton, of which $8.34 was recovered, or 89.64%. The total cost for mining and milling was $5.61 per ton, to which the expenses of litigation added 56c. per ton, a total of $6.17, which is reduced to $6.02 by miscellaneous earnings of 15c. per ton. One foot of development work has been done for every 5.56 tons milled, by which the ore reserve has been increased 10.14 tons, or approximately two tons developed for each ton milled. The ore reserve at the end of the period under review is given as 111,928 tons, of an estimated gross value of $1,007,350. The authorized capital of the company is 1,000,000 shares of a par value of $1 each, of which 868,966 shares have been issued. The net earnings during the period were $84,313, dividends 9 and 10 were paid, amounting to $69,322, leaving undivided profits on hand at the end of the period of $184,006; the cash on hand and bullion in transit amounts to $60,658. The results of exploration and development have been most satisfactory; the cross-cut which is being driven toward the Morrin vein is within 250 ft. of the seam, and has intersected four other orebodies, from 3 to 12 ft. in width, from which good ore has been obtained. The placer ground belonging to the company has been leased and a substantial profit is expected from this source during the ensuing year. An additional ten inches of water-supply has been secured. Additions have been made to the mill equipment which are expected to increase its capacity by one-fourth. It is not planned to pay additional dividends until the expiration of this year.

NIPISSING MINES CO.

The report of this company for the year ended December 31, 1910, shows that 5,548,659.56 oz. of silver was produced at a cost of 14.72c. per ounce, yielding a profit of $2,167,103, or 72.6% of the gross value. Of this $2,100,000 was paid in dividends, or at the rate of 35% per annum on the par value of the stock of the Nipissing Mines Co., Ltd., leaving a surplus of $8381.10. The Nipissing Mining Co. has a surplus of $952,798.96. The estimated ore reserve is 6,552,880 tons, of a gross value of $3,276,440, with silver at 50c. per ounce. This does not include the mill-rock on the dumps and in the mines. The reserve was slightly greater at the end of the year than at the beginning. During the year the cost of production has been reduced 1.68c. per ounce.

The shipments during 1910 were:

	Dry tons	Net value per ton	Net value	Per cent of total net value
High-grade ore	1531.792	$1,317.51	$2,018,152.21	73.6
Low-grade siliceous ore	4834.3315	88.34	427,069.68	15.6
Concentrates	319.12	456.90	145,805.27	5.3
Nuggets	13.6865	11,054.25	151,294.07	5.5
Total	6698.93		$2,742,321.23	100.0

The cost of production is analyzed thus:

	Cents per oz.
Mining, including development	8.87
Concentrator	0.83
Depreciation	0.58
Selling	5.03
General expense	0.36
	15.67
Less rents and interest	0.95
Total cost of production	14.72

The allowance here made for depreciation is somewhat scanty, even on the comparatively small capitalization of the Nipissing Mining Co., and the Nipissing Mines Co., which is capitalized for 24 times the book value of the Nipissing Mining Co., makes no further allowance for depreciation. The total value of the dividends so far paid by the Nipissing Mining Co. is $6,012,500, and the net value of the ore marketed has been $9,438,908. A small plant, designed by Chas. Butters, has recently been erected to test on a working scale a process for the treatment of the high-grade ore in order to recover a higher percentage of the value than is paid by the smelting company.

Book Reviews

Any of the books noticed in this column are for sale by, or can be procured from, the MINING AND SCIENTIFIC PRESS.

TABLES FOR THE DETERMINATION OF MINERALS BY MEANS OF THEIR PHYSICAL PROPERTIES, OCCURRENCES, AND ASSOCIATES. By E. H. Kraus and Walter Fred Hunt. Pp. 254; index. McGraw-Hill Book Co., New York. Price $2. For sale by the *Mining and Scientific Press.*

Ability to make rapid and sure determination of minerals in the field is an accomplishment of great value. Naturally, there is no royal road to it, and only years of experience lead to perfection. There are, however, short cuts to approximate determinations, and for many purposes these are entirely adequate. It is also possible, by use of tables to accurately identify most of the common minerals by simple means. The tables prepared some twenty years ago by W. O. Crosby have long been out of print, and except for Frazer and Brown's 'Tables' no satisfactory substitute has been available. The new work by Kraus and Hunt is built on the same general plan. Minerals are grouped by lustre and color, and further subdivided according to streak and hardness. The key is necessarily somewhat artificial, just as was that of the old Gray's 'Botany,' but, as in the latter case, it is simple and effective. The book is one that will be particularly useful to those who have but meagre laboratory facilities and whose use for mineralogy is incidental.

H. F. B.

OUT OF AFRICA. By Thomas Lane Carter. Pp. 288. Neale Publishing Co., New York. Price $1.50. For sale by the *Mining and Scientific Press.*

This book of short stories is one of the by-products of mining, and in these days when conservationists hold the centre of the stage, all good engineers are careful of by-products. Mr. Carter's work has called him to many of the uttermost parts of the earth when interesting things were happening. Evidently, however, he is one of those lucky individuals who has an 'experiencing nature', so that interesting things always happen to him. In these stories he tells some of the incidents that do not go into the report an engineer makes to his principals, however much they may have entered into his work. Ah Sin makes real to us some of the difficulties Rand managers had to face while Chinese were employed, and Rub Tub will recall some campfire companion to many an engineer. Prince Chala and Tung Uhrr are of Africa alone, and for that we may be thankful. That Mr. Carter put them in his book is also a matter for gratitude, as we would rather meet them there than in thicket or compound. The stories are simple, direct, and interesting. Some day we hope Mr. Carter will give us a companion volume telling what he has seen and heard in Central America. In the land where, according to O. Henry, Confederate currency will still do in a pinch, he should have found good material.

H. F. B.

METALLURGY OF THE COMMON METALS, GOLD, SILVER, IRON, COPPER, LEAD, AND ZINC. By Leonard S. Austin. Third Edition. Pp. 521; Ill., index. *Mining and Scientific Press*, San Francisco. *The Mining Magazine*, London, 1911. Price $4.

The third edition of this well-known work, which has just come from the press, includes much new matter, particularly with regard to sintering, reverberatory smelting of copper ores, basic converters, and cost of plant and equipment. In addition, the material has been rearranged and systematically and carefully revised. While the general scope and character of the book remain unchanged, much of the material in it has been entirely rewritten. A number of illustrations have been re-drawn, and others added. All these things greatly improve an already good book, and will add to its usefulness. The book remains essentially a discussion of the common principles of smelting, with illustration drawn from practice, and is well adapted to general use as a text. Mr. Austin is to be congratulated on the demand for his work which compels the issuing of a third edition.

H. F. B.

Recent Publications

A GEOGRAPHICAL REPORT ON THE FRANZ JOSEF GLACIER. By J. M. Bell. New Zealand Geol. Surv. 14 pp.; ill., map.

BIENNIAL REPORT, BOARD OF GEOLOGICAL SURVEY OF WASHINGTON. 24 pp., maps. Olympia, Wash., 1910.

THE COKE INDUSTRY OF THE UNITED STATES AS RELATED TO THE FOUNDRY. By Richard Moldenke. Bull. No. 3 Bureau of Mines. 32 pp. Washington, 1910.

CID MINING DISTRICT OF DAVIDSON COUNTY, NORTH CAROLINA. By Joseph E. Pogue. Bull. No. 22, N. C. Geol. and Econ. Surv. 144 pp.; ill., maps. Raleigh, 1910.

CHRYSOTILE-ASBESTOS, ITS OCCURRENCE, EXPLOITATION, MILLING, AND USES. By F. Cirkel. Department of Mines, Canada. Second edition, enlarged. 316 pp. Ill., maps. Ottowa, 1910.

REPORT OF THE DIRECTOR OF THE MINT. 135 pp. Washington, 1911. Replete, as usual, with tables and data of wide interest of producers of gold and silver and students of monetary problems.

ILLINOIS STATE. GEOLOGICAL SURVEY YEARBOOK FOR 1909. Frank W. DeWolf, Acting Director. Bull. No. 16. 402 pp., maps. Urbana, 1910. A general report on the work of the year with especially interesting papers on the zinc, oil, and coal deposits of the State.

THE FLOW OF HEAT THROUGH FURNACE WALLS. By Walter T. Ray and Henry Kreisinger. Bull. No. 8, Bureau of Mines, 1911. 32 pp., diagrams. This contains an interesting and useful summary of the results of the investigation of this subject in connection with the studies on combustion of fuels, made by the Bureau of Mines.

MANUFACTURE OF ROOFING TILES. By Woolsey Garnet Worcester. Geol. Surv. Ohio. Ser. 4, Bull. 11. Pp. 476. Ill., index. Columbus, 1910. Another of the excellent studies of technology of the clay-working industries, made by the Ohio Survey; written in collaboration with Edward Orton, Jr., and owing much to his inspiration and careful editorial work.

The following publications have recently been issued by the United States Geological Survey:

'Annual Report of the Director of the United States Geological Survey for the year ended June 30, 1910', George Otis Smith, 130 pp.; 'Mineral Products of the United States for the years 1900-1909', 20 by 30 in.; 'Well-Drilling Methods', Isaiah Bowman, 1911, 139 pp., ill.; 'Advance Chapters from Contributions to Economic Geology', Part II, 'Mineral Fuels', by Charles Butts, M. R. Campbell, E. G. Woodruff, C. T. Lupton, J. S. Diller, M. A. Pishel, H. E. Gregory, and A. C. Veatch, Bull 143-B, 1911, 163 pp., ill., maps; 'The State Geological Surveys of the United States', compiled under the direction of C. W. Hayes, 1911, 177 pp.; 'Results of Spirit-Leveling in Delaware, District of Columbia, Maryland, and Virginia, 1896 to 1909, inclusive', R. B. Marshall, Chief Geographer, pp. 74, Washington, 1910; advance chapters from 'Mineral Resources of the United States, 1909'; 'Production of Graphite in 1909', Edson S. Bastin, pp. 134; 'Production of Copper in 1909', B. S. Butler, pp. 34; 'Manufacture of Coke in 1909', Edward W. Parker, pp. 57; 'Production of Sulphur and Pyrite in 1909', W. C. Phalen, pp. 14; 'Production of Peat in 1909', Charles A. Davis, pp. 6; 'Production of Salt and Bromine in 1909', W. C. Phalen, pp. 25; 'Lead in 1909, Smelter Production', C. E. Siebenthal, pp. 25; 'Production of Coal in 1909', Edward W. Parker, pp. 195; 'Zinc and Cadmium in 1909, Smelter Production', C. E. Siebenthal, pp. 24; 'Production of Monazite in 1910', Douglas B. Sterrett, pp. 6.

Decisions Relating to Mining

Specially reported for the MINING AND SCIENTIFIC PRESS.

CONVEYANCE OF COAL LAND HELD BY ADVERSE POSSESSION

A person in the adverse possession of mineral lands, but without paper title, and before such adverse possession had continued for the statutory period, conveyed the coal under such land for a valuable consideration to a third person. While such a conveyanee would convey no title as against the legal owner, yet where the grantor subsequently acquired a valid title by a continuance of such adverse possession for the statutory period, he would then hold the legal title to the coal in trust for the grantee to whom it had been previously deeded and he could then be compelled to execute a valid conveyance for the coal.

Jordan *v.* Chambers, (Penn.) 75 Atlantic 956. Jan. 1910.

POSSESSION OF SURFACE AFTER SEVERANCE OF MINERALS

The right to go upon land to mine and drill for gas and oil is not defeated by covenants for quiet possession in the conveyanee of such land where the gas and oil are excepted, as covenants in a deed that are plainly intended to defend that which has been granted are only co-extensive with the grant, and mere possession of the surface of land is not possession of the oil and gas in place, where there has been a severance of title. Where oil and gas have been severed in title from that of the land under which they are, they are not in possession of the owner of the surface unless he takes actual physical possession of them, as by drilling wells.

Kiser *v.* McLean, (W. Va.) 67 Southeastern 725. March 1910.

WHAT CONSTITUTES A MINING LEASE

A lease of a tract of land for a term of ten years by which the lessee agreed to mine the same and sell the minerals produced, and pay the lessor a percentage of the proceeds as royalty, was a mining lease which gave the lessee no property rights in the ore under the land excepting such as he should mine and sell within the terms of the lease, and such lessee could not maintain an action against a trespasser who mined and removed ore from the premises during the stated term for the recovery of the value of the ore taken, but was entitled to recover damages only to the extent of the actual injury.

Providence Mining & Milling Co. *v.* Nicholson, 178 Federal 29. Feb. 1910.

CONSTRUCTION OF LEASE OF MINE—EXCLUSION OF LESSEE

The owner of a placer-mining claim leased the same to another for a term of years with the right to work the same and take mineral therefrom, paying the lessor a percentage of its value as its royalty during the entire term. The lease expressly provided that time was of its essence, and that the lessee should at once enter upon and work and mine the claim steadily and continually during the mining seasons, and that the lessee should do the necessary representation, and should keep a true account of all clean-ups. Before the expiration of the first year the lessor wrongfully excluded the lessee from the claim and prevented him from working it during the entire remainder of the term. In an action by the lessee for an injunction and damages, the United States District Court of Alaska held that the lease, in addition to being a demise of the mining claim for the term stated, also vested the lessee with the right to become the owner of the mineral therein on condition that it be extracted and converted into personalty during such term, and having wrongfully prevented the lessee from complying with such condition, the lessor thereby waived or estopped himself from exercising the right of excluding the lessee from the claim until the expiration of the term, and until he had a reasonable time to extract the ore he had contracted to purchase. It was also held that a court of equity had power to protect the lessee by injunction where the act of the lessor would result in irreparable injury.

Halla *v.* Rogers, 176 Federal 709. Feb. 1910.

Personal

Professional men are invited to send news of their engagements and travels. Such news is interesting to friends.

R. H. ELLIOTT is in San Francisco.

W. A. SCOTT is at Spokane, Washington.

F. G. FORESHAW is temporarily in London.

S. F. SHAW has returned to New York from London.

J. PARKE CHANNING has returned to New York from Arizona.

B. B. LAWRENCE has left New York for some weeks in the West.

E. M. HAMILTON has gone to England for a three months vacation.

ALBERT BURCH has returned to San Francisco from Goldfield, Nevada.

W. S. NOYES has returned to San Francisco from Texas and Colorado.

VICTOR E. TULL has gone to the Tubal-Cain mine, in Washington, for the summer.

EDWARD M. MCILVAIN has been elected president of the Universal Vanadium Company.

F. W. BRADLEY will leave San Francisco May 13 to spend the summer in Idaho and Alaska.

J. MALCOLM MACLAREN has gone to Porcupine, Ontario, from which place he will go to London.

RUFUS M. BAGG has been elected professor of geology in Lawrence University, Appleton, Wisconsin.

W. G. ANDERSON is now with the Negociacion Minera La Fe y Anexas, at Guadalupe, Zacatecas, Mexico.

DESAIX B. MYERS will be at Chloride, Arizona, for the next thirty days engaged in mine examination.

A. D. FOOTE has been in southern California and is in San Francisco recovering from an attack of neuritis.

C. COLCOCK JONES has removed his office from the Henne building to 1001 Trust & Savings building, Los Angeles.

F. L. SIZER is acting manager at the Balaklala smelter as well as mine, E. B. BRADEN being now general manager.

MARK R. LAMB is manager for the Allis-Chalmers Co. in South America and has established his office at Santiago, Chile.

H. W. EDMONDSON, for the past five years general superintendent for the Rio Plata Mining Co., has resigned, and has been succeeded by A. H. PRIOR, formerly cyanide superintendent.

COURTENAY DE KALB has been made a member of the Committee on Explosives of the Eighth International Congress of Applied Chemistry, which will meet at Washington, September 1912.

H. R. HOLBROOK, formerly of the Balaklala Consolidated Copper Co., Coram, California, has accepted a position as chief chemist for the Mexican-American Smelting & Refining Co., at Guaymas, Mexico.

HENRY R. COBLEIGH has resigned as mechanical editor of *The Iron Age*, which position he has held for the last seven years, to take charge of advertising and publicity of the International Steam Pump Co., with an office at 115 Broadway, New York City.

THE SAN FRANCISCO SECTION of the Mining and Metallurgical Society of America met following dinner at Techau's Tavern, May 1. Messrs. S. B. Christy, C. W. Merrill, F. W. Bradley, J. B. Keating, A. D. Foote, Douglas Waterman, W. S. Noyes, T. T. Read, B. B. Meek, and H. F. Bain were present. The subject of mine inspection was discussed.

ON THURSDAY, MAY 4, 1911, the Bunker Hill & Sullivan M. & C. Co. paid dividend No. 164 of $81,750. This makes the total amount of dividends paid $12,701,850.

Market Reports

LOCAL METAL PRICES.

San Francisco, May 4.

Antimony	12—12¾c	Quicksilver (flask)	46.50
Electrolytic Copper	14—15¼c	Tin	45—46½c
Pig Lead	4.75—5.70c	Spelter	7—7¾c

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

METAL PRICES.

By wire from New York.

Average daily prices in cents per pound.

Date.	Electrolytic Copper.	Lead.	Spelter.	Silver, per oz.
Apr. 27	12.00	4.40	5.38	54
" 28	12.00	4.40	5.38	53⅜
" 29	12.00	4.40	5.38	53¼
" 30	Sunday.	No market.		
May 1	12.00	4.40	5.38	53⅜
" 2	12.00	4.40	5.38	53¼
" 3	12.00	4.40	5.38	53¼

ANGLO-AMERICAN SHARES.

Cabled from London.

	Apr. 27. £ s. d.	May 3. £ s. d.
Camp Bird	1 12 1½	1 14 0
El Oro	1 4 6	1 4 6
Esperanza	1 12 6	1 13 9
Dolores	1 5 0	1 5 0
Oroville Dredging	0 5 9	0 5 9
Mexico Mines	7 8 9	7 12 6
Tomboy	0 15 3	0 15 6

(By courtesy of W. P. Bonbright & Co., 24 Broad St., N. Y.)

MINING STOCK QUOTATIONS—NEW YORK.

(By wire from Catlin & Powell Co., New York.)

	Closing prices, May 3.		Closing prices, May 3.
Amalgamated Copper	$ 63¼	La Rose	$ 4⅛
A. S. & R. Co.	75¼	Mason Valley	8⅛
Braden Copper	4	Miami Copper	19⅞
B. C. Copper Co.	5⅛	Mines Co. of America	5¼
Butte Coalition	17⅝	Nevada Con	18¼
Chino	24¼	Nevada Utah	⅝
Davis Daly	1⅜	Nipissing	10¾
Dobie	3	Ohio Copper	1¾
Dolores	5⅛	Ray Central	1⅝
First National	1⅜	Ray Con	17¾
Foley O'Brien	1⅛	South Utah	¾
Giroux	6⅝	Superior & Pittsburg	14⅜
Goldfield Con	6⅛	Tenn. Copper	37⅛
Greene-Cananea	6⅜	Trinity	8¾
Guanajuato Con	⅛	Tuolumne Copper	4¼
Hollinger	11⅞	United Copper	3⅞
Inspiration	7⅝	Utah Copper	46⅛
Kerr Lake	6⅛	Yukon Gold	3⅞

COPPER SHARES—BOSTON.

	Closing prices, May 4.		Closing prices. May 4.
Adventure	$ 5⅞	Mohawk	$ 38
Allouez	31	North Butte	28
Atlantic	5	Old Dominion	39⅛
Calumet & Arizona	51	Osceola	100
Calumet & Hecla	480	Parrot	11¾
Centennial	12	Santa Fe	⅞
Copper Range	60⅛	Shannon	10¼
Daly West	4½	Superior & Pittsburg	14⅛
Franklin	9⅛	Tamarack	38
Granby	32½	Trinity	8¾
Greene Cananea, ctf.	6	Utah Con.	14½
Isle-Royale	13¼	Victoria	1⅛
La Salle	3½	Winona	6¼
Mass Copper	6	Wolverine	107⅛

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

OIL SHARES

San Francisco, May 3.

Associated Oil	$51.00	Palmer	1.37
Bay City (New Stock)	.48	Palmer Union	$ .54
Brookshire	1.47	Peerless	4.00
Caribou (New Stock)	1.25	Premier	.63
Claremont	1.25	Producers	2.50
Coalinga National	.20	Republic	.45
Cons. Midway	.15	Sauer Dough	1.40
Crescens	.20	Silver Tip	1.00
De Luxe	1.20	S. & F. McKittrick	13.00
Empire	1.45	S. W. & B.	.20
Enos	.52	Sunset Monarch	.52
Maricopa National	.26	Turner	1.10
Monte Cristo	2.05	United Oil	.85
Nevada Midway	.16	Wolverine	.40
Occidental	.15	W. K. Oil	2.50
Pacific States Petroleum	.26	Yellowstone	.15

(By courtesy of San Francisco Stock Exchange.)

COMSTOCKS

San Francisco, May 3.

Alpha	$ .02	Kentuck	.14
Alta	.10	Mexican	5.12
Andes	.20	Occidental	.55
Belcher	.90	Ophir	1.92
Brunswick Chollar	.20	Overman	.35
Brunswick Potosi	.20	Potosi	.25
Bullion	.10	Savage	.35
Chollar	.15	Scorpion	.46
Con. Virginia	1.32	Seg. Belcher	.19
Crown Point	.75	Sierra Nevada	.67
Gould & Curry	.18	Union	1.92
Hale & Norcross	.28	Utah	.18
Julia	.45	Yellow Jacket	.40
Justice	.14		

(By courtesy of San Francisco Stock Exchange.)

SOUTHERN NEVADA

San Francisco, May 4.

Atlanta	$ .10	Mayflower	$ .04
Belmont	6.07	Midway	.28
Booth	.07	Montana Tonopah	85
Columbia Mtn	.03	Nevada Hills	3.15
Combination Fraction	.08	Pittsburg Silver Peak	.66
Florence	1.55	Round Mountain	.58
Goldfield Con	6.13	Sandstorm Kendall	.08
Gold Kewenas	.05	Silver Pick	.04
Jim Butler	.26	Tonopah Extension	1.05
Jumbo Extension	.28	Tonopah of Nevada	6.25
MacNamara	.12	West End	.55

(By courtesy of San Francisco Stock Exchange.)

Current Prices For Chemicals

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

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

	Min.	Max.
Acid, sulphuric, com'l, 66°, drums, 100 lb.	$0.80	$1.00
Acid, sulphuric, com'l, 66°, carboy, 100 lb.	1.00	1.50
Acid, sulphuric, C.P., 9-lb. bottle, bbl., lb.	0.13	0.18
Acid, sulphuric, C.P., bulk, carboy, lb.	0.09½	0.12
Acid, muriatic, com'l, carboy, 100 lb.	1.60	2.00
Acid, muriatic, C.P., 6-lb. bottle, bbl., lb.	0.15	0.20
Acid, muriatic, C.P., bulk, carboy, lb.	0.10½	0.15
Acid, nitric, com'l, carboy, 100 lb.	5.25	6.50
Acid, nitric, C.P., 7-lb. bottle, bbl., lb.	0.16	0.22
Acid, nitric, C.P., bulk, carboy, lb.	0.12½	0.15
Argols, ground, bbl., lb.	0.20	0.25
Borax, cryst. and conc., bags, 100 lb.	2.75	3.85
Borax, powdered, bbl., 100 lb.	3.00	4.00
Borax glass, gd., 30 mesh, cases, 100 lb., tin lined	10.00	13.00
Bone ash, 60 to 80 mesh, bbl., 100 lb.	4.50	5.50
Bromine, 1-lb. bottle, lb.	0.55	0.65
Candles, adamantine, 12 oz., 40 sets to case	3.60	4.15
Candles, adamantine, 14 oz., 40 sets to case	4.00	4.55
Candles, Stearic, 12 oz., 40 sets to case	4.95	5.50
Candles, Stearic, 14 oz., 40 sets to case	4.65	5.20
Clay, domestic fire, sack, 100 lb.	1.50	2.00
Cyanide, 98 to 100%, 100-lb. case, lb.	0.20¾	0.24¾
Cyanide, 98 to 100%, 200-lb. case, lb.	0.20	0.24
Cyanide, 127-129%, 100 lb. case, lb.	0.27½	0.28½
Cyanide, 127-129%, 200-lb. case, lb.	0.26¾	0.27½
Lead acetate, brown, broken casks, 100 lb.	8.75	9.00
Lead acetate, white, broken casks, 100 lb.	10.00	10.25
Lead acetate, white, crystals, 100 lb.	11.75	12.25
Lead, C.P., test., gran., 100 lb.	13.00	15.00
Lead, C.P., sheet, 100 lb.	15.00	18.00
Litharge, C.P., silver free, 100 lb.	10.50	13.00
Litharge, com'l, 100 lb.	7.50	9.00
Manganese ox., blk., dom. in bags, ton	20.00	25.00
Manganese ox., blk., Caucasian, in casks, ton. (85% MNO_2—¾% Fe)	45.00	50.00
Nitre, double ref'd, small cryst., bbl., 100 lb.	7.00	8.00
Nitre, double ref'd, granular, bbl., 100 lb.	6.50	7.50
Nitre, double ref'd, powdered, bbl., 100 lb.	7.25	18.00
Potassium bicarbonate, cryst., 100 lb.	12.00	16.00
Potassium carbonate, calcined, 100 lb.	15.00	18.00
Potassium permanganate, drum, lb.	0.11	0.12½
Silica, powdered, bags, lb.	0.03	0.05
Soda, carbonate (ash), bbl., 100 lb.	1.50	1.75
Soda, bicarbonate, bbl., 100 lb.	2.00	2.50
Soda, caustic, ground, 98%, bbl., 100 lb.	3.16	3.50
Soda, caustic, solid, 98%, bbl., 100 lb.	2.65	2.85
Zinc shavings, 800 fine, bbl., 100 lb.	10.50	11.50
Zinc sheet, No. 9—18 by 84, drum, 100 lb.	9.25	10.25

Current Prices for Ores and Minerals

(Corrected monthly by Atkins, Kroll & Co.)

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

	Min.	Max.
Antimony ore, 50%, per ton	*$20.00	$25.00
Arsenic, white, refined, per lb	0.02	0.02½
Arsenic, red, refined, per lb	0.06¾	0.07¼
Asbestos, according to length and quality of fibre, per ton	100.00	350.00
Asbestos, lower grades, per ton	10.00	100.00
Asphaltum, refined, per ton	15.00	20.00
Barium carbonate, precipitated, per ton	42.50	45.00
Barium chloride, commercial, per ton	42.50	47.50
Barium sulphate (barytes), prepared, ton	20.00	30.00
Bismuth ore, 10% upward, per ton	*75.00	upward
Chrome ore, according to quality, per ton	10.00	12.50
China clay, per ton	15.00	20.00
Cobalt metal, refined, f.o.b. London, per lb	2.50	
Coke, foundry, per 2240 lb	15.00	17.50
Diamonds:		
Borts, according to size and quality, per carat	2.00	15.00
Carbons, according to size and quality, per carat	75.00	100.00
Feldspar, per ton	5.00	25.00
Firebrick:		
Bauxite, per M	175.00	
Magnesite, per M	190.00	275.00
Silica, per M	42.50	47.50
Flint pebbles for tube-mills, per 2240 lb	15.00	25.00
Fluorspar, per ton	10.00	15.00
Fullers earth, according to quality, per ton	20.00	30.00
Gilsonite, per ton	35.00	40.00
Graphite:		
Amorphous, per lb	0.01	0.02½
Crystalline, per lb	0.04	0.13
Gypsum, per ton	7.50	10.00
Infusorial earth, per ton	10.00	15.00
Magnesite, crude, per ton	7.50	10.00
Magnesite, dead calcined, per ton	22.50	27.50
Magnesite, brick (see firebrick).		
Manganese ore, oxide, crude, per ton	10.00	25.00
Manganese, prepared, according to quality, per ton	40.00	120.00
Mica, according to size and quality, per lb	0.05	0.30
Molybdenite, 95% MoS_2, per ton	400.00	500.00
Monazite sand (5% thoria), per ton	150.00	200.00
Nickel metal, refined, per lb	0.45	0.60
Ochre, extra strength, levigated, per 100 lb	2.25	3.25
Platinum, native, crude, per oz	25.00	30.00
Scheelite (see tungsten ore).		
Sulphur, crude, per ton	15.00	25.00
Talc, prepared, according to quality, per ton	20.00	50.00
Tin ore, 60%, per ton	450.00	475.00
Tungsten ore, 65%, per ton	520.00	550.00
Vanadium ore, 15%, per ton	200.00	250.00
Wolframite (see tungsten ore).		
Zinc ore, 50% up, per ton	*15.00	20.00

Commercial Paragraphs

The Pittsburgh Testing Laboratory has moved into its new building at the corner of Seventh and Bedford avenues, Pittsburgh, Pennsylvania.

The Universal Vanadium Co. has been incorporated to act as selling agents throughout the world for ferro-vanadium, manufactured by the American Vanadium Co. of Pittsburg. It will act in conjunction with the Vanadium Sales Co. of America. Edward M. McIlvain, 30 Church street, is president.

The Lunkenheimer Co. has recently opened a new branch store at 138 High street, Boston. Wm. W. Beal is in charge.

The name of the Constant-Herzig Co. has been changed to the C. L. Constant Co. The offices of this well known firm of engineers and assayers remains at 42 New street, New York City.

Stephens-Adamson Mfg. Co., of Aurora, Illinois, has opened a branch office at 303 Abington building, Portland, Oregon, under the charge of R. G. Cornell, and will be a large factor in the building of conveying, transmission, and screening machinery in the Northwest. The company has recently completed at Aurora, Illinois, a large new steel shop which will give added facilities. Mr. Cornell was formerly in the company's engineering and later in the sales department in the main office.

American Institute of Mining Engineers

The following itinerary is provisionally announced for the fall meeting, subject to such changes and additions as may be made by the local committee or by the management in charge of transportation:

Saturday, Sept. 30, Lv. Chicago 8 p.m.; Tuesday, Oct. 3, Arr. Grand Canyon 8 a.m.; Wednesday, Oct. 4, Lv. Grand Canyon 7:30 p.m.; Thursday, Oct. 5, Arr. Los Angeles 2:30 p.m., *via* A. T. & S. F. railroad. Sunday, Oct. 8, Lv. Los Angeles 3 a.m.; Sunday, Oct. 8, Arr. Santa Barbara 7 a.m.; Sunday, Oct. 8, Lv. Santa Barbara 11 p.m.; Monday, Oct. 9, Arr. Del Monte 8 a.m.; Tuesday, Oct. 10, Lv. Del Monte 4 a.m.; Tuesday, Oct. 10, Arr. San Francisco 7a.m., *via* Southern Pacific railroad.

Tuesday, Oct. 17, Lv. San Francisco 10:40 a.m., *via* Southern Pacific railroad. Wednesday, Oct. 18, Lv. Ogden 2:30 p.m. *via* Union Pacific railroad. Thursday, Oct. 19, Lv. Omaha 11:30 p.m., C. M. & St. P. railroad; Friday, Oct. 20, Lv. Chicago 1 p.m., *via* Chicago, Milwaukee & St. Paul railroad.

Japan Excursion.—Tuesday, Oct. 17, Lv. San Francisco 1 p.m.; Sunday, Oct. 22, Arr. Honolulu, H. I.; Monday, Oct. 23, Lv. Honolulu, H. I.; Friday, Nov. 3, Arr. Yokohama, Japan, *via* steamship *Manchuria* of the Pacific Mail Steamship Company.

Eighteen-day excursion in Japan, including Tokio; Nikko and Chuzenji district; Tokio, Kamakura, and Hakone; Kioto, Nara, Osaka, Kobe, etc.; Ikuno Silver-Mine; Miyajima, Imperial Steel Works, Yawata, Kiushu, Miike Colliery, Tokio, or Yokohama.

Tuesday, Nov. 21, Lv. Yokohama; Thursday, Nov. 30, Arr. Honolulu; Friday, Dec. 1, Lv. Honolulu; Thursday, Dec. 7, Arr. San Francisco, *via* S.S. *Siberia*, P. M. S. S. Company.

Friday, Dec. 8, Lv. San Francisco 10:40 a.m. *via* S. P. railroad. Saturday, Dec. 9, Lv. Ogden 2:30 p.m. *via* U. P. railroad. Sunday, Dec. 10, Lv. Omaha 11:30 p.m. *via* C. M. & St. P. railroad. Monday, Dec. 11, Arr. Chicago 1 p.m. *via* C. M. & St. P. railroad.

The Goldfield Consolidated Mines Co.

The quarterly report of the general superintendent is as follows:

	January.	February.	March. (approx.).	Total.
Dry tons treated	27,192	23,675	25,814	76,681
Value recovered	$742,980.28	$913,684.43	$1,040,000.00	$2,696,664.71
Operating cost	185,592.48	175,708.80	212,000.00	573,301.28
Construction cost	4,760.85	18,650.59	3,000.00	26,411.44
Total costs	190,353.33	194,359.39	215,000.00	599,712.72
Net profit	552,626.95	719,325.04	825,000.00	2,096,951.99

The cash balance of the company on March 31 was $2,780,989. After paying a dividend of 50c. per share, being the regular quarterly 30c. dividend plus an extra 20c. dividend, the cash balance will be approximately $1,600,000.

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EDITORIAL

EIGHT stenographers, it is said, are employed by Mr. George Graham Rice in his efforts to boom Porcupine. If the supply of white paper lasts, this should secure to everyone a chance to lose money.

POSTAL savings banks are proving popular. At Bisbee, Arizona, $2000 was deposited on the first day the office was open. At Globe and elsewhere in the mining regions the new system affords great convenience.

STATE AID in metallurgical research has been undertaken in Colorado, where an ore-dressing and metallurgical laboratory designed primarily for testing and research rather than instruction, is being built at the School of Mines at Golden.

DUST from portland cement-making plants in California has been making trouble for orange growers, and injunction has been granted against one of the large cement mills in southern California. It is understood that the Cottrell process will be tried, and in many particulars the situation seems especially to favor its success.

OUR attention has been called to an error in our article describing the El Oro steel spud. Mr. W. S. Noyes modestly disclaims credit for the design, which it seems was made by Mr. J. B. Hardy of the Indiana Machine Shop. Fortunately in this, as in other good pieces of work, there is credit enough to go around. The spud, by the way, is attracting much favorable comment from dredging men.

GERMAN coal mine owners are making systematic efforts to increase their foreign trade and are meeting with good success, 58 cargoes having cleared from Rotterdam alone in March. When accessibility and quality of coal are taken into account the field seems even more open to Americans than Germans and the large surplus capacity of our collieries could be thus utilized with great advantage to many local industries.

ALASKAN railways are not under control of the Interstate Commerce Commission and there is no local body corresponding to a State Commission. When shippers desired to object to rates over the White Pass & Yukon route, Canadian authorities were the only ones competent to act. Attention has been called to the matter at Washington and it is probable that the authority of the Interstate Commerce Commission will be extended.

ARMY MEDICAL OFFICERS have good reason to feel proud of their record in connection with the mobilization of United States troops this year. A division of 18,000 men has now been in the field over two months, during which time there has been much rain and bad weather, and yet the percentage of men on the sick list is less than before the men were mobilized. The contrast with conditions in 1898 is inspiring. Incidentally, mining engineers, who must so often be responsible for the health of numerous subordinates, would do well to study thoroughly the methods and results of the army doctors.

ENGLISH is a language having many mutations. Our British cousins always 'amalgamate' companies when in the United States they would be 'consolidated.' Similar differences give point to the announcement in a shop window on the Rue de Rivoli: "English spoken and American understood." A friend in Arizona sends the following as an example of English as sometimes written by an earnest aspirant for American citizenship: "Wey hat too houst 10 cars of wast of the track be for wey could stort on the ore it was 20 minnets too nine befor wey get cleant oup."

AUTOMOBILE extravagance has been charged with many of the ills of society lately, but the latest is the well-attested fact that in the last year delivery of mining machinery on time became impossible because of the demand for mechanics in the automobile plants. One manufacturer employing ordinarily 1800 men was only able to hold an average of 1400 through the season. The profits in automobile-making are so large as to permit payment of wages impossible in the manufacture of standard articles, and serious losses have already resulted.

GLYCERINE is an essential constituent of the high explosives used in mining. In the past the supply has been obtained as a by-product of soap and candle-making, but with the increase in the use of nitro-glycerine and changes in methods of making candles, a serious shortage of glycerine impends. Mr. W. Cullen recently called attention to the situation at a meeting of the Chemical, Metallurgical & Mining Society of South Africa. Unless new sources of supply or an acceptable substitute is found, mine managers must be prepared to pay high prices for explosives. Experimental work should be encouraged. In the meantime urge the increased use of soap and discourage war.

THE Governor of California has not yet announced his choice among candidates for the position of State Mineralogist. The post is an important one and should be filled promptly. There are several men available who would serve in this place acceptably. The last name suggested is that of Mr. F. J. H. Merrill of Los Angeles. Mr. Merrill is eminently qualified for the position. His administration as State Geologist of New York was notable for the high character of the work done by the department while under his control, and there is no doubt that he would fill the position in a way that would make the office what it ought to be—a powerful agent for wise conservation and economical development of the mineral resources of the State. We are sure the Governor desires to appoint a qualified man and we hope the matter may not be longer delayed.

CONSERVATIONISTS are greatly pleased at the decision of the United States Supreme Court relative to the authority of the United States over the public lands. It certainly gives a broad foundation for a conservation policy on the part of the National Government; this places on Congress the responsibility of prompt action. There is a general impression in the East to the effect that the people of the West do not favor Federal control of the water-power sites, or of the coal, oil, or phosphate lands. We would say rather that Westerners object to the withdrawal of these lands and failure to enact any legislation under which they can be utilized. This is perhaps only a temporary incident in the development of the conservation policy, but it is a cause of much irritation. Coupled with this has been the fact that in making withdrawals rights previously acquired have not always been scrupulously respected. This properly offends a native sense of justice. If, however, Congress will offer the people a definite and workable plan, permitting continued development of the lands in controversy, we believe Western sentiment will be found surprisingly favorable. It should be remembered that under present conditions proceeds from the sale of public land are required by law to be spent in the West, and the land once in private ownership becomes locally taxable. It would be unjust to permanently hold free from all local taxation any large part of any State, Eastern or Western, unless some compensation in revenue be provided. We do not believe this is contemplated, and within the suggested limits there is ample room for building a system that will permit at once, proper control, suitable local revenue, and economical development.

CORDOVA has become the centre of interest since its citizens have been giving a realistic revival of the historic 'Boston tea party.' Evidently Cordovans take their United States history seriously. We will confess at once that our sympathies are with them. To stand idly by with your local coalfields securely locked up, and watch the unloading of cargo after cargo of foreign coal, is as exasperating as the situation is unjust. Paying the fiddler may prove distressing, but the participants in the venture will, at least, have the comfort of having acted, and, incidentally, of having thoroughly impressed their view-point on all the world. That Alaskan coalfields are still undeveloped is due to nothing less than a break-down in government. The famous and thoroughly complicated Cunningham case has just been argued at Washington and a settlement is expected within three weeks. The new Secretary of Interior is devoting himself to the Alaskan muddle and, with neither prejudice nor disposition to dodge responsibility, is endeavoring to get at the facts and the law. We have no notion what his decision will be, but we have great confidence that it will be right; and it should settle the matter. It must be followed promptly by constructive work on the part of Congress. Already a year's time has been lost, the matter has been thoroughly discussed, and the needs of the situation are acute. Less attention to the effect on the next presidential election, and more to that on the future of Alaska, is needed at Washington.

Federal Aid for Mining Schools

A bill has been introduced at Washington by Mr. M. D. Foster, chairman of the Committee on Mines and Mining, of the House of Representatives, proposing to extend to State schools of mining and metallurgy substantially the same aid now given to agricultural colleges. Specifically the bill proposes an initial appropriation of $5000 per year to each State, with an increase annually of $5000 until $25,000 per annum is being appropriated. The money can only be used for instruction, research, and experiment, but with that limitation the terms are broad and funds expended under them would be certain to accomplish much good. There is some slight difference of opinion among educators and public men as to whether the United States Government does well to take up the work of instruction, and there are those who hold that it should be left to the States. There is no disagreement, however, as to the propriety of the Nation using its resources to stimulate research and experiment designed to enable more economical development of material and to promote safety. Neither can there be maintained any good argument why in distribution of benefits the miner should be discriminated against in favor of the farmer. The bill Mr. Foster has introduced is well drawn and details have evidently been carefully considered. The object he has in view has been before Congress often enough for intelligent action. Western miners are especially concerned, since it is in the West that the

work proposed most needs doing, at the same time that the facilities are most inadequate. The House Committee on Mines and Mining gave last year a notable exhibition of what a few determined men, among whom was Mr. Foster, can accomplish even with a moribund institution. They went far to make it, as it should be, one of the most important committees at Washington. The bill now proposed, H. R. 6304, deserves support, and the active cooperation of mining men is urged.

Wanted,—Mines

Probably more money is now available for investment in mines than at any time in recent years—and the mines are not being found. Those that come to notice, even many but incompletely developed, are promptly financed if the owners are at all reasonable in their attitude. Within a year an expensive examination of a California gold mine was made, where the ore averaged only $2.60 per ton in value. The mine was rejected, not because of the low value of the ore, but because the quantity proved did not warrant the investment. The orebodies found at Porcupine passed promptly into the hands of experienced and capable men amply prepared to furnish all the money needed to develop them on the largest scale, and there is money waiting for anything else that shows equal promise. The case is all the more striking since even now relatively little ore has been developed at Porcupine, if the word be used in the strictest engineering sense. Men having money and experience were, however, at once attracted to the camp and were willing to buy upon terms that involved substantial risk on their part as well as profit to the owners. Men accustomed to investing large sums of money are now willing, as seldom before, to go into metal mining; but, and this spells the difference, they have learned to value expert assistance and they know the difference between a mine and a hole in the ground. The little artificial flurry in Porcupine 'stocks' in New York, and the promptness with which it subsided, indicates that even the general public is disposed now to discriminate between investment, and buying capitalized blue sky and adjectives. There are constantly in San Francisco, and the same thing is true at other centres of mining, representatives of a number of financial groups anxious and willing to buy any mine that is likely to prove profitable. If one has a mine of real value it is not necessary to reach capital through a long string of hungry promoters. Anyone who knows what he has and is prepared to talk business can get a respectful hearing. These facts are thoroughly well known among engineers. We state them for the benefit of the general public and perhaps, for the small mine-owner who is too busy on his claim to visit the city often.

It is an encouraging sign of the times that substantial business men of large resources are prepared to invest in metal mines on terms fair to all concerned, including the promoter and the minor stockholder. It is to be hoped that their experience may justify a continuance of this attitude. Making mining less of a game for gamblers, and more a business for investors, is worth while. We would not, however, lose sight of the fact that in legitimate mining there is a stage where speculation is a large element. This, though, we believe is properly in the development of prospects rather than the manipulation of shares in companies operating producing mines. A prospect is always uncertain. To discover it in the first place, and to develop it in the second, calls for skill, experience, and money. Much of the first two, and, relatively, little of the third, are needed. This is the part of mining that attracts the man who has little capital but abundant nerve and optimism. Of the whole number of prospects found, few make good mines; but a mine once developed can be promptly converted into cash at a very large profit on the original investment. A prospector may work all his life and never discover anything of value. He may become wealthy in a few months. Surely this affords a sufficiently wide field for any legitimate desire to speculate.

It is none too easy to find even a good prospect. Most of the rich ore-shoots that outcrop at the surface and pay 'from the grass roots down' have already been staked. Great portions of the world have been thoroughly prospected so far as this stage of the work is concerned. Not that similar ore-shoots will not still be found in the old and 'thoroughly prospected' country—indeed, experience at Cripple Creek, Goldfield, National, and elsewhere, urges to the contrary—but in the main, prospectors must expect either to go into country till now inaccessible or to spend more in testing each outcrop in depth. Until the automobile was developed, much desert country was practically inaccessible and rich ore outcropped at the surface without attracting attention. In the Northwestern States, in British Columbia, and in Alaska, there are doubtless many bodies of ore as valuable as any yet found on the Mother Lode, in the Coeur d'Alene, at Nelson, or at Juneau; but the country is heavily covered with forest and underbrush, and many parts are only accessible with great expense and difficulty. Evidently discovery of new districts here must wait on lucky chance or follow much more difficult and persistent search than led to the finding of mines now worked. In Ontario and adjacent provinces there are thousands of square miles covered with forest or muskeg. The country is almost wholly unprospected. Rock outcrops are few and trenching is necessary. A knowledge of geology is extremely helpful if not essential. Cobalt and Porcupine point to the possibilities of the area and a wide expanse awaits the prospector.

Modern prospecting is a peculiarly suitable field for the organization of limited partnerships or small 'syndicates,' to use a large and pleasing word for a modest venture. The men going into it should recognize the speculative nature of the business and should choose their field agent with care. This done, they should be hopeful and persistent. When a suitable claim is found, attention should be concentrated on finding ore. There is no need to worry over metallurgical difficulties or treatment charges; if the ore is found it can be sold at a profit to some one else who will shoulder those worries. Find ore, that is the first essential; do not gouge it out so that nothing is left but the shell, that is the second. It is a mistake to waste good ore by mining and selling it at the high costs always incident to prospecting operations. Find the ore, take your profits and find more ore, and you will soon cease to worry over the increased cost of living. Show faith in your prospect. If you can not do that, stay out of the business, but if you go into the game play it fairly. Not long ago our attention was called to a company financed and promoted by attorneys and bankers and engaged in selling stock to the general public. A report by a reputable engineer stated his belief that expenditure of $25,000 would result in developing several hundred thousand dollars worth of ore. The amount needed was by no means beyond the resources of the group handling the property. Yet they were asking the public to furnish it. Either, apparently, they had no faith in the engineer and the property, or they wanted to have their cake and eat it too. There have been too many organizations designed on the comfortable basis of the public supplying all the money and receiving but an exceedingly diminutive share of the profit. Good properties in good hands are not so financed, and if either of these essentials is lacking, any proposal for investing is likely to prove unprofitable.

Operation of the Goldfield Consolidated Mill

By J. W. Hutchinson

(Continued from page 616.)

CONCENTRATION

The third aisle of the mill is the main concentrator floor, containing 30 8-ft. Callow tanks, and 60 primary and 16 secondary concentrators (all No. 3 Deister slimers). The concentrators were put in after a competitive test on this ore with the suspended vanner; the Deister No. 3 machine winning by a wide margin. Each machine has the capacity, when followed by secondary concentrators in the ratio of 1:5, of handling 11 tons of dry slime, 80% of which will pass a 200-mesh screen and all of which will pass a 100-mesh, and each will concentrate therefrom 72% of the gold in the ore into 1000 lb. of concentrate. From this, 20% of the gold is recovered by amalgamation, leaving 52% to be recovered by further treatment of the concentrate. When the facts are taken into consideration, that the ore has been slimed before any of the concentrate has been removed, that 80% of the material recovered is −200-mesh, and that the ore can not be classed as a concentrating ore, the performance seems remarkable. Repeated monthly tests on a general sample of the tailing from the cyanide plant fail to show any appreciable gold recoverable by concentration. When the capacity of the plant was increased, 18 additional tables were placed on the regrinding floor, and 6 on the secondary floor. As stated, the tables on the regrinding floor take their feed from the spitzkasten, this feed assays 20% higher than the feed on the main floor. For this reason, the middling from the 18 upper tables is re-concentrated on the main floor and the tailing from the upper floor mixed with middling from the 60 primary tables.

Although 30 Callow tanks were placed on the main floor and were used for dewatering when the plant crushed 600 tons, at the present only 16 are in commission, since less water is now used for crushing. The Deister machine operates more satisfactorily on a pulp containing 3 to 3½ parts water. They are driven at 300 strokes per minute through $^{7}/_{16}$ in. and require 0.73 hp. each to operate. One man per shift operates the 60 primary and 16 secondary tables; one man with a helper keeps all the machines in repair. This work includes all mechanical up-keep, as well as cleaning floors, machines, and pulp-thickeners. The helper brushes the mineral edge of each table every morning with a dilute HCl to remove precipitated salts. Each deck is brushed thoroughly every 60 days. No deck renewals have yet been necessary.

The concentrate from all floors, approximately 5½% by weight of the ore milled, gravitates to the concentrate-treatment plant and will be discussed later. Middling from the primary tables, amounting to 15% by weight, is re-concentrated without further regrinding on the 16 secondary tables. Reference to the flow-sheet will show the disposition made of each product. The cost for all renewals for 94 tables, including head motions, deck, riffles, etc., has averaged $150 per month for twelve months, or at the rate of $1.60 per table per month, or 0.6c. per ton milled. The labor for repairs and maintenance has been approximately $3 per table per month, or 1.2c. per ton milled, which includes everything incident to keeping the tables in first-class operating condition. The following table shows the total cost of concentrating, including the above items of repair:

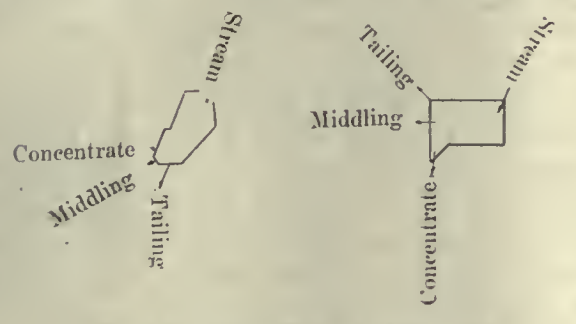
Year	1911	1910	1909
Tonnage	850	850	600
	Cents.	Cents.	Cents.
Labor	3.5	4.0	4.0
Supplies	0.5	0.4	0.4
Power	1.5	1.5	1.8
Total	5.5	5.9	6.2

As pulps are being conveyed here with more variety in size of solids and degree of dilution than in the gold mills of this country or elsewhere, it is hoped the following table will prove of interest:

Product.	Dilution	Width of launder	Height of launder	Grade of launder	Dry tons handled in 24 hr.	Conveying pulp.
		In.	In.	In. per ft.	Tons.	
4-mesh from batteries	4:1	8	8	1¾	255	From 30 stamps to spitzkasten.
12-mesh from batteries	6.5:1	8	8	⅝	200	(1909) from 30 stamps to 8-ft. cone.
−4 mesh to Chileans	3.3:1	8	8	1⅛	400	From spitzkasten to three 6-ft. Chilean mills.
−30 mesh from Chileans	3.3:1	8	8	⅝	400	From three 6-ft. Chilean mills to boot of B. & B. elevator.
Tube-mill discharge, 50% −200 mesh	1.5:1	6	5	1¾	100	From one 5 by 22-ft. tube-mill to boot of B. & B. elevator.
Mixture of tube-mill and Chilean products	2.6:1	8	8	¾	700	From three 5 by 22-ft. tube-mills and three 6-ft. Chilean mills to 8-ft. cone.
Mixture of tube-mill and Chilean products	2:1	6	5	1⅛	200	Feed to one Dorr classifier.
Final product from tube-mills	3:1	5½	8	⅜	330	Feed to 30 No. 3 Deister slimers.
Product from Callow tanks	3:1	3½	3½	⅞	22	Feed to 2 No. 3 Deister slimers.
Concentrate	9:1	3	3	$1^{1}/_{16}$	3.5	From 6 No. 3 Deister slimers to main launder.
Middling	3:1	3	3	¾	10	From 6 No. 3 Deister slimers to main launder.
Tailing	5:1	5	5	¾	52½	From 6 No. 3 Deister slimers to main launder.
Concentrate	9:1	4	10	¾	50	Main launder to concentrating plant.
Tailing	5:1	10½	10½	$^{3}/_{16}$	800	From 100 stamps.
Clear water		18	14	⅛	4000	Clear water overflow from 800 tons.

NEUTRALIZING AND DEWATERING

The lime-mixing plant is situated about 200 ft. from the mill proper and consists of storage bins (capacity 120 tons) into which the lime from the railroad cars is shoveled. Lime from these bins is slacked and dumped into two 4-ft. Wheeler pans, from which the mullers have been removed. These pans act simply as stirrers and deliver a continuous stream of milk of lime, which is laundered to the mill, with branch launders to the dewatering tanks, Pachuca agitators, and concentrate-treatment plant. The bulk of the lime consumed is added to the main launder conveying the table tailing to the dewaterers. No lime is added at the battery, and for this reason there is not the serious trouble with concentrator decks noticeable at most cyanide plants. The



FLOW OF MATERIAL OVER DEISTER TABLES.

lime for neutralizing is so regulated that the overflow water from the dewaterers titrates 0.4 to 0.5 lb. CaO per ton of water. This mill-water gravitates through two clarifying tanks to mill-water sump-tank, from which it is elevated by means of two 10 by 12 Aldrich pumps to the mill-water supply tank behind the stamps. The water leaving the batteries is a trace acid to phenol, which acidity has increased to 0.2 when the pulp reaches the concentrators. The ferrous salts generated during crushing are neutralized and oxidized en route to the dewaterers. The 16 dewatering tanks, 29 ft. 6 in. by 12 ft., with 16° false cones, are arranged in two aisles of 8 tanks with 7 ft. difference in elevation. The total capacity of the dewaterers is 96,000 cu. ft., equivalent to 120 cu. ft. per ton of ore, or 20 cu. ft. per ton of pulp. Each tank is equipped with a central well for the inflow of pulp, and peripheral launders and pipe decanters for handling the clear water. The helper in the cyanide plant regulates the lime and settlers, decants and transfers the charges. The cost of these operations is as follows:

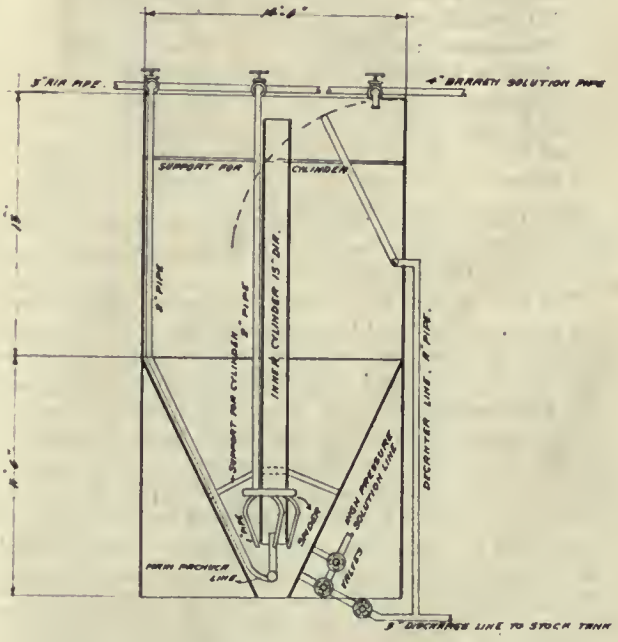
	Neutralizing, cents.	Dewatering, cents.
Labor	0.6	1.4
Supplies	4.1	4.1
Power	0.1	0.1
Total	4.8	5.6

CYANIDATION

From the dewaterers the pulp, containing 40% water, is pumped to a battery of ten 15 by 45-ft. Pachuca agitators, arranged in series, and is diluted to 1½:1 (Sp. G., 1.35) with solution from the wash-solution tank (No. 3 above) in the Butters filter system. The solution is increased to 1.2 lb. KCN per ton and the alkalinity 0.5 lb. in terms of CaO, and maintained at these strengths for 26 hours. Lead acetate, to the amount of ¼ lb., is added at the beginning of treatment and again in tanks 4 and 8 of the series. This seems unusual for gold ores, but the decomposition of the complex sulphides in the Goldfield Consolidated Mines Co.'s ore makes it necessary. All attempts to reduce the amount have resulted disastrously. Various oxidizing agents, together with bromo-cyanide, have been tested on a working scale without commercial success. The bromo-cyanide gave increased extraction, but the cost was prohibitive, except on high-grade ore. As stated, concentration tests on the tailing are made on a general monthly sample, but the loss is not in recoverable concentrate.

There is one feature which is most interesting. The assay value of the −200 product in the tailing is considerably higher, nearly 30%, in fact, than the product remaining on 200 and 150-mesh screens. This is true in both the mill and concentrate plant and is doubtless due to the presence of very brittle and insoluble alloys of gold. A picked sample of the higher-grade ore supplied to the mill gave by analysis the following percentages of elements which tend to confirm this theory: Bismuth, 0.25; antimony, 0.055; tellurium, 0.025; selenium, 0.050.

In the agitators approximately 80% of the value of the ore after concentrating is dissolved. Previous to connecting the tanks in series they were operated as 4 batteries, two of 3 and two of 2 tanks. At a gravity of 1.35, with a loss of 4 hours for transferring, the average period of agitation was 23 hours. After the publication of M. H. Kurylas' article on the results of continuous agitation at Esperanza, I wrote the management of that property asking for additional information, which was given. Using Mr. Kurylas' sketch, the Pachuca tanks were connected in series by means of 8-in. pipe connections, and experiments begun. These were not favorable to continuous agitation, and for six months thereafter the tanks were worked intermittently. The failure of the system was not explained until recently. After a new compressor with much more capacity than those previously used for agitating was put in, the tanks were again connected in series and with marked success. The only reason known here for the failure at first is that uniform agitation throughout the series is most essential. With the inadequate amount of air at



PACHUCA AGITATOR FOR CONCENTRATE TREATMENT.

that time, this could not be maintained, and the tailing, gravitating from the series to the filters, had not received uniform treatment. The following assays will give an idea of the first and second trials.

	First Trial.			*Present Operation.*		
		Oz. Au.			Oz. Au.	
	Gravity.	Pulp.	Sol.	Gravity.	Pulp.	Sol.
Heads	...	0.44	...	...	0.62	...
Agitator No. 2	1.36	0.17	0.17	1.35	0.31	0.21
" No. 4	1.36	0.16	0.17	1.34	0.26	0.256
" No. 6	1.34	0.16	0.18	1.33½	0.20	0.30
" No. 8	1.33	0.14	0.193	1.33	0.14	0.328
" No. 10	1.33	0.12	0.20	1.32	0.10	0.348
Filter Tailing	...	0.10	...	...	0.08½	...

The lighter gravity in the last tanks of the series is accounted for by the addition of solution for dissolving chemicals. The screen tests on the various tanks is as uniform as could be expected. There are so many different

kinds of ore being fed to the mill, that it is impossible to make a definite comparison of the two methods of treatment, as the ore varies within wide limits during a week's run. The continuous system during the first run was alternated weekly with the intermittent three times, with an apparent increase in tailing loss of 30%. The present operation shows a decrease of nearly the same amount, but on a higher grade of ore. The following analysis of the solution before precipitation shows some of the difficulties encountered in the treatment:

Analysis of Cyanide Solution at G. C. M. Co. by Von Schultz & Low.

(The percentages refer to the weight of the solution. Total solids by evaporation, 0.3932%. Sp. gr. solution at 70°F., 1.002.)

	Per cent.
Silica	0.00198
Ferric oxide	0.00014
Alumina	0.00020
Manganese	Trace
Lead	Trace (faint)
Bismuth	Trace (faint)
Cadmium	Trace (doubtful)
Copper	0.03686
Arsenic	0.00010
Antimony	0.00014
Nickel	0.00010
Cobalt	0.00020
Zinc	0.00330
Selenium	None
Calcium oxide	0.02837
Magnesium oxide	0.00014
Phosphorus pentoxide	Faint trace
Sulphur trioxide	0.03282
Chlorine	0.03260
Tellurium	0.00008
Gold	0.185 (oz. Au)
Silver	0.068 (oz. Ag)

The total sulphur was determined as sulphur trioxide, and no attempt was made to determine the form of combination of the elements found.

The cost of cyaniding, which, in the method of accounting employed at the plant, is really the cost of agitating, includes all chemicals necessary for the dissolution of gold, and all labor connected with the operation of tanks, pumps, and compressors, is given below. Naturally the cost has varied considerably during the three years operation, due to the increasing cyanide consumption. The mechanical cost is practically constant. Approximately 75 cu. ft. of free air per minute is required for each tank of 85 dry tons, equivalent to 6 hp. per tank. Power per ton agitated is 2c. Maintenance and repairs for tanks, compressors, pumps, and pipe-lines is less than one cent per ton agitated. The total cost, including all the above items of chemicals and repairs, is as follows:

Year	1911	1910	1909
Tons	850	850	600
	Cents.	Cents.	Cents.
Labor	2.8	2.6	2.8
Supplies	56.6	51.0	40.3
Power	2.4	2.5	3.2
Total	61.8	56.1	46.3

It may be well to state here, in order to correct erroneous impressions given in articles on cyanidation of the low-grade surface ores at Goldfield in mills other than those of the Goldfield Consolidated Mines Co., that it is a characteristic of the sulphide ores of the district to increase in refractory elements with the increase in value. One notable shipment of high-grade ore contained nearly 2.5% tellurium with a gold content approximating 2%. With depth the baseness of the ore naturally increases. It has been demonstrated here to the satisfaction of all interested, that the lower-grade ore is more amenable to treatment by cyaniding than the higher-grade ores, and that the percentage of gold extracted does not necessarily increase with the increase in value. This is the inference made in some recent articles commenting on the extraction of one of the local mills, operating on $12 upper-level ore. It is stated that this mill makes a saving of 93% on such ore, which approximates the saving made at the Consolidated mill on $30 ore. It is interesting to note that immediately after the fire of 1910, when the higher-grade ore from the deeper levels was shipped to smelters, and the mill heads lowered to something like twice the value of those at the mill referred to, the extraction at the Goldfield Consolidated mill averaged 96%. As soon as normal operations were resumed with the mill treating all the deep-level ore, with consequently increased value in the feed, the percentage recovered dropped to 94½, which was the average for the year of 1910. Attention may be called to the performance of the old Combination mill, which for crudeness of design and lack of conveniences rivaled the plants in question. In this mill, which treated the upper-level ores, and consequently those least refractory, an average extraction of 95% was maintained. It has been the policy of the Consolidated company to include in the cost in its monthly and annual reports the residues from the concentrate treatment plant which could not be shipped at a profit, with the tailing losses at the mill. As a consequence the published report of recoveries has not been a statement of the metallurgical efficiency, but more nearly the statement of the percentage of value applicable to expenses and profits. Therefore, the greater metallurgical efficiency in the concentrate plant resulted in a lower reported extraction in the mill.

(To be Continued)

Filling Mine Workings

By Charles Enzian

The tailing from the screens preparing the smallest coal for market, or particularly for boiler fuel purposes, called the 'culm', is utilized in the anthracite district of Pennsylvania for mine filling. This culm is taken into the mines by means of bore-holes or pipe-lines in the shaft or slope, in mixtures containing about 90% water, and deposited into worked-out chambers, being confined by means of suitable dams and batteries. The water drains off and the culm remains as residue, which in the process of depositing and draining generates considerable heat due to the pyrite particles present, and this, in combination with calcareous or carbonaceous shale finely ground and held in suspension by the water, forms a binder. The aggregate becomes quite firm and will stand unsupported after some time and thus sustain considerable weight. This enables second mining to the extent of from 25 to 35% of remaining solid ground. The new opening is then filled and allowed to settle into stability, and, depending largely upon whether or not the surface is valuably improved, and assuming that a risk of subsidence would be discreet, an additional or third mining may be undertaken, leaving at least 50% of the remaining solid as permanent support and the filled area to give vertical and lateral support.

To illustrate: Assuming that the first mining was so conducted as to leave 60-ft. pillars solid, the chambers being worked 20 ft. wide; this would leave a 'remaining solid' of about 60 ft.; upon the second mining, a 15-ft. slice is taken, representing 25% of the remaining solid, or a total extraction of 44%. After filling again, another slice of 20 ft. is taken, or 44% of the remaining solid, thus giving a total extraction of 70% of original solid—an ultimate mining impracticable without the method of refilling or 'flushing' as it is termed. The flushing may be with other than vein material. A common practice at the present time is to crush all refuse material from breakers, boiler plants, and rock banks, and flush into the mines. Flushing should be done systematically and scientifically; keeping in mind the preservation of roads and air courses. This necessitates building dams at the foot or entrance of each chamber, also a drainage or overflow through the entire chamber length for the escape of accumulated water, thus relieving the dams from water pressure.—*The Black Diamond.*

The Bugbear of Gold

By Charles Sewell Thomas, Jr.

Much has been said concerning the enormous gold production of the world, how it has advanced since 1880, like a great financial cyclone threatening the destruction of all credit, how it will continue to increase abnormally, and how it will eventually swamp the earth and all its industries, reducing values to chaos. It is said that the use of gold in the arts is limited—almost negligible compared to its use as a medium of exchange, that its value exists only in the mind of man. From this it appears that, should the quantity of gold become so great as to render it no longer of value as a basis of values, there will be no use for it. Enormous quantities of gold are said to exist in sea water. Untold millions of ounces of it are 'known' to exist in the clays around Philadalphia, huge deposits are spoken of, with bated breath or described with reluctant pens, in other localities. New processes whereby deposits less than fifty cents per ton in value can be profitably worked are coming to the fore—so it is said—processes that experimenters fear to tell about on account of the great harm that would result should they be utilized. So much has been said that it may be worth while to consider the matter from the miner's point of view. A consideration of the physical and chemical properties of gold, and of its occurrence in nature, will help to an understanding of the truth about the solubility of gold in sea water, of the possibility of it being held in suspension in sea water, and of the possibility of its existence in clay banks.

Gold's specific gravity is very high, 19.29. Some physicists have obtained a specific gravity as high as 20.72 by precipitation from special solutions. It is more malleable and more ductile than any known metal; leaves not more than one three hundred thousandth of an inch in thickness can be obtained by beating it. Its hardness as compared to the diamond is as 979 is to 3010. When pure, it has a tenacity of 7 tons to the square inch. Its electrical conductivity is only exceeded by that of silver and copper. It is soluble in free chlorine, in mixtures containing chlorine and bromine, in the hyposulphites of calcium, sodium, potassium, and magnesium in the presence of an oxidizing agent, in selenic acid, and in the alkaline cyanides. It is also soluble in sulphuric acid when electrolyzed, but is almost immediately precipitated by the liberated hydrogen. It is insoluble in water except under enormous pressure. With mercury, gold forms an amalgam of variable composition from which it may be freed by distillation. Advantage is taken of these properties in the extraction of gold from its ores by cyanidation, amalgamation, and mechanical concentration. In nature gold is almost always found in its native, or uncombined, state. A great deal of it occurs in combination with tellurium, the principal localities being Cripple Creek and Western Australia. Very rare compounds of gold with palladium, rhodium, and bismuth have been observed, but they are absolutely negligible as a source of supply. With few exceptions gold exists only in the volcanic or igneous crystalline rocks. Sceptics, contemptuous of the knowledge of engineers and geologists when the latter attempt to draw the line between auriferous and non-auriferous country by making use of the knowledge gained from countless districts, often say that "gold is where you find it." That is undoubtedly true. Anything is where you find it. But there exist many conditions, that are well known and without exception, under which gold cannot be found.

It has been said by many that gold exists in sea water. This hypothesis has been upheld by several reputable chemists, chief among them being J. R. Don, Henry Wurtz, and Luther Wagoner. The largest quantity found, however, was 16 milligrams in a metric ton, or, $0.0097 per metric ton in value. Of all the chemists attempting to isolate gold from sea water only Mr. Wagoner succeeded, and then only by the most painstaking and expensive methods of analysis.

Gold cannot be held in solution except in the form of a chloride, a cyanide, or a hyposulphite. In analyses of sea water cyanogen is not found. No free chlorine, the only solvent of gold, exists and there is only enough combined chlorine to satisfy the chemical requirements of the alkaline earths found. Therefore it may safely be assumed that the gold is combined in such extremely minute quantities that the presence of its solvents makes no appreciable difference in the regular analysis. If there were any greater quantity than about 15 milligrams per metric ton (12 milligrams per cubic yard) the presence of its solvents would be quite easily detected. And surely no one would go so far as to assert that a metal of the high specific gravity of gold could be held in suspension throughout countless centuries in any but the most minute quantities. It has been asserted that sea water carries 5c. in gold per cubic yard. This would be about 6½c. per metric ton. The only printed record I can find of any such quantity as this was in the literature of the Electroyltic Marine Salts Co. of Maine—a most notorious 'wild cat' swindle.

Again, suppose gold does exist in sea water to the amount of five cents per cubic yard. Its value decreases when the matter is examined from an operating standpoint. How many cents worth of chemicals per cubic yard of sea water would be necessary to obtain the proper conditions for gold precipitation? Certainly more than five. If to this be added depreciation on an immense plant, the idea becomes absurd. Suppose concentration by evaporation be tried. If natural evaporation is employed there must be more outlay for plant. If artificial evaporation be attempted the cost of fuel will add its quota to the cost of operation. Again where should the waste water be run so that the ocean, in time, may not be diluted? From a study of the literature on the subject I am of the opinion that the most painstaking analyses of sea water will not reveal an average of over $0.005 per metric ton, or $0.004 per cubic yard. It is fairly obvious that even with a great falling off in the prices of commodities, and consequent decrease in operating costs, the economical extraction of gold by any conceivable metallurgical process is impossible. We need not fear the possible demonetization of gold through overproduction from sea water.

Consider the case of the clay bank under Philadalphia. This has been said to carry 30c. per ton in gold. The only dimension of this bank that was given was a length of forty miles. Is it to be assumed to have width and thickness, or not? To have arrived at the value of this clay, assays of representative samples must have been made. The vital questions in valuing this deposit are: how were the samples taken, how were they spaced, and how many of them were there? I will venture to say that the valuation of this forty-mile clay deposit was made on not more assays than can be counted on the fingers of two hands. Suppose the clay to be a mile wide and a few feet thick. It is a matter of simple arithmetic to divide it into squares, 100 ft. on a side, and determine how many samples it would require to properly valuate it, taking samples 10 ft. apart on the lines of these squares. The job of taking these samples would cover a long period of years if properly done. The value of 30c. per ton for this clay may be taken as unwarranted until proved in some such manner as outlined. Clays are alluvial, lacustrine, or glacial deposits; generally they were deposited in some inland lake; occasionally along a seashore. Why—if sandstone, limestone, etc., deposited by heavily impregnated seas, do not generally contain gold originally laid down with them, and then only in most minute quantities—should clay be favored with the precious metal? Gold must come from some place, and the chance for it to be brought in and deposited in any rock where it does not originally exist must be given it by some dynamic disturbance that will open fissures. The entire clay bank referred to above would have had to be fissured in order to allow gold-bearing solutions to deposit their contents, for one of the properties of clay is its imperviousness to liquids.

In an endeavor to throw light on ore genesis, J. R. Don

some years ago made an elaborate series of experiments with many classes of rock, assaying all of them for gold. In the course of his work he found that several sedimentary rocks contained small quantities of gold, but only discovered this to be the case in rocks in the immediate vicinity of ore deposits. To narrow the field still further, it may be stated that in fully 90% of the cases where he found gold in the sedimentaries, it occurred in slates containing pyrite. Thus it is possible that the gold found was introduced by or after metamorphism, which made the slates, and not as an original constituent of the rock. The average quantity he found under these most favorable circumstances was 2.27 grains per long ton, or $0.11. In most cases, even near ore deposits, he got nothing at all of value from the sedimentaries, and in practically all cases at any distance from the ore deposits he got no gold. It is a generally held hypothesis that at some time in the past all beds of limestone and shale were deposited in inland seas; seas more heavily impregnated with solids than the present. Yet the largest amount of gold found in clean, unmetamorphosed sedimentaries is 39 milligrams per metric ton, or $0.0236 per metric ton in value. It is reasonable to assume that there was considerable concentration in the deposition of these beds of rock so that the seas from which they came must have contained most minute quantities of gold, if they contained it at all. Now, assuming that this clay bank does contain an average of 30c. per ton, the question of profitable mining and extraction, now and in the future, is of importance. It is necessary to take into account the rise in the prices of commodities and labor. Unless handling can be accomplished without power or labor, the cost of both rising year by year and the purchasing power of gold falling year by year, I fail to see how this great deposit of gold can be mined and treated even with great improvements in metallurgical processes. Mining with steam-shovels, handling material mined, disposal of waste and overburden, crushing and disposing of tailing will all make a charge of over 30c. per ton at present-day costs. The future, with its rise in prices, would increase this.

The rise in the price of commodities is, by many, ascribed to the immense production of gold. This is to be questioned if one takes into consideration that expansion of business has far distanced increase in gold production. If this is not so, why the advance of credit shown by the panic of 1907 so far ahead of the actual gold supply and the subsequent adjustment of business conditions more nearly to the gold supply of the world? In the principal gold-producing districts of the world the value per ton of the ore produced has been gradually falling. The great improvement in mining methods and metallurgical processes have so far kept pace with the fall, that the net profits per ton of ore produced have been fairly well maintained at a constant figure. But the time has come where further improvement will come but slowly, and, eventually, gross yield per ton and cost per ton will meet, and where this occurs further mining must necessarily cease. The following table is of interest in this connection, as it shows the condition of gross yield approaching gross costs. It represents statistics of the Rand Mines in South Africa, at present producing over one-third of the world's gold output each year.

Year.	Recovery per ton.	Cost per ton.	Dividends per ton.
1897	$9.53	$7.10	$2.43
1898	9.91	6.72	3.19
1899*	10.50	8.35	2.15
1903	9.55	6.91	2.64
1904	9.40	6.96	2.44
1905	8.59	6.53	2.06
1906	8.35	6.34	2.01
1907	8.16	6.00	2.16
1908	7.58	5.31	2.27
1909	6.91	4.71	2.20

*1899 to 1903, war period.

Those who prophecy an increase in gold production each year as great as has occurred in the last thirty years are easily answered. Statistics covering the period from 1880 to the present are valueless as a basis for future production prophesies. Thirty years ago the mining industry was in its infancy. Most mining was confined to placer work and to mining large bedded deposits. The placer miner far outnumbered the hard-rock, or lode miner, and about the sum of the knowledge of the metallurgy of gold was that it would amalgamate with mercury and could be so recovered when passed over riffles containing the latter. Today the industry is in its prime and extractions of gold are made at a cost per ton that was impossible thirty years before. The lode miner has far outrun the placer miner. Costs have been reduced to a point where they can hold their own with decrease in value of deposits and increase in prices. This abnormal development is the result of thirty years experimentation. The mining engineer thirty years ago knew little of underground mining or of the economic geology of ore deposits or of genesis of ores. Today he is an expert in the mechanics of breaking and handling material, the chemistry of metals, and the action of water on material of different specific gravity when certain impulses are given it. Mining, metallurgical, and realization costs in most places thirty years ago were such as to make ore worth less than $50 per ton unprofitable. Today in most places, these costs are seldom over $5 per ton. In a nutshell, the period from 1880 to the present represents the growth of the mining industry from a slow dormant state to its present importance. It is the period of maximum development and represents an increase in knowledge and efficiency of several thousand per cent. Hereafter improvements must necessarily proceed much slower, as in any industry that has passed the experimental stage, and the next decade will show a much smaller percentage of increase for the same reason. It will show less increase for another reason. Thirty or forty years ago little was known of the economic possibilities of most of Western America, Alaska, Canada, Mexico, South America, Central America, Australia, and Africa. Today, the unknown area of the world's surface is much less than it was at the beginning of the great rise in the world's gold production. The new fields that will come into prominence in the future will certainly do a little more than balance the ultimate exhaustion of the present fields. Rise in prices can not be attributed to too much gold, whatever else may be the cause. Rather, too little gold may sometime be attributed to rise in prices, if the latter continue to rise as they have in the last decade, for they will ultimately make the exploitation of anything but very high-grade deposits impossible.

Manganiferous Silver Ores

Manganiferous silver ores, according to E. C. Harder of the U. S. Geological Survey, consist of mixtures of manganese and iron oxides with small quantities of silver sulphide and lead carbonate. As a rule, the iron content exceeds the manganese content, but locally the iron is altogether absent. Manganiferous silver ores are divided into three classes, according to their uses: (1) The greater number of such ores is used for their silver and lead content. Manganese and iron content often insures these ores a higher price because of their fluxing value. (2) A second class of manganiferous silver ore is too low in silver and lead to be used as a source for these metals, but is sufficiently high in manganese and iron to be used for the manufacture of ferromanganese and spiegeleisen. (3) There is a third class of ore too low in silver and lead to be used primarily for these metals and two low in iron and manganese to be used for the manufacture of iron-manganese alloys. This ore is sold to the smelters as flux, the iron and manganese becoming waste products, while the silver and lead content is recovered during the smelting. These ores occur in the Rocky Mountain and Great Basin regions, the principal producing locality being Leadville, Colorado. Some of the Leadville ores are used in the manufacture of spiegeleisen. All the other localities produce these ores for fluxing only.

Ruby Mines of Burma

By John L. Cowan

It is regarded by gem experts as not improbable that the 'synthetic process' of manufacturing rubies will render unprofitable the further operation of the great ruby mines of Burma, and bring that ancient industry to a premature close. As yet, however, the British lessees of the ruby mines show no indications of apprehension as to the future. They have expended large sums of money on a drainage adit, designed to relieve the mines of the excessive floods of water that have always impeded operations, and have given serious consideration to a plan for introducing American hydraulic-mining methods to enable them to work the vast hillside expanses bordering the valleys, in which rubies are found in quantities insufficient to justify the mining methods employed in the valleys. Whether the mines are doomed to speedy oblivion, or destined to long retain their place among the world's greatest gem mines, these notes compiled from material supplied by the Burma Ruby Mines, Ltd., of London, England (with permission to reproduce the accompanying cuts) may not be uninteresting.

Shwebontha Ruby Mine.

The Burma ruby mines have been worked for at least 300 years, but little is known concerning their history. In 1597 the ruby-producing villages of Mogok and Kyat-pyin were traded by the Shan ruler to the king of Burma, who gave in exchange an important town on the Irrawaddy river. From that time until 1885, the ruby mines were claimed as the personal possessions of the Burmese monarch. Foreigners were forbidden to visit the neighborhood, and native miners were permitted to search for rubies only on condition that any stone found exceeding a specified size must be turned over to the Crown. The result might easily have been foreseen. Unless an emissary of the king happened to be on the spot when a gem of exceptional size was discovered, it was promptly broken into fragments. Its value was reduced to a fraction of what it was originally, but the finder received the benefit.

In 1885 Upper Burma was annexed to Great Britain, and not long afterward the ruby mines were leased by the Crown to British subjects. In 1889 the lease was taken over by the Burma Ruby Mines, Ltd., with a capital of £300,000; and from that time dates the modern exploitation of the world's greatest ruby mines. It was felt that it would be both unjust and impolitic to dispossess the native miners, who, like their ancestors, had been mining rubies under the restrictions imposed by the Burmese monarch for generations. So these were permitted to continue at work, on terms more advantageous than they had enjoyed under the native regime. Each native operator is allowed to employ as many men as he pleases, paying to the company a fee of 20 rupees per month, and disposing of the stones found as he wishes. The native methods of mining are crude and primitive, no machinery being employed, the gravel being raised from the pits in baskets, and the precious stones picked out by hand. It is largely a gambling enterprise. Handling such small quantities of gravel, a man may work for months without finding a stone of any considerable value. On the other hand, he may at any moment find a stone worth a fortune.

Years of costly experimenting were required before the English company succeeded in working out a profitable method of operating the mines. It was found that all the ground of certain value was already taken up by the native miners. The field open for exploitation, then, consisted of trackless jungle and rocky hillside. Not caring to begin with untried ground, of problematic value, the company bought out a large number of the native miners in the valley of the Mogok river. As soon as extensive operations were attempted, such vast floods of water entered the pits that work had to be abandoned. The rainfall there is very heavy, a precipitation of 24 inches having been recorded in three days, so that both the surface and underground flow is very great. In another valley, a few miles distant, a conical peak, known as the 'Hill of the Spiders' (or *Pingu-taung*, in the Burmese dialect), contains many caves, and these were indicated by native tradition as the real home of the ruby. The entire working force available was next put to work in these caves, in the belief that a volcanic pipe, similar to the famous pipes of blue ground at the Kimberley diamond mines, would be found. The first day's washing resulted in the discovery of one of the largest and finest rubies that the English company has ever recovered. That stimulated the engineer in charge to renewed endeavor, appearing to prove conclusively that he was on the right track. Strangely enough, that single large ruby was the only one of value that the Hill of Spiders ever yielded. Thousands of dollars were expended in bootless labor, and months of time were lost, before the conclusion was reached that nothing more than a waste of money was being accomplished.

Pumping Pit at Shwebontha Mine.

All this simply shows that ruby mining, even before the discovery of a method of manufacturing artificial rubies, was not all poetry and profit. It had its difficulties, discouragements, and losses, just like such prosaic enterprises as digging coal or raising potatoes. It is fortunate that the company was provided with ample capital, and backed

by British pertinacity. Otherwise the history of ruby mining in Burma might have ended right there. A mile or so distant from the Hill of Spiders is the Tagoungnandaing valley, small in extent, and impossible of operation by the Burmese on account of the extraordinary flow of water encountered as soon as pits were dug. Pumps were put in to rid the pits of water, and work was begun here with all the native labor that could be hired. At last success crowned the efforts of the ruby miners, and the enterprise was placed upon a paying basis. This little valley was worked out in two years, but the methods employed there have given results equally gratifying in the Mogok valley and other localities in the ruby-producing district. Mining methods seem rather crude, but their best defense is found in the circumstance that they pay. A pit is sunk, 10 ft. square and usually about 25 ft. deep. Then a centrifugal pump is put to work in the pit, gradually draining out the water from the soil surrounding. Then the ground around the pit is dug away, loaded into cars, and hauled to the washing plant. In time the ground is removed down to the bottom of the pumping pit, which is then dug deeper, and additional pumps put in. The Shwebontha mine, which has been operated since April 1894, is now a great open-cut, in successive 'lifts', with a large pool of water in the centre, fed by rivulets coming from all directions. From the pool, the pumps raise 5000 gallons of water every minute. The pumps, mine-cars, and all machinery used are run by electric power, a large dam across the Mogok river, with a fall of 208 ft., generating the power required for these purposes.

It is obvious that the removal of the water is a difficulty that grows more and more serious with every additional foot of depth. To dispose of this once for all, a drainage tunnel 5400 ft. long, 7 ft. wide, and 7 ft. high is being excavated. This will drain the ground to a much greater depth than has yet been attained in the workings, and will carry the water far down the gorge. As fast as the earth is excavated it is loaded into trucks, which are hitched to endless chains and hauled away to large screens, through which it falls, thoroughly shaken and disintegrated, into the washing pans, 14 ft. in diameter. It is now a thick mud, which is worked over and over by rows of steel teeth set in revolving arms. Water running through these pans washes out the clay and light gravel, leaving the heavier materials, including the precious stones. In ten hours 1000 truck-loads of earth from the mine are reduced to 10 truck-loads. In the safety-pans the concentrating process is repeated, as a precautionary measure, but it is found that not more than one per cent of the gems escape from the first washing pans. The materials left in the washing pans are thrown into covered trucks, which are then locked until the sorters are ready for them. Then the mass of gravel, including the rubies, is thrown into a large bin, from which it gradually escapes into a revolving screen, arranged with meshes of different sizes. First the sand is eliminated, then the clean stones and pebbles drop in five different sizes, the last and largest size falling directly upon the sorting tables, and the other four into the 'pulsator'. This is described by the company's manager as a "sort of perpetual-motion jigger which passes the light stuff away into trucks, while the heavy remainder falls into a locked receptacle." From this receptacle it is taken by the sorters. A large sieve is taken by the sorters, filled with the concentrate, placed in a tub of water and worked and shaken until all the heavier materials sink to the bottom. The sieve is then turned upside down, and its contents emptied upon a table, so that the rubies (being the heaviest) are on top. They are then picked out by hand. Every afternoon the sorters take the day's find to the company's office, where the rubies are sorted into fourteen different grades.

In addition to rubies, spinels, sapphires, garnets, corundum, tourmaline, beryl, and fragments of rock crystal are found. For most of this material there is practically no market in Europe, so that it is usually sold to Burmese dealers for any price it will bring. About half a million carats are sold monthly for from $8000 to $10,000. Every two weeks the company holds a sale, when all inferior rubies and other stones that are considered valuable enough to be included in the monthly clean-up sale are auctioned off to Burman, Shan, Chinese, and East Indian dealers. These auction sales are often scenes of great excitement, intense rivalry prevailing among the dealers. Lumps of red corundum are often put up, apparently of little value on account of their poor color; and yet there may be a ruby of perfect color somewhere in the mass. The Burmese are born gamblers, and always anxious to take a chance of that kind. As high as $3000 has been paid at one of these sales for a lump of red corundum that turned out to be worthless.

Mogok, 60 miles from the Irrawaddy river, is a very considerable town supported entirely by the ruby trade. Many hundreds of men are employed by the British company and the native lessees, and buyers flock thither from all parts of Asia. While the British company sends all its finest stones to London, there are no restrictions placed upon the Burmese lessees, who sell their finds wherever they can get the best price. Then the tens of thousands of small and inferior rubies, as well as the spinels, sapphires, garnets, tourmaline, and other gems are distributed all over Siam, China, India, and the East Indies, supplying the major part of the cheap jewelry of the Orient. In nearly every other house in the town may be seen a group of dealers, Burmans, Shans, or natives of India, squatting around a metal plate upon which the stones for sale are displayed. In addition to these private sales, a regular stone bazaar is held every afternoon in some sheds outside of the village. Mogok, in fact, is one of the world's greatest marts for the purchase and sale of precious stones, as the British company does not by any means enjoy a monopoly of fine gems, and prefers that inferior stones be sold in Burma, and thus kept off the European markets. When the drainage adit is completed, it is estimated that it will make available 177 acres of ruby-bearing gravel, estimated to contain rubies to the value of at least $15,000,000, at present prices. In addition to the Mogok valley, which alone will be affected by the tunnel, the Myintada, Enjauk, Yaybu, Loodah, Kathay, Pama, Kyat-pyin, Bernardmyo, and numerous other valleys are known to contain rich ruby-bearing deposits, some of which are being worked by the natives, while others have never been touched excepting by prospectors. Then in addition to the alluvial deposits of the valleys, there are extensive hillside expanses in which rubies are found, but not in sufficient quantities to justify the application of the same methods that are now in use. It is thought that hydraulicking, as practised in California and elsewhere in America for the recovery of gold from similar deposits, will be applicable to these regions. It is evident, then, that the active exploitation of the ruby deposits of Burma has been no more than rightly begun. It is unquestionable, however, that the future of the ruby mines is endangered by the manufactured rubies. These, it is said, can be made at an expense of about 40 cents per carat. They are not imitation rubies, inasmuch as in chemical composition, color, refraction, hardness, durability, and beauty they are identical with the rubies of the mines. Of all the world's gems, the perfect 'pigeon's blood' ruby has long been esteemed the most valuable. Several years ago the largest stone yet found by the British company, weighing only 11 carats when cut, was sold in London for $35,000. A perfect ruby of five carats weight is worth more than ten times the price of a first-water diamond of the same size. In 1875 the financial exigencies of the Burmese government made necessary the sale of two fine rubies. One, when recut by European lapidaris, weighed 38 $^{9}/_{16}$ carats, and sold for $100,000. The other weighed, when recut, 32 $^{5}/_{16}$ carats, and sold for $50,000. These are among the finest rubies that have ever reached the Occident. It is true that there are larger rubies among the crown jewels of France, Russia, Portugal, Spain, and England, and even in several private collections, but most of these are Ceylonese or Siamese gems and lack the perfection of color that makes the Burmese stones the world's standard of excellence.

Rand Metallurgical Improvements

By R. W. Schumacher

*Considerable improvement has been effected during the last year in our metallurgical work. I refer, in the first place, to the Butters vacuum-filter which was put in at the Crown Mines and formally taken over by the company after a most exacting trial of six months' duration. Tests were made first on current slime, then on a mixture of current and accumulated slime, and finally on residue from the existing slime plant after washing treatment by the Adair-Usher system had taken place. The most important points to be determined in these tests were: (1) To what extent could the gold in solution be recovered? (2) What would be the cost of this recovery? The six months' trial showed that the recovery of gold was practically complete, the minute quantity of gold in the final residue being due to traces of unprecipitated gold in the solutions used as washes. As regards the cost of treatment, the operations of the plant at only one-third of its capacity and under conditions requiring an abnormal consumption of acid in clearing the filter-leaves, made it difficult to arrive at finality. But it can safely be deduced from our Crown Mines experience that at a plant working normally on current slime, the cost of operating should be somewhere between 2d. and 4d. per ton, according to the tonnage treated. The final test at the Crown Mines showed a recovery of over one shilling per ton from residue already washed by the Adair-Usher system. The results of the vacuum-filter plant have, so far, been decidedly satisfactory, and show a distinct improvement on former methods of treating slime, so that on the advice of the chief metallurgist of the company, F. L. Bosqui, the same type of plant is now being erected at the Bantjes Consolidated Mines, Ltd., the New Modderfontein G. M. Co., Ltd., the Robinson G. M. Co., Ltd., and the Modderfontein B. Gold Mines, Ltd.

The Merrill zinc-dust precipitation process has also been ordered for the New Modderfontein and the Modderfontein B. The advantages consist chiefly in the lower consumption of zinc, and the saving in labor. This process has also, together with the Butters filter, the advantage of introducing greater precision into metallurgical calculations. The zinc-dust system admits of a more accurate determination of the gold precipitated from day to day, and gives a complete clean-up, so that there is little chance for error in estimating the gold carried over in the zinc from month to month, as in the existing system.

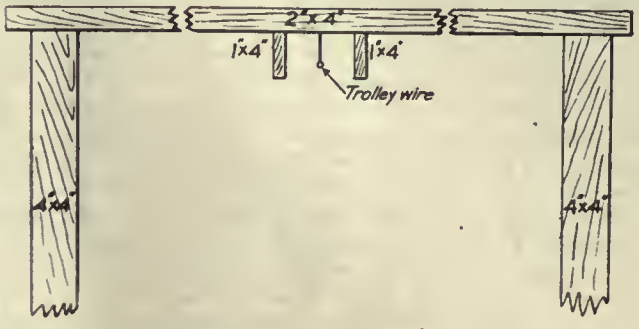
Barytes as a Pigment

One of the principal uses of barytes is as a pigment in mixed paints. It is used in the finely ground, bleached, and floated condition and is a constituent of lithopone. Barytes and blanc fixe (artificial barium sulphate) belong to the class of pigments called inert extenders and reinforcing pigments, along with such other minerals as gypsum, whiting, asbestine, and silica. In the past the overloading of mixed paints with inert pigments has been the main cause of a strong prejudice that has grown in the minds of consumers against the use of such pigments. So-called 'pure-paint laws' have been enacted in certain States, making it compulsory for paint manufacturers to label all paint packages with the formula of the contents. In connection with this movement toward paint legislation the thorough testing of mixed paints has been carried on during the last four years by a committee representing the Masters Painters' Association of Philadelphia and the scientific section of the Paint Manufacturers' Association of the United States, which reports that these materials have no especial value as pigments when used alone, but that their intelligent use within certain limits is necessary for the production of a satisfactory mixed paint.

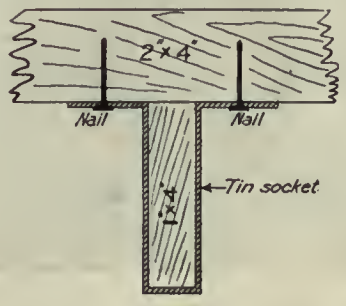
*Abstract from report of the annual meeting of the Rand Mines, Ltd., published in *The South African Mining Journal*, March 25.

Trolley Protection

The increasing use of overhead trolley wires in and around mines makes important any devices for minimizing the danger of men coming into contact with them. While the current used varies, it is always of sufficiently high potential to severely shock and often to kill. Different individuals exhibit unlike degrees of susceptibility to electric shock and the same person under different conditions may be killed, burned, or shocked by current of the same voltage. In mines the wires are usually strung at one side, or high enough to be out of the way of a man walking under them. It is impossible, however, by these means



alone to prevent accidents due to contact through tools or pipe carried on a man's shoulder, and it is equally impossible to prevent men from resorting to this customary manner of carrying a load. At the Harvard mine, near Jamestown, California, where C. E. Shafer is manager,



there is an electric trolley system for carrying ore from mine to mill. The trolley here has been housed-in on each side so as to effectually prevent accidental contact. The details of the method of construction are illustrated in the accompanying figures. Essentially, 1 by 4-in. boards are fastened by means of tin strips to the overhead stringers, in such position as to parallel the horizontal wire. As the wire is hung less than 4 in. from the stringers the effect is to give complete security. At this mine a four-wire system is used, but for clearness only one wire is represented in the figures.

The same system is used at the Melones mines, managed by W. G. Devereux. This mine is opened by a 700-ft. adit. The construction illustrated is only found necessary in and around stations. From the loading station to the entrance of the adit, the trolley is high and the distance is so long that men never walk carrying tools. For transporting men a passenger car has been built, and this is completely covered with a light wooden roof, so as to make it impossible for either men or tools to touch the wire.

Peat is used as a fuel in European countries, but has found but little application to this purpose in the United States, as the amount of the production so used last year was but little over a thousand tons. Peat has numerous disadvantages, the chief being its large content of water (and corresponding low fuel value) and its bulky and friable nature, which unfits it for transportation. These may be partly overcome by drying and briquetting, but the cost of so doing is in most cases too high to be commercially profitable. Plants are in operation in Maine, Massachusetts, New Jersey, Michigan, and Iowa.

Roasting at Kalgoorlie

By M. W. von Bernewitz

At the Associated Northern Blocks, Kalgoorlie, Western Australia, the ore from the Main Lode is of a rather soft schistose character and contains tellurides and pyrite, the sulphur averaging 3%. The ore from the West Lode is much harder, containing practically no telluride, but some graphite and 4% S. All the ore is crushed in Krupp ball-mills through a 27-mesh screen, and fed into six Merton ordinary furnaces. These have three hearths 6.5 by 30 ft. each in the clear, and a finishing floor 6.5 ft. in diameter. The furnaces are run at one revolution in 45 seconds, and absorb 2.5 hp. each. It was found that, with the first-mentioned class of ore, 120 tons per day could be roasted; but with the latter, the tonnage fell off to 110 and 100. The furnace feeders, simply small screws in a cast-iron tube at the top floor of the furnace, and driven by sprocket wheels and chain, are arranged for different quantities. The Merton furnaces here are fairly satisfactory, but at times difficult to regulate. On the top hearth the ore is merely warmed. Roasting commences on the second, while on the third hearth most of the sulphur is eliminated, helped, of course, by the action on the finishing floor. The temperature is not easily regulated, and the third floor is depended

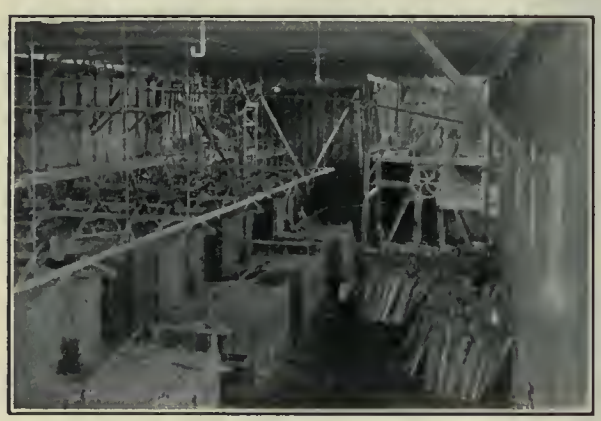


Fig. 1. Interior of Associated Northern Mill, Showing Merton Furnaces.

upon to do too much work. The flue-gas averages 600°F., a mercury pyrometer being fixed in each goose-neck flue that connects with the main and stack, the latter 100 by 6 ft., bell-bottomed. The draft averages 0.5 inch in the main flue, dropping to 0.02 inch at the fire-box. There being so many turns in the furnace, the draft is checked somewhat. If the furnace was fired too heavily, the ore tended to 'ball,' and the roast would test poor. This 'balling' is a peculiar thing in roasting in Kalgoorlie ores, and was discussed at one of the meetings of the Australian Institute of Mining Engineers. When the heated ore 'balls,' it does not get hard, as the slightest touch with a bar will break it up again. One metallurgist thought that it must be the result of a change in the lime in the ore during roasting to $CaSO_4$. Another said that possibly the schistose nature of the ore would account for it. However, it is rather interesting, and if the lumps are discharged from the furnace, they enclose particles of ore not properly roasted; hence, it is desirable to prevent their formation.

On firing up afresh, it is found advantageous to let in an extra quantity of air for perhaps one-quarter hour, until the firewood is well alight, there being a deficiency of oxygen at this time, due to the new fuel. It is not customary to fire continuously, as tests showed that, if this were done, the soluble sulphides in the roasted ore were much higher than when firing was intermittent. Roasting the heavy sulphur ore after it had been crushed through a 30-mesh screen was tried, but the result was little better than with the coarser material.

In connection with the subject of furnace design, namely, superimposed hearth furnace and the straight-line type, the remarks of J. E. Edwards in 1909 before the Western Association of Technical Chemists and Metallurgists should be read. At the Associated Northern, the formation of sulphuric acid has been noticed for years, on the arches under the furnaces where the footstep bearings of the rabble spindles are. This acid is highly concentrated, and is less noticeable toward the finishing hearth. Its formation was puzzling for a long time, but it is probably due to gas drawn down between the spindles and bottom hearth, and condensing on the cool arch outside. Fuel consumption averages 14% of weight of ore fed into the furnaces. The discharged ore is taken by a short push-conveyor to an elevator, and from this into a mixer, and mixed with 0.04% KCN solution. The resulting pulp flowing to the pans is very hot. There does not appear to be any extra consumption of cyanide on this account, and fully one-half of the gold in the ore is in solution at this point, so much so that, when roasting is good, no more cyanide is added to the agitators, which only work for four hours. For a quick, though rough, test of the roasted ore, the lead acetate method is used; while for accurate work in determining soluble sulphides the iodine test is used. The cost of roasting averages 66c. per ton roasted.

No accurate estimate of the amount of the dust saved

Fig. 2. Stack of Roasting Plant, Giving Off Arsenious Oxide Fume.

was ever made, and as for determining stack losses, that is rather difficult. The dust is raked out at regular intervals into a small push-conveyor, and is elevated to the fine-ore bin, mixing with the raw ore from the mills to be roasted. This mixture roasts fairly well, but the half-roasted flue-dust tends to make the ore flow very fast in the furnaces. The dust from the ball-mills was drawn off by a fan, and blown into a canvas-lined house for collection. This stuff was exceedingly fine, less than 200 mesh, and roasted well. In the furnace it puffed up a good deal, and gave the impression of a tremendous feed coming through. The ball-mill dust is now blown into the furnaces on the second hearth. Part of the Northern mill is set apart for custom work now, and some interesting lots of ore come in for roasting. Perhaps the most interesting lot was one of 40 tons of concentrate containing over 20% arsenic. One Merton furnace dealt with nine tons daily of this, giving a splendid roast. As soon as the concentrate was fed into the top hearth it caught fire, and the sulphur and arsenic were well out before the end of the third hearth. Dense white fume of arsenious oxide was emitted from the stack, and quickly settled to the ground, but there were no complaints.

The ore at the Associated mine is hard and high in sulphur, the average during the month these notes were written being 5.5%. The ore that comes from Tetley's section of the mine runs as high as 7% S. The ore is crushed in Krupp mills through an average screen of 28 mesh, and the fine ore is fed into 17 ordinary Merton, one Associated, and two Edwards duplex furnaces. The Merton furnaces

were built badly at the start, and reconstruction has not helped them much. Being generally in poor order, their capacity on this ore is only from 10 to 15 tons each daily. Four of them were experimented with on the following lines. On one the finishing hearth was extended about 7 ft., this making three rabbles working in the hottest part of the furnaces; on another furnace the finishing floor was extended to admit putting in an extra rabble; the third was rebuilt similar to the first, only that it had a stack of its own to test the draft; while on the fourth a fire-box was built at the back of the second hearth. The ore roasted gets too hot near the feed end, while the work of the other three is a slight improvement over that of the ordinary type.

The Associated furnace, devised by Messrs. Daggar and Bull, is rather interesting. It has two hearths, each 46 by 6 ft., and the feed travels along the top floor to the fire, drops through a port on to the second hearth, and is rabbled from the fire to the discharge end. The fire has no connection with the bottom floor at all. This is not simply a cooling hearth, as when the ore drops on it, not more than 50% of the sulphur has been eliminated. Here it burns away until the third rabble from the discharge, when the ore cools off quickly. The furnace has 14 rabbles on each hearth, traveling at 3 r.p.m., the rabble in the fire end going at 6 r.p.m. It has a stack of its own, with 0.55-in. draft. The stack for this furnace is erected close to the discharge end, there being only a flue of a few feet. With such a strong draft, a fair amount of dust results. A screen test

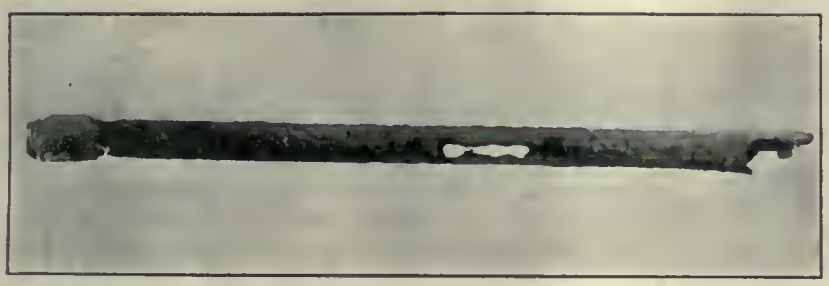


Fig. 3. Water-Pipe in Rabble; Showing Corrosion.

of the dust left in the flue, quoted below, shows that practically only coarse particles are left behind.

Mesh.	Per cent.
On 30	14.3
" 40	42.6
" 60	16.3
" 80	7.3
" 100	4.0
" 120	1.3
" 150	1.0
Through 150	13.0

The daily capacity is 27 tons, and the roast is rarely poor. Fuel consumption is about 11%. I think that, some years ago, J. A. Greenawalt, of Cripple Creek, also advocated this principle in roasting.

The Edwards duplex furnaces do admirable work on the heavy sulphide ore. The two in use are not exactly similar. The hearth area, common to both, is 11.75 by 107 ft., with three fire-boxes, each 6 by 2 ft., No. 1 furnace has the first fire-box 56 ft. and the second 66 ft. from the feed end, the third being at the discharge end. This furnace has a fall of 0.25 in. per foot, and the rabbles travel at 4 r.p.m. In No. 2 furnace the fire-boxes are 42 and 66 ft. from the feed end. It has a fall of 0.31 in. per foot, while the rabbles travel at 2.62 r.p.m. The draft averages 0.55 in. There are 52 rabbles in each furnace, 32 of these being water rabbles. Hot water circulating in roasting plants is, for some reason not yet understood, very corrosive. It eats away pipes wholesale, especially the water-pipes in the rabbles. A ¾-in. iron pipe may last a year, when it is riddled with holes, as will be seen in Fig. 3. Copper pipes have been used on some mines with some success. The rabbles used here are cast at the mine, and instead of having a pipe to the toe of the rabble, a web is cast in the rabble about ½ in. thick, and this gets over the trouble.

In the No. 1 Edwards, the ore gets a dull red about the fifth rabble from the feeder, while in No. 2 it starts quite near the end, and this furnace does the better work of the two, with about 10 tons more capacity daily, simply because of the first fire-box being nearer the feeder, the extra fall, and slower rabbling. The furnace feed conveyor is fed by a screw, from the fine-ore bin, driven by cone pulleys giving about 75, 90, and 105 tons of ore to each furnace daily. Recently they have averaged about 95 tons each. They are motor-driven, and use 6 amp. at 550 volts each, the ammeter being a splendid guide as to the amount of ore fed into the furnace. These furnaces are easily regulated, and if results are poor at any time, they are stopped for a few minutes, then run slow for perhaps a quarter of an hour, and fired heavily, letting in plenty of extra air. In about half an hour a bad roast is entirely corrected. The end fire-boxes are not used much, just two or three logs are kept burning to warm the air passing through the fire-bars. I might say here, with reference to bad roasting, that often this end fire-door is left open to let in an excess of air. It would seem that certain liberties may be taken with such high sulphur ore, much different to an ore carrying only 3% S. The middle fire-boxes are fired heavily, and the sulphur continues to burn till the fourth rabble from the discharge, namely, 22 from the feed end, and then discharges quite cool. Fuel consumption averages 11% of the ore roasted. The flue temperature is 700°F. One man attends two furnaces, and they are greased only on day shift. On these furnaces roasting costs about 60c. per ton, while the total cost for the whole roasting plant is 80c. The roasted ore is elevated and mixed with 0.03% KCN solution, and unless roasting is poor, the consumption is low, and a great deal of gold is dissolved here, the final pulp being agitated for 1½ hours with 0.065% solution in A. Z. agitators.

Since the above notes were compiled, the Associated mill is being overhauled and remodeled, with a view to cheaper and more efficient work. In the roasting department, eight Merton furnaces have been dismantled, and the nine remaining shut down for good, and the flues torn out. In place of these, two Edwards duplex are being erected similar to No. 2 described, while the fire-boxes of No. 1 will be altered also. It is hoped with the four furnaces to deal with 10,000 to 12,000 tons monthly. Except the brick, every part of the roasters is being made in the mine's foundry and fitting shop, so they will be erected at a minimum cost. This, with the lowered cost of roasting, should allow a marked decrease in treatment cost.

Oil-Land Withdrawn

The petroleum lands in the public-land States constitute one of the most important natural resources remaining in the hands of the Federal Government. As a result of investigations by the United States Geological Survey large areas of these lands have been withdrawn from public entry pending legislation needed to prevent their wasteful exploitation. On April 1, 1911, these withdrawn oil lands aggregated near 4,000,000 acres. The States in which they are situated and the acreages are shown in the table which is given below.

	Acres.
Arizona	230,400
California	1,594,332
Colorado	87,474
Louisiana	414,720
New Mexico	419,901
Oregon	74,849
Wyoming	392,306
Total	3,795,548

Improvements in Assaying

By Abbot A. Hanks

*It is interesting to note the changes that have taken place in the last twenty-five years in the apparatus and methods used in fire assaying. In the early eighties, assay furnaces were ponderous affairs built of fire-brick and fired with coke or charcoal. Here on the Pacific coast we could not use local coke and our fuel was the so-called 'English' coke imported from abroad, principally Belgium, at a cost of from $20 to $25 per ton. The furnace was mounted on a base in order to bring the muffle to the proper height. On account of the smoke and heat special chimneys were necessary. In the city, where furnaces were connected with flues in ordinary buildings, there was continual danger of fire from over-heating. All crucible fusions were made in a special crucible or wind-furnace. Where the assayer was not burdened with an abundance of work, he generally made one furnace do for both fusions and cupellations. The muffles were small, usually not over 6 in. wide, and held from 6 to 12 cupels. Modern muffles hold from 20 to 30. Space around and under the muffle was filled with burning fuel. The charge-door above the muffle permitted the introduction of crucibles which were imbedded in the hot coke. If the fire was not properly built up it burned away completely in the 40 to 50 minutes required for fusion and the crucibles fell over and spilled the charge. There was always danger of the coke getting into the crucibles, and they are frequently covered with fire-clay lids. These covers induced boiling, and where the pots did not boil over the charge frequently stuck to the bottom of the cover. It was not customary to use nitre in those days for oxidizing the sulphide ores. In some cases the heavy sulphides were given a preliminary roast in a flat roasting-dish in the muffle.

The other method was the use of just enough litharge to give the proper size lead button, while the excess of sulphide was taken care of by adding iron nails. This gave dirty slags, and in a heavy sulphide ore the nails would eat through or form matte, which adhered to the lead buttons. The wind-furnace held 4 to 8 crucibles to a charge, while the combination fusion and muffle furnace usually held 2 to 4. Now in the large muffle furnaces 15 to 25 can be run at once, according to the size of the muffle, and of the crucibles used. When cupellation was carried on in a furnace used also for fusions, the temperature of the muffle would vary with the condition of the furnace, being high when the fusions were about ready to pour, and low when the new lot of crucibles had been charged. Of course, with this wide variation of temperature, careful cupelling as it is understood today was impossible. Although silver at that time was selling for its full coin value ($1.29 per oz.), closer check than 1 oz. was not expected even on low-grade ores. The gold and silver button was parted in a test tube, using comparatively strong nitric acid and heating the test tube over the flame of a bunsen burner or alcohol lamp. Under this energetic action the gold broke up into a fine powder. In fact this breaking up was considered necessary to insure proper parting. When the silver had all dissolved, the acid solution was decanted and the test tube filled with distilled water. It was inverted over a small clay annealing cup and when, in the opinion of the assayer, the gold had all settled into the cup, the tube was slipped off with a dexterous motion of the hand, the cup dried and annealed.

Few balances were made in this country, all the fine scales coming from England and Holland. The beam was not graduated to its full length and frequently there was difficulty in getting an exact weight where the button registered less than 1 mg. and more than $^{9}/_{10}$ mg., this latter being the highest weight which could be read on the beam with the rider.

*Read before the California section of the Amer. Chem. Society.

Samples were prepared by breaking down large lumps with a hammer on an anvil, or were given a preliminary crushing with mortar and pestle. The mortar has made more trouble in salting samples than any other piece of apparatus. Energetic action with the pestle wears pits in the bottom of the mortar, and particles of free gold are driven into the little holes, where they remain to be gradually ground out as successive samples are pulverized, much to the detriment of accurate work. The final pulverizing was usually done on the bucking-board. As this was pretty hard work, the assayer or his assistant contented himself with putting through just enough pulp for one assay. Instead of grinding from 8 to 12 oz. through 80 to 100-mesh screen, a 2 or 3-oz. sample ground to pass 40 mesh, or in special cases, 60-mesh, was considered good enough. A strong man could buck down a 6-lb. sample in from 12 to 15 min., while now by machinery a sample twice this size is ground to a much finer mesh in 5 min. It must be remembered that in those days there was in our cities no easily available source of power. Electricity was not then supplied to the business portion of the city as it is today, and the assayer who required power would have had to put in a steam plant or gas engine.

The first crusher which I remember was the John Taylor rock fine-crusher. It was a hand machine on the lever principle, which enabled us to crush samples of several pounds each to a uniform product of ¼ in. or finer. It could be readily cleaned, and it was a great improvement over the old method of breaking large samples with a hammer. This was followed by power machines, both crusher and grinder; most of these, however, were large machines, requiring considerable power, and more adapted for the use of smelting and sampling works where big samples had to be prepared. The first crusher which I used was the Bosworth, manufactured in Denver, a ponderous little machine which, however, was not strong enough to be driven by power and gave a good deal of trouble. One of the early pulverizers was the Luckhardt grinder built on the same principle as the Braun pulverizer, but of course much more crudely constructed. With the introduction of electric power, laboratory crushing and grinding machinery has been improved until today it is possible to obtain rock breakers of steel, built just as carefully as the machines of full size used in large mills, and capable of crushing from 150 to 500 lb. per hour to ¼-in. size, with every facility for careful cleaning between samples. Our pulverizers can be set to grind to 100 mesh and even finer and can also be perfectly cleaned after grinding each sample.

The first radical improvement in assay furnaces dates back to the invention of the gasoline burner. In England, where illuminating gas was cheap, the gas muffle-furnace has been used for many years in the mint and Government assay offices. In this country, however, the high price of city gas has until within the last few years prevented its general use. The first gas burner was the Hoskins, manufactured by Mariner & Hoskins, the well known assay firm of Chicago. While this burner had many disadvantages, it foreshadowed better things. The gasoline flame is intense and can be confined to a small box. There is no smoke and small furnaces are used which can be placed on an ordinary work-table. Frequently no connection is made with the flue, the small amount of gas and fume generated passing into the room. It will be seen at once what a radical change this involves from the unwieldy coke furnace which had to be frequently rebuilt or relined. There was an enormous saving of labor in handling fuel and ashes, and as there was practically no dirt the furnace could be placed in a room where the more delicate operations of assaying were carried on. The Hoskins burner, however, never found favor on the Pacific coast. It could not be used for cupelling, owing to the fact that a reverse draft was created in the muffle which prevented the cold air from entering and stopped oxidation.

Frank Fielding, head assayer of the Con. Virginia mines, of Virginia City, invented and patented, about 1885, a gasoline burner that was a great improvement over the Hoskins.

At that time Mr. Fielding was in charge of a plant which ran assays for all the Comstock mines. With several assistants he turned out from 150 to 200 assays per day. Mr. Fielding constructed a large number of small crucible furnaces, each capable of holding four pots and each equipped with its own burner. The furnaces themselves were not much larger than 1 ft. cube, and were placed on a worktable covered with sheet iron. With this plant Mr. Fielding and his assistants were able to fuse from 50 to 75 assays per hour; an unheard of amount of work in those days. But he was forced to use coal or coke furnaces for cupelling.

The first notable advance in gasoline-burner construction was the advent of the Cary burner, put out by Braun of Los Angeles about fifteen years ago. In this burner the proper principles were applied. A needle-valve permitted the perfect regulation of gasoline vapor and the combustion chamber did away with all trouble of flashing back. Improvements have been steady in burners, tanks, and pumps, so that now the apparatus of the assayer is portable, even to the gold balance, and can be carried on muleback to almost inaccessible localities. There have been improvements also in gas burners and many large offices are using city gas for both fusion and cupellation work.

The introduction of oil has been of great importance on this coast and this fuel has been adapted to use in the assay-furnace. A number of large mills and reduction plants using crude oil for fuel have introduced this also for their assay-furnaces. It gives a satisfactory heat, but it requires a large fire-box, and if the furnace is not properly constructed the hottest part of the flame will be in the chimney instead of around the muffle. Stove distillate of 28 to 32° gravity is better than crude oil for furnace work and almost as cheap. It flows more freely, giving no trouble even in the coldest weather. It is not explosive and does not carry the water and grit found in crude oil. It burns with a shorter flame and apparently gives just as much heat. In the old days all silver assays were run in scorifiers in the muffle. In Colorado, where at that time most of the ores assayed were silver ores, this led to the building of large coal furnaces carrying two or three muffles each. The scorification assay has its limitations, however. Only a small amount of ore can be used, and the results on gold are generally low. It was not long before small crucibles were run in the muffle and now the best practice calls for running all fusions in the muffle rather than in the open or pot-furnace. This method has many advantages. The heat of the muffle is more even and all crucibles receive the same treatment, while in the direct-flame furnace the crucibles nearest the burner are hotter than those farther away. The muffle holds 15 to 20 crucibles, which are all charged at once. They require very little attention for 30 to 50 min., during which time the assayer can busy himself about other work. In the direct-flame furnace it is necessary to pour and recharge a set of pots about every 10 min. The muffle is not nearly as hot as the open furnace and so is much easier on the operator. After all fusions are complete the temperature is lowered and the lead buttons are cupelled in the same muffle.

In few of the modern assay offices are silver buttons parted in test tubes. Almost all assayers now treat twice with nitric acid of different strengths. A weak acid of about 1.11 sp. gr. (18% HNO_3) is first run on which dissolves the bulk of the silver. The button is given a final treatment with stronger acid of about 1.32 sp. gr. (50% HNO_3) and then washed. In the old method of treatment in the test tube with one boiling with strong acid there were undoubtedly considerable losses in fine gold which was broken up to a powder by means of the violent action and which did not settle but floated off in decanting. The present custom is to flatten the silver button and place it in a porcelain cup. Here it is treated with the two strengths of nitric acid, washed, annealed, and the fine gold brushed from the parting cup directly to the pan of the balance. It is possible to part buttons containing a large excess of silver and still retain the gold in one lump or mass, and as there is no transfer, the possibility of loss of gold is reduced to a minimum. Some assayers still part in glass, using small Erlenmeyer flasks.

There have been great improvements in balances for assay work. The long-armed machine of twenty-five years ago was quite accurate, but altogether too slow for the requirements of the modern assay office. We are frequently required to weigh up 50 to 75 gold buttons at the end of the day's work. To do this with the slow-moving long-armed Ortling balance in use twenty-five years ago would have been almost an endless task. Now a good operator can accomplish this in 1 to 1¼ hours, or at the rate of about one button per minute. The Keller type of balance is finding favor now for the most delicate work. This balance is made with short hangers, the distance from the knife-edge to the pan-support being about two inches as compared with nine inches in the older type. This makes a low and self-contained instrument, not easily affected by any ordinary amount of jar, and holding its adjustment well. The needle is inverted, indicating on an ivory scale above the beam. The beam is not itself graduated, but the position of the rider is indicated on a scale behind the beam by a pointer on the carrier. The best balances of this type will readily indicate 0.005 mg. and can be kept at this sensitiveness under the demands of daily work. Another improvement is the multiple rider attachment. A number of riders of different weights are held on suitable racks above the beam. A special carrier enables any one of these to be placed on a hook on the stirrup. In this way buttons up to 30 mg. can be accurately weighed by a combination of riders without placing any weights in the pan or opening the door of the balance.

The assayer is now able to secure very accurate riders and assay weights. Sets of weights can be secured which have been compared with the standard gram in the U. S. Bureau of Standards, Washington, D. C., and graduated to be accurate to 0.005 mg. These weights do not retain their accuracy even in the hands of a careful operator, but become heavy. The lip of the weight gets rough under constant handling with the pliers, and dirt and dust are rubbed in, making the weight heavy. All assay weights of 5 mg. and less used for delicate work should be checked against a standard weight every six months.

The art of assaying is as old as metallurgy itself. Agricola, whose work on metallurgy was published in the early part of the seventeenth century, shows a cupelling furnace that was operated in a manner similar to that now in use. It is questionable whether assaying was then applied to ores. Probably it was used as a means of refining gold and silver alloys. In the United States it is only within comparatively recent years that the position of assayer has been considered of any importance. At most of the mines when it was thought advisable to have an assayer, he was about as useful as the paper-weight on the superintendent's desk. The position was filled by some young man not capable of doing hard physical work, usually a relative of the president or of some large stockholder. There are in the assay business a great many rule of thumb men who have been instructed by such men, and who have no knowledge of the principles of chemistry or metallurgy. There are the usual number of quacks who do not know anything and who do not attempt to assay the samples entrusted to them. Assayers have also fallen into bad repute through 'high-grading.' At all mining camps where rich ores are produced the miners and those employed underground manage to steal a great deal of rich ore. This ore is brought to the surface concealed in their clothing, in their ears and mouth, or other parts of the body. It is necessary to find a market for this ore, which is known by the name of 'high-grade.' In all such camps there are so-called assay offices that are merely 'fences' for the disposition of stolen ore. Such places are only called assay offices as a blind. In Goldfield there were, at one time, twenty-three of these assayers. A miner would take his stolen ore to the office of Smith, where it was crushed, and a sample given to him to be run by an independent assayer, as a check. This sample he would

perhaps take to the office of Jones. Jones, noticing the name of Smith on the pulp envelope, would telephone Smith to know how much he was going to allow for the ore. When Smith replied, Jones wrote out an assay certificate for the amount, while the assay sample was thrown aside without being opened. There is no more reason to call a man presiding over this sort of an establishment an assayer, than there is to dignify the name of the manager of quack medical institutions with the name of Doctor.

The estimated value of ores bought and sold in the United States alone on the basis of assay is over $1,500,000 per month. This does not take into account the enormous amount of bullion handled through the mints and U. S. assay offices, but applies only to ores purchased by smelters, sampling plants, and custom mills. At every such plant and at every gold and silver mill of any size throughout the country the operations are controlled by assays. The accuracy of assay methods is far in excess of that required in ordinary chemical determinations. Gold determinations must be accurate to 0.01 mg., equivalent to 1 part in 2,900,000 or 0.00003%. In addition to the products bought and sold on the results of fire assays, consider the enormous amounts involved in the sale of mining properties that change hands on the results of samples, which are all assayed by fire method.

There are a great many mistakes made in mining, and a great deal of dishonest work is done. Speculation in mining shares is rife all over the world, and the unthinking public calls this mining and blames the certain losses which result, to one of the largest and most necessary of our natural industries. Mining shares are simply used as a means of indulging the desire of the average man to gamble, and there is no more relation between playing the stock market and legitimate mining than there is between the betting ring and the scientific breeder of blooded horses. It frequently happens that mistakes and errors are magnified while a large amount of good work passes unnoticed. Many of the errors charged against the assayer are not his fault and are due to improper sampling. The assayer can only work on the sample brought to him, and it is astonishing to find how many mining men are wholly ignorant of this important detail. A man will bring a single piece of ore of about 2 lb. weight and say, in all seriousness, that it represents the average of a mine which has perhaps 200 ft. of development. Or he will bring in three or four lumps of ore the size of apples, which he claims to be an average of a dump of several hundred tons, while in the same breath he may say that he picked out the worst-looking pieces, rejecting those that showed free gold because he did not wish to obtain too high results. With such ignorance on the part of the mining public, is it any wonder that there are discrepancies in assays or that the metal found in crudely selected grab-samples fails to materialize when the ores are milled or sent to the smelter?

Improvement in apparatus and methods is rapidly extending the sphere of the assayer, and his work is becoming better known. Where not long ago the superintendent expected his assayer to check with what he thought the mill was doing, we are now beginning to feel that the results of the assayer are the real index of what the plant is accomplishing. To do this we must first have well-trained conscientious men, supplied with the proper and accurate apparatus, given a decent place to work in, and not overworked. With these necessary conditions filled, we have reason to expect and to insist on accurate work.

LEAD AND ZINC in large quantities are secured by working over the drosses, old metals, and alloys resulting from commercial operations. Lead so obtained is chiefly derived from skimmings, drosses, old metal, and alloys; solder, type-metal, and babbitt, for example. The amount obtained in this way was over 40,000 tons in 1909. Secondary zinc is chiefly obtained from the drosses and hard zinc produced during the operation of galvanizing, but an appreciable quantity is obtained from various zinc alloys, the total for 1909 amounting to about 35,000 tons.

Goldfield Consolidated

The following is a summary of operations and costs for the first five months of the current fiscal year, November 1910 to March 1911, inclusive, of the Goldfield Consolidated Mines Co. and Goldfield Consolidated Milling & Transportation Company:

	Total.	Average.
Ore milled, 126,872 tons, value	$4,361,234.22	$34.38
Loss in tailing	270,115.56	2.13
Net recovery	$4,091,118.66	$32.25
Ore shipped, value	156,440.58	727.63
Values realized	$4,247,559.24	$33.42
Mining:		
Mohawk shaft	136,373.84	3.35
Combination shaft	52,405.60	2.17
Red Top shaft	96,843.28	5.10
Jumbo	163,232.28	3.78
Total	$448,855.00	$3.53
Transportation	13,757.91	0.11
Milling:		
100-stamp mill	269,166.72	2.12
Concentrate treatment	49,450.09	0.39
Total	$318,616.81	$2.51
Marketing:		
Bullion	22,334.55	0.18
By-products	3,941.67	0.03
Concentrate residue	58,539.54	0.46
Total	$84,815.76	$0.67
General expenses:		
Administration	15,734.01	0.13
Manager's office	5,183.38	0.04
Secretary and treasurer's office	5,176.34	0.04
Legal expense	12,411.12	0.10
Insurance	397.95	0.003
Mine Operators' Association	2,815.07	0.02
Damages	3,155.25	0.03
Property tax	2,657.14	0.02
Corporation expense	14,139.76	0.11
Sundries	18,040.48	0.14
Total	$79,710.50	$0.63
Bullion tax	54,449.34	0.43
Marketing high-grade ore	13,562.74	0.11
Construction	97,466.74	0.77
Total costs	$1,111,234.80	8.74
Miscellaneous earnings	17,815.29	0.14
Net costs	$1,093,419.51	$8.60
Net profits	3,154,139.73	$24.82

MICA is used in large quantities in both sheet and ground form. Sheet mica is used in stoves, gas-lamp chimneys, lamp shades, for glazing purposes, and in many kinds of electrical apparatus and machinery. The electrical industry consumes by far the greater part of the sheet mica produced. Mica serves as a perfect insulator in various parts of dynamos, motors, induction apparatus using high voltage, switchboards, and lamp sockets. The domestic mica is satisfactory for all insulation except for commutators of direct-current motors and for dynamos built up of bars of copper and strips of mica. For this purpose no mica is as satisfactory as the phlogopite or 'amber' mica. This mica is of about the same hardness as the copper of the commutator segments, and therefore wears down evenly without causing the motor to spark. A large quantity of the small sheet mica used in electrical apparatus is built up into micanite or mica board, the thin sheets being built up layer after layer with shellac, with or without tissue paper, and then subjected to great pressure.

Copper Producers' Association Report

The monthly report of the Copper Producers' Association for April shows an increase in stocks on hand of approximately 3,548,000 lb., compared with a gain of 5,370,000 in the preceding month. Production for April amounted to 118,085,223 lb., a decrease of about 12,500,000 from March. Domestic delivery was only 52,407,650 lb., a falling off of almost 14,000,000 from the preceding month, and foreign delivery, which was supposed to have been very heavy for April, amounted to but 62,129,599 lb., or a gain of a little more than 3,000,000 over last March. Total deliveries for April were 114,537,249 lb., or less by 10,624,667 than in March.

Foreign Visible Copper Supply

The foreign visible copper supply in England, France, and afloat thereto on May 1, 1911, was 78,069 tons, a decrease of 1534 tons within the past two weeks. Below is given the foreign visible supply at the beginning of each month since January, 1909 (in tons):

	1911.	1910.	1909.
January 1	83,797	109,022	55,677
February 1	83,196	110,808	52,935
March 1	82,387	113,455	52,295
April 1	82,267	111,432	51,354
May 1	78,069	110,207	50,918
June 1	.....	106,815	56,854
July 1	.....	103,957	67,379
August 1	.....	99,239	76,559
September 1	.....	97,507	88,218
October 1	.....	93,961	93,851
November 1	.....	88,422	99,357
December 1	.....	86,250	105,743

Cobalt Silver Production

The shipments from Cobalt during the week ended April 21 were:

	Pounds.
La Rose	311,930
Nipissing	146,130
Cobalt Lake	122,200
Kerr Lake	120,000
McKinley-Darragh	118,890
Crown Reserve	118,600
Temiskaming	65,090
Coniagas	63,170
Cobalt Townsite	62,100
Hudson Bay	60,400
Buffalo	58,400

The quarterly statement of the La Rose Mines, Ltd., shows that it has cash in bank, ore in transit and at smelters valued at $782,564 and ore at the mine ready to ship valued at $393,640; while the quarterly statement for the Nipissing shows that on April 1 it had cash in the bank amounting to $731,883, ore in transit and at smelters valued at $316,638, and ore ready for shipment valued at $266,711.

Sons of Gwalia Mine

The Sons of Gwalia gold mine is situated near Mount Leonora in the North Coolgardie district of Western Australia. The company was floated in 1898 by the London & Western Australian Exploration Co., of which Bewick, Moreing & Co. were the moving spirits. The management of the mine is still in the hands of this firm. Though not now yielding such rich ore as in the years 1903 to 1905, the mine is in a distinctly healthy condition and promises well for the future. The main incline shaft is down 2503 ft., and in order to protect the dip additional claims have been acquired. Development continues to reveal large bodies of ore with here and there rich shoots. On December 31 the reserves were 3½ years ahead of the mill. During 1910, 162,082 tons of ore was raised and sent to the 50 stamps. By amalgamation 44,002 oz. was recovered, 6326 oz. was obtained from concentrate, 10,106 oz. from sand, 5596 oz. from slime, and 704 oz. from slag and accumulated slime, making a total production of 66,734 oz., or 35s. per ton milled. The net profit, after payment of taxes and making allowance for depreciation, was £112,360, out of which £97,500 was paid as dividend, being at the rate of 30%. The company has taken a share in the promotion of the Northern Ontario Exploration Co., which has been formed by the Bewick-Moreing group to acquire properties in Porcupine.

Railway Operating Costs and Revenue

The table below shows the relative percentage of revenue and of cost of operation of Eastern, Southern, and Western railways for the month of February 1911.

	Total.....	Eastern Group...	Southern Group...	Western Group...
Revenue per cent of total:	%	%	%	%
Freight revenue	69.3	70.4	72.5	66.7
Passenger revenue	22.5	21.1	20.6	24.7
Other transportation revenue	7.2	7.4	5.8	7.3
Non-transporation revenue	1.1	1.0	1.1	1.2
Cost:				
Maintenance of way and of structures	11.7	11.2	13.0	11.9
Maintenance of equipment	17.4	18.7	16.7	16.0
Traffic expenses	2.4	2.2	2.4	2.6
Transportation expenses	40.3	42.8	33.5	39.9
General expenses	3.0	2.8	2.9	3.2
Total operating expenses (excluding outside operations and taxes)	74.7	77.7	68.4	73.6
Daily averages:				
Revenues per day per mile	$30.39	$47.57	$26.39	$22.26
Expenses per day per mile	22.71	36.97	18.05	16.38
Net revenue per day per mile	7.68	10.60	8.34	5.88

British Columbia Land Titles

The question of title is again cropping up in regard to a large territory in British Columbia, and it is possible that the decision of the British Privy Council in the Ophir case may influence the result. The Cowichan Indians lay claim to the Cowichan valley under a proclamation issued in 1763 by King George III in which he confirmed the rights of the Indians to the lands not included in the limits of the colonial governments then existing, or the Hudson Bay territory. This claim British Columbia has never recognized. The Indians, after in vain urging their case for many years, have retained as counsel J. M. Clark, of Toronto, recognized as one of the ablest Canadian exponents of constitutional law, and who, as it happens, successfully argued the Ophir mining case for the Ontario Government before the Privy Council. The claim of the Indians of British Columbia rests on the very same legal points as were decided in the Ophir mining case, so that if the former ruling is sustained when the case comes before the British law lords and the rights of the Indians are upheld, it will mean that the province of British Columbia has acted illegally in granting lands within the Indian claims. Consequently all the titles to mining property in that part of British Columbia will be invalidated. As the case now stands the Imperial Government, to which the petition of the Indians for relief was addressed, referred the matter to the Canadian Government. The latter endeavored to induce the British Columbia authorities to agree to refer the case to the Supreme Court of Canada, but they refused to do so, and the Canadian Government has referred the case back to the British Government.

New York Copper Gossip

The copper situation looks a little more hopeful. The break below 13c. last month brought buyers into the market in greater strength than for some time. The European visible supply shows a healthy decrease in the last fortnight of 3,438,400 lb., and an improved statement was shown by the Copper Producers' Association figures for April. In reality, however, nothing in this regard goes to the root of the matter. Improved methods of extraction and improved ore-handling machinery have brought about a production which outstrips consumption and entails economic waste. Curtailment should be in the development of new properties, not in cutting down production at mines now in operation.

The annual report of the Utah Copper Company was made public last week. It shows a production in 1910 of 85,644,511 lb. of copper at an average cost of 8.069c. per pound, for which an average price was received of 12.672c. per pound. The net operating income from the Utah Copper plant was $3,890,912. Dividends received from Nevada Consolidated were $1,459,775. Other items of revenue were $51,088. Interest charges to be deducted were $187, making a net income of $5,401,588. Dividends totaling $3 per share were paid, a total dividend of $4,648,075, leaving a margin of a trifle more than three-quarters of a million to be carried to surplus account. The Utah Copper is a magnificently conducted enterprise, but in hardly any other business, and certainly in no other kind of mining enterprise, would the payment of so nearly the whole of the net income in dividends be considered justifiable, especially in the face of the unfavorable conditions now ruling.

The Chadbourne fight against the Calumet & Hecla merger has taken the form of an action brought by F. W. Denton, who is general manager of the Copper Range, and who is also a son-in-law of the late Thomas L. Chadbourne. The suit brought in Mr. Denton's name is really in behalf of all the Chadbourne heirs and the other Ahmeek shareholders, who are protesting against the absorption of that company. A temporary injunction has been issued, and in the meantime Thomas L. Chadbourne, Jr., is insisting that an independent examination of the Calumet & Hecla be permitted. The whole question is an exceedingly important one to the Boston market. If the merger is completed, Boston, which has always possessed a wider market for copper shares than New York, will in all probability lose its leadership in this regard. The Lake coppers have been active trading issues, and their absorption will mean that there will be few issues left to invite any speculation.

William E. Corey, former president of the United States Steel Corporation, was prominently mentioned last fall as the probable head of the projected copper merger. This was some months previous to any general talk of Mr. Corey's resignation. It appears to be quite possible that, merger or no merger, Mr. Corey is to give his attention to copper. Mr. Corey and Thomas F. Cole were, for many years, associated in the steel business when Mr. Cole was at the head of the ore department of the Steel Trust. Now Mr. Corey has taken a directorship in the Calumet & Arizona and is expected to become an important factor in the management of the Cole-Ryan properties.

The selling of the Miami Copper Co.'s metal output is to be handled by S. S. Rosenstamm, of the General Development Co., if present plans mature. Mr. Rosenstamm has not been actively in the copper metal market for the past three or four years, but prior to that time he was a very active factor and enjoys as large an acquaintance as any copper salesman in the country. It is said that Giroux will begin shipments in July and that Greene-Cananea will probably go on a dividend basis by the end of the current year. Both events, if carried out as promised, will greatly strengthen the Cole-Ryan group. Mason Valley has applied for trading privileges on the floor of the New York Stock Exchange. If the present movement continues it will not be a long while before the mining section of the 'big board' will include practically all of the important porphyries.

Concentrates

Most of these are in reply to questions received by mail. Our readers are invited to ask questions and give information dealing with the practice of mining, milling, and smelting.

A TUBE which is too small for the use for which it is needed may be expanded by the use of an ordinary boiler expander, or it may be reamed out, if the walls are thick enough to allow this to be done.

TO REMOVE old paint from iron and steel, apply the flame of a gasoline torch until the paint blisters and softens; it is then scraped off while hot. Lye or caustic soda can also be employed to remove paint, but is inconvenient to use, and has a bad effect on the hands of the workmen.

BLUESTONE is a name applied to two entirely different substances; copper sulphate, or blue vitriol, and to a variety of sandstone which is quarried in New York and Pennsylvania and used for building, as flagstones, and for making curbing for sidewalks. Over two million dollars worth of this stone is produced annually.

TOOLS, when not in use, should be protected from rust by a thin coating of oil. Any good non-drying oil will do for this purpose, but a mineral oil is better, as it will not become rancid. Kerosene oil should be avoided, as sulphuric acid is used in purifying the oil, and will cause the tool to rust faster than when no oil is used.

PLUGS in classifiers, settling tanks, etc., can be readily inserted without the operator suffering the inconvenience of a wetting, if the tapered end of the plug be cut off at an angle of about 45°. Turning the bevel from the operator will deflect the stream away from him and result in a gradual closing of the opening to be plugged.

GRINDSTONES that have been allowed to stand in water often show soft spots, which wear away, leaving the stone uneven. It is best to drain the water from the tank each time the stone is used. A stone which has become very irregular can be cut down by fixing a hard piece of steel so that it only touches the high places, and running the stone until these are ground away.

LIMESTONE has a great variety of uses; the largest quantity of it is used in the making of crushed stone for macadam, railroad ballast, and concrete, and about $10,000,000 worth is annually used as a blast-furnace flux. It is also burned as lime, used as building stone, paving, and flagstones, used in paper-making and glass-making, and in the manufacture of carbonated waters and all kinds of alkaline salts.

TO CEMENT leather belts, have both ends clean. If they are fatty, lay them on a clean rag and set a hot flat-iron on them so as to melt the fat, which will be absorbed by the cloth. Mix 10 parts of carbon bisulphide with one part of turpentine and dissolve enough gutta percha (soft rubber) in the mixture to make a thin syrup. Coat the surfaces to be joined with this solution and keep them pressed together until the joint has set hard. This cement is said to work equally well with leather and rubber belts.

LAKE COPPER is a term applied to copper which comes from the Lake Superior district, and has a double significance, due to the fact that the copper from this region differs fundamentally in quality and method used in refining from that produced in other parts of the United States, so that the real significance of the term is to designate the highest quality of copper rather than a particular locality. Lake copper, owing to its superior quality, always sells for a small fraction of a cent more than electrolytic copper does.

Discussion

Readers of the MINING AND SCIENTIFIC PRESS are invited to use this department for the discussion of technical and other matters pertaining to mining and metallurgy. The Editor welcomes the expression of views contrary to his own, believing that careful criticism is more valuable than casual compliment. Insertion of any contribution is determined by its probable interest to the readers of this journal.

Gold Nuggets of California

The Editor:

Sir—In your issue of May 6 there appears an article entitled 'Gold Nuggets in California,' the first item of which I beg to correct: (1) Date should be January 24, 1848. (2) The finder's name was James W. Marshall. (3) There is no record of James W. Marshall ever being married or having children. (4) The first find was a few small nuggets, and none of them are in the possession of the Society of California Pioneers. (5) There is nothing in either Bigler's diary (the companion of Marshall) or in the diary kept by Sutter at Sutter's Fort which states the weight or value.

WM. F. CASHMAN.

San Francisco, May 8.

Hardening and Tempering Drill Steel

The Editor:

Sir—Having read the comments on 'Hardening and Tempering Drill Steel' in your issues of October 22 and November 12, 1910, I have made several experiments along the line suggested, and watched others sharpening and tempering drill steel. Summarizing my observations, I have come to the following conclusions: Drill steel should never be heated above a medium red; more steel is wasted by forging too hot than too cold. Hot steel works best, consequently the overworked tool sharpener will sometimes almost burn the steel in order to get through quickly. All steel, even cheap grades, will do excellent service if not heated above a medium red. Tempering should be carried on with the utmost care. Judgment and sharp eyesight are essential. A color-blind smith cannot temper properly. Horace F. Lunt's remark about a moderately lighted shop is to the point. It is impossible to work steel in excessive or intense light. I find different waters require different heats for tempering. So do different grades of steel. I prefer rain or snow water or soft spring water. Clear water should be used. If steel is brittle, draw it out over night in a heap of burning charcoal; this will toughen any steel. I prefer plunging after heating to the required degree in a clean fire. Scaly bits should never be immersed.

If the above points are kept in mind and directions followed to the letter miners will have no trouble with their tools. Tool-sharpening is a trade almost amounting to a science. A good tool-sharpener is hard to get, and if found should not be overworked.

LORENZ VON SCHOEN.

Gold Hill Mines, California, April 12.

Cobalt District, Ontario

The Editor:

Sir—In reading the article by S. F. Emmons on the Cobalt district of Ontario, in the *Mining and Scientific Press* of March 18, the suggestion of the compressibility and elasticity of the rocks in connection with the fissuring in which the native silver is deposited occurred to me.

There would appear to have been extensive erosion here, resulting in removal from over the present surface of a tremendous weight of material, some from the present formations, and some, possibly, from formerly overlying formations or from possibly comparatively recent sediments. That this former weight would compress the rocks now being worked and maintain them in a tight, close, compact mass seems probable. With the progress of erosion, simultaneous with the process of secondary enrichment, the gradual reduction of the weight would release these rocks, their elasticity would have a tendency to cause changes from the shapes or relative positions maintained when under pressure, and thus produce a gradual fracturing, creeping downward as the masses were relieved of their burden of weight. To illustrate this, a number of cubes of rubber might be placed on a solid base, bounded by some wall on all sides and spaced $^1/_{16}$ in. apart. If over these a cover be placed and weighted sufficiently to deform the cubes, spread them till all the spaces are closed, and the walls touch those of the adjacent cubes, then upon the release of the pressure, the cubes would resume their shape and the spaces be restored. A still better conception may be obtained by assuming square columns with individual weights placed on each and gradually reducing the weight, whereupon the cracks will open at the top, more than toward the bottom. The difference in the elasticity, or other conditions of the formation at various points would account for the greater depth to which the fissuring has penetrated and to which the silver has followed, in one section as compared by another nearby.

Helena, Montana, March 25. L. S. ROPES.

Republic Mining District

The Editor:

Sir—In a diagramatic sketch, forming plate XI of the report by Joseph B. Umpleby, of the U. S. Geological Survey, on the geology and ore deposits of the Republic mining district,* showing the vertical distribution of gold and silver in the Republic mine, the impression is given that gold decreases and silver increases with depth in the mines of Republic camp; an impression that is almost entirely erroneous. The ratio of silver to gold contained in the ores produced from the several leading mines has been carefully determined from the smelter returns of ore shipped to the smelters and the milling results from ore treated in the camp. In the Republic and Lone Pine mines the average ratio has been two or three to one, while in the Quilp mine the ratio has been as high as fifteen of silver to one of gold, but the depth at which the ore has been mined has evidently had no bearing whatever. In the lower workings of the Republic mine silver slightly predominated when ore containing selenium in the form of selenide of silver was found, but the amount of ground opened is comparatively small. In the mines situated northward from the Republic, up Eureka gulch, the relative proportions of gold and silver vary considerably, the value of the silver being generally in excess of the gold. The ratio, however, differs materially in the different mines. For example, in the Lone Pine the weight of silver in a ton of ore is about three times that of gold, while on the upper levels of the Quilp the ratio of silver to gold was about 15 to 1. On the No. 4 level of the Quilp mine, now being opened into the Surprise ground, a large proportion of silver is found in the high-grade ore, while material having a value of $20 or less per ton usually contains only from one to two ounces of silver. Quite recently that condition was demonstrated when the drift in question yielding $20 to $25 ore containing a ratio of about two of silver to one of gold, ran into a body 6½ ft. wide, with a ratio of 31 oz. silver to 7.4 of gold. The No. 4 level of the Quilp mine is fully 600 ft. deeper than the Jim Clark adit level of the Surprise mine, where the ratio of silver is from four to eight to one of gold. In February a deposit of ore was found on the 50-ft. level of the Quilp mine that was exceedingly rich in silver, from which, in fact, the finest specimens of native silver ever seen in the camp were taken. At the same time on the 500-ft. level the highest grade of ore in the mine was being extracted and contained practically no silver. In the general development of the mines of the camp the ratio of silver to gold contained in the ores has been shown to bear no relation whatever to depth from the surface, but on all of the various levels differs materially, gold predominating in one place and silver in another. Usually the richest ores of the district contain a large proportion of silver glance, but are more

*Washington Geological Survey, Bull. 1.

valuable for the gold than the silver. No matter whether the ores are high grade or low grade, gold usually predominates in value, irrespective of depth.

M. H. Joseph.

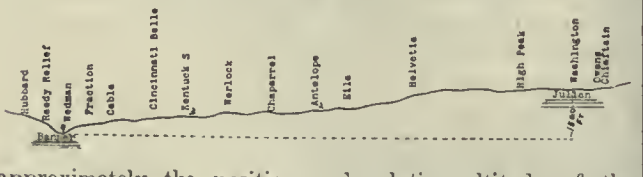
Republic, Washington, March 15.

Surface Indications of Ore-Shoots in Depth

The Editor:

Sir—In his discussion of my original contribution under the above title, in the *Mining and Scientific Press* of October 22, 1910, T. A. Rickard, in the issue of April 8, calls attention to a new phase of the subject, namely, the depth of ore occurrence as related to the present surface. How far Mr. Rickard's theory will apply, I am sure I do not know. I have thought that in a mountainous country, where veins traverse the hills and gulches, outcropping on the highest ridges, down their sides, and often appearing in the bottoms of the gulches or canyons, that it was not unreasonable to expect the veins or fissures observed on the hill-tops to extend downward into the earth at least as deep as the outcrops found in the neighboring canyons. This has been my idea, or hope, though I am not prepared to offer much substantial proof of the correctness of my theory. On the Mother Lode of California the veins are found outcropping on the hill-tops, often forming conspicuous objects in the landscape, as exemplified at Pinion Blanco, in Mariposa county; at Quartz mountain, in Tuolumne county; Carson hill, in Calaveras county; and Seaton hill, in Amador county. In this great lode the fissures extend not only as deep as the levels of the bottoms of the neighboring gulches, but thousands of feet below them. The apex of some of the ore-shoots in these fissures does not come within 1000 ft. of the surface. However, the Mother Lode may be assumed to be an exception to the rule, though the present relief of the country traversed by it is insignificant as compared to the depth already reached by some of the mines along its course. The probable depth of erosion has been estimated at 3000 feet.

I have in mind another region of California, in San Diego county, known as the Julian district, in which a mineralized zone extends across the country in a direction somewhat north of west, for several miles. With a few exceptions, notably the Stonewall and Golden Chariot, the most important mines of the district are situated between the villages of Julian and Banner, four miles distant from each other. Julian is at an altitude of 4200 ft. and Banner is at 2800 ft., a difference of 1400 ft. in altitude. The rocks of the region are mica-slate, mica-schist, and granite. Dikes of pegmatite are common in the mineral zone. There are four distinct lines of mineralization. For the most part the 'veins' occur as a succession of quartz lenses in the schist and slate. So far as I am aware there are no fissure veins in the district. In the Cincinnati Belle mine, near Banner, is found a fissure filled with fragments of country rock and clay, but as far as known it contains no profitable quartz. It lies a few feet distant from and parallel to the auriferous quartz lenses in which is found the real value of the vein. The accompanying sketch shows



approximately the position and relative altitude of the more important mines on the principal lode. There are outcrops of gold-bearing quartz on each of the claims indicated, but none of them have thus far developed into deep mines. These lenses of quartz have resulted from the filtration of silica into a zone of crumpled and folded slate and schist, deformed by a compressive stress which had a tendency to cause a reverse fault (as indicated by local torsion of the rocks), but which stopped short of producing an abrupt fracture. It seems hardly possible that this stress, the unmistakable evidence of which may be seen along the surface and underground for several miles, in these hills, should have been exerted only near the present surface, or even confined to a zone extending from a region 300 or 400 ft. below the present surface up to a pre-existing surface approximately conforming in contour to the present outcrop, a few hundred feet higher. If such be the case, then these veins come within the limitations of vein formation suggested by Mr. Rickard. If the stress extended to a deeper-seated region, then there would be a reasonable probability of the veins of the district also extending to far greater depth than has ever been reached in any of the mines. Several local authorities have variously estimated the output of this district at from $3,000,000 to $5,000,000. The smaller amount is probably nearer the truth. The ore was undoubtedly of good average grade, and some of it wonderfully rich. Without doubt much of the specimen rock so frequently found was the result of secondary enrichment, though ore of this class was found in spots throughout the entire depth of the exploited mineral zone, suggesting that its occurrence was in part due to local conditions, such perhaps, as the crossing seams or other physical features little understood by the miners, and consequently overlooked by them. The veins 'pinched out' in depth, just as they do longitudinally, though in the latter case by drifting in the general direction of the strike, and possibly by cross-cutting, the lenses of quartz were rediscovered. I have long thought that a more thorough exploration of these veins in depth might result in happy surprises. It should be recognized that the type of vein herein described differs materially from the lead-silver deposits referred to by Mr. Rickard as occurring in the Hautes Alpes, France, though this fact may have no material bearing on the question under discussion. The gold-bearing quartz lenses of the Julian district are similar to those found in Madera county, California; those in the central and southern Black Hills of South Dakota, some of those in the southern Appalachian States, and in many other localities, and are uniformly due to the silicification of crumpled schist and slate, and not to fractures which would tend to produce fissure veins rather than a succession of lenses of relatively limited extent.

It is interesting to note that in this district, as well as in others to which I have previously referred, ore-shoots do not cross gulches or depressions at the surface. One noticeable instance was in the Helvetia mine, where a rich shoot of ore occurred on the crest of the ridge, but where the vein crossed the gulch, although quartz occurred, it was valueless.

Berkeley, California, April 9. W. H. Storms.

Blue-Print Filing-Case

The disposal of blue-prints so that they are readily accessible but not in the way is hard to secure. The best way is to use the filing cabinets manufactured for this purpose, but a less expensive substitute can be made from an ordinary box, which should be about 40 in. high, 32 in. wide, and 12 to 15 in. from front to rear. Inside and a few inches below the top, 1-in. strips are fastened to the sides to support light wooden rods. From each pair of rods there depends a bag made of heavy manila paper; for convenience this is usually open down the sides to within a foot of the bottom. Blue-prints, drawings, or maps up to 30 by 36 in. can thus be conveniently kept flat and readily accessible. For convenience of reference the bags should be numbered, and an index can be kept pasted on the lid of the box, so that any required map can be quickly found. To keep blue-prints and drawings in this way they must be flat; maps that have been rolled can usually be flattened by rolling them the other way, while blue-prints can be effectually flattened by soaking them in water and allowing them to dry flat. Drawings of the same size should be kept together. Such a box will hold a dozen or more bags. Maps and blue-prints can also be kept flat in large drawers, but this takes up too much floor space, and if there are more than a few maps in a drawer it is difficult to remove those beneath and the edges quickly get dog-eared.

Special Correspondence

MEXICO

West Coast Railroad Extension.—Progress at El Favor.—Annual Report of Amparo Co.—Work at the Pachuca Mills.—New Mill of Purisima Grande.—Oil in West Coast Territory.

In order to facilitate shipments to and from mines in the Hostotipaquillo district of Jalisco, the Southern Pacific will at once extend the Jalisco line of its West Coast extension to La Quemada, nine miles beyond the present terminus. Arrangements for the extension were made through correspondence between W. C. Brown, president of the New York Central railroad, who is interested in the El Favor properties in that district, and Mr. Lovett, president of the Southern Pacific. The distance from La Quemada to El Favor and adjacent mines is about twelve miles. The El Favor mill, which recently started work, is handling 80 tons per day, and with two additional tube-mills, now being erected, the plant will be able to handle at least 125 tons per day. In March the Casados mine of the Consolidated Mining Co. shipped ore to the value of ₱25,000, and the April returns will exceed those of March. The Casados ore-shoot has been opened for a length of 1000 ft., and the indications are that it will prove to be fully 2000 ft. long. All ore shipped is from development. The 150-ton reduction unit, now under construction at Casados, will be in operation before the end of the year. The annual report of the Amparo Mining Co., of Philadelphia, operating in the Etzatlan district of Jalisco, shows a production of ₱1,439,665 from 68,217 tons of ore. The operating expense in 1910 reached ₱822,896. The net profit for the year, after a 10% depreciation charge, was ₱563,054. Net returns from the company's store and ranch raised the net income to ₱596,905. The company paid 12% on a capital of $2,000,000. A big reduction in operating expenses will be shown this year, due to the fact that the company is now using electric power for its operation.

Up to this time operations in the important Pachuca district have not been affected by the political disturbances in the Republic, but precautions have been taken against interference, the mining companies having armed men to protect property. The Real del Monte y Pachuca is following its program of enlargement and betterment, and as soon as all additional equipment is in place at the Guerrero plant it will be able to mill 1350 tons of ore daily. The Real del Monte y Pachuca is the first in production among the enterprises controlled by the U. S. Smelting, Refining & Mining Co. The new 600-ton plant of the Santa Gertrudis (Camp Bird) will be soon in commission, materially increasing the output of the district. The Guadalupe plant of the Santa Gertrudis, built by the former owners at a point about 2½ miles from the Santa Gertrudis mines, has been in operation for over a year, treating low-grade ore principally. The Purisima Grande y Guadalupe Co. has added a modern 100-ton plant to the reduction works of the district, and is supplying ore from its Guadalupe-Fresnillo mines. The new plant takes the place of the old Purisima Grande reduction works. The Encino y Anexas Co. has commenced deliveries to the La Luz mill under a contract calling for 1000 tons per week. The La Luz plant is being operated under lease by the Blaisdell-Cosecotitlan Syndicate, of Los Angeles, Cal., which for several years has been cyaniding the old tailing of the Pachuca district. Reports of the San Rafael y Anexas and La Blanca companies show excellent results.

The West Coast Oil Co., in which English capital is largely invested, has begun oil exploration work in Sonora. The scene of operation is near Mascareñas, a station on the Nogales-Cananea line of the Southern Pacific. Much interest attaches to the work, as the development of oil in the West Coast territory would mean much to that section of Mexico. The Mexican Petroleum Co., Ltd., has announced that it will omit dividend payments on its common stock for six months or a year, using the money for development. The company paid its first common-stock dividend last year, having been enabled to do so by the earnings of the Huasteca Petroleum Co., one of its subsidiary concerns. The disbursement was at the rate of $298,000 a quarter.

THE COEUR D'ALENE, IDAHO

Gross Proceeds, Costs, and Net Profits of Ten Leading Mines.—The Proposal to Assess Property at Cash Value.

In accordance with the laws of Idaho, the mining companies operating in the State filed with the county assessors, on May 1, a statement showing the tonnage of ore extracted, gross values of metals recovered, costs of extraction, reduction, and transportation, and the net profits for the year ended on that date. The statements given by the companies operating ten of the largest mines of the Coeur d'Alene district, Shoshone county, are especially interesting, a résumé of which is presented below:

Bunker Hill & Sullivan—Ore mined, 425,160 tons; gross

Map of the Coeur d'Alene.

yield, $3,514,431; cost of mining, $1,023,094; costs of reduction, transportation, and sale, $1,350,205; net profits, $971,263.

The Hercules—Ore extracted, 25,765 tons; gross yield, $1,249,081; costs of mining, transportation, reduction, and sale, $516,546; expended for new equipment and repairs, $313,992; net profits, $418,542. The new mill, built for the Hercules during the winter, is now finished and in operation.

Federal Mining & Smelting Co.—Wardner mines: Ore extracted, 191,500 tons; gross yield, $1,765,188; costs of mining, reduction, transportation, and marketing, $1,523,885; net profits, $235,303. Mace mines: Ore mined, 201,350 tons; gross yield, $1,852,282; costs, $1,358,893; net profit, $493,439. Morning mine: Ore extracted, 333,900 tons; gross yield, $1,203,013; net loss, $40,799.

The Stewart M. Co.—Ore extracted, 55,347 tons; gross yield, $327,790; cost of mining, $113,582; transportation, $13,933; smelter charges and freight, $108,221; reduction, $29,373; betterments and repairs, $40,891; total costs, $306,001; net profits, $21,788.

Caledonia M. Co.—Ore mined, 8078 tons; gross returns, $479,307; cost of mining, $136,262; costs of transportation, reduction, and sale, $184,631; net profits, $165,597.

Success M. Co.—Zinc and lead ores mined, 8471 tons; gross yield, $134,955; costs of mining, reduction, and sale, $124,906; net profits, $10,049.

Hecla M. Co.—Ore extracted, 129,480 tons; gross proceeds, $950,848; cost of mining, $402,702; transportation, $320,899; betterments, $10,373; total costs, $733,939; net profits, $216,909.

Snowstorm M. Co.—Ore mined, 62,700 tons; gross returns, $676,076; mining costs, $164,288; reduction and transportation, $358,730; betterments, $33,380; total costs, $556,399; net profits, $119,676.

Recapitulation as to net profits: Bunker Hill & Sullican, $971,263; Hercules, $418,542; Federal mines, $728,742, less net loss of $40,799 at Morning mine, $687,943; Stewart, $21,788; Caledonia, $165,597; Success, $10,049; Hecla, $216,909; Snowstorm, $119,676. All the companies named operate concentrating plants except the Caledonia and the Snowstorm; the Stewart operates a leased mill.

The amount of net profits made by mine operators is required to be stated for the purpose of tax assessments. There is much discussion in Idaho concerning tax assessments on mining and other property by reason of the governor's instruction to tax officers to assess at full cash value as the law specifies. Heretofore assessments have varied in the different counties from 30 to 60% of the cash valuation. It is generally admitted that assessments in Shoshone county, where there is a vast amount of mining property, have been on a higher valuation than those of most of the agricultural counties, which makes the State tax for Shoshone disproportionately high. Certain rates of tax levy are fixed by statute, and if assessments on a cash valuation basis are carried out, school and certain other taxes will be abnormally high, as the State legislature failed to change the rates of levy in anticipation of the plan insisted on by the governor. The convening of the legislature in special session is being considered, that it may change the fixed levies so that taxes will be equitable if property is to be assessed at cash value.

LONDON

REPORT OF THE DUCKTOWN SULPHUR, COPPER & IRON CO.—LARGE INCREASE OF BUSINESS.—SUCCESSFUL WORKING AT TRONOH MINES.—VALUABLE PROPERTY.

One of the few American copper mines owned and directed in London is that belonging to the Ducktown Sulphur, Copper & Iron Co. Owing to the excellent work recently undertaken to save sulphur and thus conform with modern requirements as regards the prevention of the escape of sulphurous gases, this company has attracted some attention, and though overshadowed as regards output by its greater neighbor, the Tennessee, it is probable that the technological methods are just as good. The latest financial details of the company will therefore be of interest. The company was formed in London in 1891 and has paid dividends continuously. During the year 1910 a profit of £38,376 was made. Out of this £4000 was allowed for depreciation, £2792 was paid as debenture interest, £6000 has been placed to reserve, £18,814 has been paid as dividend on the ordinary shares, being 10% less income tax, and £5644 has been distributed on the founders' shares. The production during the year was 2200 tons of copper, obtained by smelting 128,583 tons of ore, as compared with 2446 tons from 140,504 tons produced during 1909. The production of sulphuric acid was 46,500 tons. Important alterations and additions to the furnaces and power-plant have been made during the year whereby the amount of copper and acid will be increased and the smelting cost reduced. The cost of these improvements will be about £50,000, which will be provided by the issue of further debentures. The new shaft at the Mary mine has been completed and it gives access to a large body of recently developed ore. The East Tennessee mine has been fully equipped and is now yielding regularly. The business of this company has grown so much during the last year or two that two additional directors have been elected to the board.

The Cornish capitalists nowadays prefer to put their money in Malay tin mines rather than into those of their own country. A few weeks ago I cited the Gopeng, which is giving large profits on a small outlay. Another example is the Tronoh, which has on its list of directors such well known Cornish names as C. V. Thomas and G. B. Pearce. This mine had an interlude of adversity in 1907 to 1909, due to the incapacity, or worse, of the local directors. Some particulars will be of interest. The mine was introduced in England by Foo Choo Choon and E. G. Edgar in 1901, who continued to direct operations on the spot. For some years large profits were made, and from 1902 to 1907, £244,000 was distributed as dividends on a capital of £160,000. The tin is found in gravels of which some are on the surface and others in the form of deep leads. The mining was easy enough at first, but as time went on conditions altered and the local directors were not capable of meeting the difficulties. Another engineer was sent out from England, but did no better, and finally, three years ago, Harry D. Griffiths was appointed. He made certain recommendations for rearranging the work, and the directors consulted R. J. Freeheville before finally accepting them. Mr. Freeheville agreed entirely with Mr. Griffiths' views. The report for the year 1910 now issued shows that Mr. Griffiths has done excellent work in every way and that the output and profit have strikingly increased. The production of tin concentrate was 2945 tons, as compared with 2158 tons in 1909 and 1712 tons in 1908. The amount of gravel treated was 410,777 cu. yd., as compared with 292,825 cu. yd. in 1909 and 156,366 cu. yd. in 1908. The price obtained for the concentrate averaged £92 per ton, as compared with £80½ in 1909 and £72¼ in 1908, and the total receipts were £271,304, as compared with £167,755 in 1909 and £123,683 in 1908. The yield per cubic yard under Mr. Griffiths' régimé is about one-half what it was five years ago, the reason being that the old method of working only the richer patches introduced the danger of speedy ruin. The profit for the year was £72,927, as compared with £38,774 in 1909, and the dividend was £56,000 or 35%, compared with £16,000 or 10% in 1909.

NEW YORK

CAUTION IN PORCUPINE INVESTMENT.—LITTLE INTEREST IN MEXICO.—SELLING OF NEVADA SHARES.—SILVER MINES EXPLORATION CO.—KIRKEGAARD.—FAVORABLE REPORT.—CAMP BIRD EXPANSION.—YUKON GOLD.

The mining situation in New York is peculiar. Everything for the time being is Porcupine, although as yet there is no market activity worth mentioning. The air is full of the stories of deals under way or just completed at figures that sound out of all reason, and, indeed, would be out of all reason were it not for the fact that only small cash payments down are ordinarily required. There have been some deals made, however, and others attempted, where large sums were paid or promised to claim-owners, with the result that prices demanded are so absurd that capital otherwise eager for the development of the new goldfield is halted. The overreaching, eager greed of the claim-owners is actually retarding the growth of the camp. The Eastern press is wisely sounding a note of caution, calling attention to the fact that only one or two properties have yet been demonstrated to be anything but mere surface showings, and the further fact that Porcupine is, if it is anything beyond a sensational surface showing, a low-grade camp that must have big development done on its orebodies and large expenditures made for milling plants before profit is possible. When property owners come down out of the clouds and get on a sane basis, there will evidently be plenty of money in the States as well as English capital available for development. The present standstill is in the nature of a protest against the option holders who are trying to take out large profits with no money invested.

One of the particular and peculiar reasons for the exclusive interest in Porcupine at the moment, is that it has the stage all to itself. Mexican mining projects are interesting just now only to those already involved, the ruling conditions there prohibiting the formation or projection of new enterprises. Coppers are without a market public, and evidently must remain so until the metal situation improves. The shrinkage in copper shares is tremendous, and the margin between earnings and dividends in many cases has become perilously narrow. In Goldfield stocks there is a little accumulation of the cheaper prospects and a very little trading in Goldfield Consolidated. In the latter there has been steady liquidation for many months, it being evident that some large holding is being turned into cash just as fast as the shares can be absorbed. In the Tonopahs there has been some heavy selling of Tonopah Mining. The principal market for the stock is in Philadelphia, and while traded in on the New York curb, it is not officially quoted there. Recently there was some heavy selling of the stock in New York which was not duplicated in Philadelphia. It was quite plain that the sales were made in New York simply to evade the quotations and the records of the sales.

Taking the situation as a whole, it is quite evident that if Porcupine does not succeed, it will not be because of any distraction of attention elsewhere. There are more real mine-makers getting into the camp all the time. The Silver Mines Exploration Co., which is the Lewisohn organization controlling Kerr Lake and Wettlaufer at Cobalt, has just taken over three claims just over the line in Deloro township and directly south of the Dome Mines. The consideration has not been made public, but it is understood that the Lewisohns have several months for development work before any cash payment is required. This appears to be one case in which sanity prevailed. One of the best known properties in the camp, the Kirkegaard ground, of 120 acres, has recently been financed in New York by interests connected with the Proprietary Mines Co. of America, the flotation being offered to the public and oversubscribed almost immediately. A comparatively few successful deals of this nature have given the prospectors and option holders such absurdly exaggerated ideas of values. It is needless to say that there is a small army of camp-followers ready to grind out promotions over night and keep the printing-presses running overtime the moment the public begins to buy stock certificates. Up to the present moment nine-tenths of the investors in Porcupine shares have bought odd lots of Hollinger and hundred-share lots of the best-known prospects.

While Cobalt continues to be persistently overlooked in favor of the new Canadian goldfield and the Cobalt stocks sold to provide grub-stakes for Porcupine prospectors, there are some facts regarding Cobalt that are very interesting. A. A. Cole, mining engineer for the Temiskaming & Northern Ontario Railway Commission, has just made a report on Cobalt in which he states that the ore reserves of that camp are larger than at any time heretofore, that $30,000,000 worth of ore can be measured up in Cobalt, and that the camp could mine for two years at its present rate if no new veins were opened. The question of ore reserve has always been the vital one for Cobalt, and this statement is decidedly a bull argument for the silver camp.

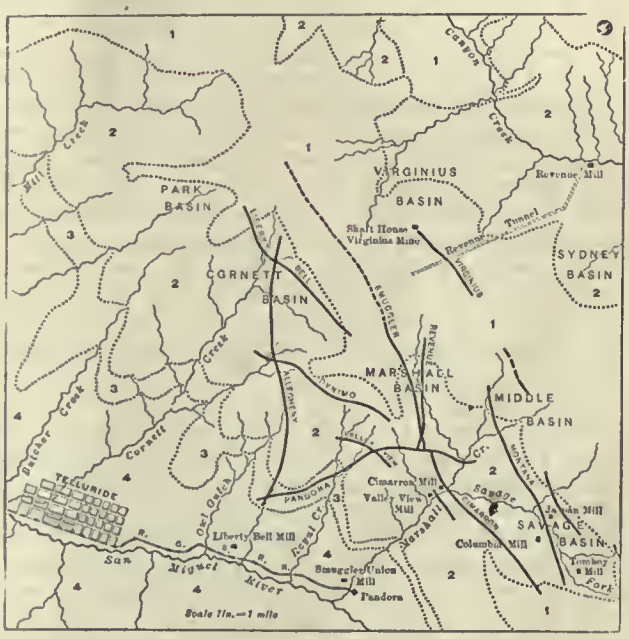
The Camp Bird shareholders in the East, of whom there is a large number, are much interested in the report that the company is negotiating for additional territory at Ouray, Colorado. An effort is being made to shape an option for the Camp Bird covering the ground owned by the San Pedro company. Control of the latter company lies with Terry & Tench, the great contracting firm. In addition, it is reported that the Camp Bird is probably to acquire the Revenue Virginius. Both properties adjoin the Camp Bird ground. The Revenue Virginius is owned by A. E. Reynolds of Denver and has a large production to its credit. On the Colorado property there is a large mill of the best type, and while the Revenue Virginius has been worked out on the original Virginius vein, it is said that what is practically a new mine has been made on the Montana vein. The San Pedro owns a large and practically unexplored territory. If either or both properties can furnish profitable ores to the Camp Bird mill, it will be a splendid move to acquire them. The Camp Bird has earned and is earning a steady profit from its present territory, but it has been recognized for a year and a half that the question of diminishing ore reserve was becoming of pressing importance. The Camp Bird, controlled by the Venture Corporation of London, owns the Santa Gertrudis in Mexico, which is expected soon to enter dividend ranks.

The Yukon Gold Co., the Alaska company of the Guggenheims, is said to have recently made some large purchases of mining property in the Yukon district on Gold Run creek and on Dominion creek. The consideration paid is said to have been more than half a million dollars.

SILVERTON, COLORADO

Renewed Activity.—Gold King Dividends.—Sunnyside Mill.—Fire at Frank Hough.—Development near Animas Forks.

The winter season in the territory tributary to Silverton has been a very dull one, but the coming of spring brings many signs of renewed activity and prospects of a more active season than for several years past. The stagnation of the past season was due to several causes, but was greatly



Sketch Map of Telluride District, Colorado.

increased by the shut-down of the Gold King, Hercules, and Silver Ledge mines and mills, all of which were producers and shippers during last summer and had promised to continue so for some years. The Gold King and Silver Ledge have been developed during the winter, a force of 30 men being employed at each mine, and both are now in a position to resume milling and shipping. The Silverton, Gladstone & Northerly railroad has been cleared of snow, and the King started to break ore on the 28th of April. This company intends to employ 200 men at the mine and mill, treating 300 tons of ore per day and shipping about 2000 tons of concentrate per month. The Gold King has paid over $1,300,000 in dividends, and it is claimed that the mine has now a two years' ore supply in sight at full mill-capacity. The Silver Ledge has large orebodies developed and will resume milling about June 1, at the rate of 200 tons of ore per day, producing 750 tons of concentrate per month. It is persistently rumored that the Hercules company will start development work soon, but there are no signs of activity at the plant as yet. This mine has been a steady producer at the rate of 100 tons per day for several years, but has been idle since February. The Terry estate, controlling the Sunnyside mine at Eureka,

will double the mill capacity at once. The present plant handles 80 tons per day and turns out 600 tons of concentrate per month. A local leasing company has applied for a lease on the Silver Lake mine, owned by the Garfield Smelting Co. This mine was purchased by the Guggenheims for $2,000,000, but has been idle for five years, except for small-scale operation by several local leasing companies. The new company, if granted the lease, proposes to sink the Titusville shaft to the next level, 150 ft., and drive both ways for about 200 ft., opening a block of ground that yielded a large amount of ore in the upper levels. The lessees expect to produce 100 tons of ore per day. The property of the Iowa Gold M. & M. Co., considered worked out in 1908, has been operated since August of that year by lessees who have produced over $500,000 and are at present milling 100 tons per day and shipping 400 tons of concentrate per month with at least a year's supply of ore. The Intersection mine is leased to local miners, and the 5-stamp mill is being operated steadily. The Gold Prince property at Animas Forks has been taken over by the bondholders and will probably be idle this year. This company owns the largest mill in the district, with a capacity of 500 tons per day, erected at a cost of $500,000, but the mine has never been able to supply that amount of ore. The property has been operated by a receiver for the past two summers, but has been unable to pay interest on the bonds and has passed into the possession of the bondholders. In February a disastrous fire destroyed the surface plant of the Frank Hough mine on Engineer mountain, and it is very doubtful whether it will be rebuilt. The underground workings are all in porphyry, which swells when wet, and it is probable that they have all been closed, as the shaft is now full of water. The Vermillion, at Animas Forks, will resume milling operations June 1, at the rate of 75 tons per day. This property is situated two miles above Animas Forks and cannot operate during the winter, as the water-supply freezes and the railroad is blocked by snow. Development has been carried on during the winter with a force of 12 men, and excellent orebodies are reported as exposed. The Columbus, in the same locality, has driven a new tunnel which cuts the vein 200 ft. below the old workings. This work has developed a large amount of milling ore, and it is expected that the company will build a mill in the near future. This mine has produced some excellent shipping ore from the upper workings. The Hamlet company, operating at Middleton, has voted to issue $150,000 in bonds for completing the lower adit which cuts the vein about 1400 ft. below the outcrop. The money will be used to develop the vein and to enlarge the present mill if the ore is as good as that found in the upper workings. In general, indications point to the best season for years, and with the return of capital to mining, the San Juan may be expected to occupy a prominent position among Western mining camps.

JOHANNESBURG, TRANSVAAL

ANNUAL MEETINGS.—PROGRESS AT CROWN MINES.—GOOD PROSPECTS.—FAR EAST RAND.—POOR SHOWING AND BAD GROUND.—RAND COLLIERIES.

During the past fortnight there have been many annual meetings of mining companies here, and when it is said that among them are included such concerns as the Crown Mines, Cinderella, Robinson, and many others, it will be readily understood that the fortnight's happenings have been of much interest. The only matter of regret in the report of the Crown Mines is that the working costs have gone up and the profits since the amalgamation have failed to come up to anticipations. When the extensive alterations and developments now in hand are completed the property should tell quite a different tale, because, whatever may be said to the contrary, the Crown Mines property will eventually be a striking example of amalgamation in its fullest sense, and not in name only, as has been the case hitherto with the various amalgamations which have so far taken place on the Rand.

Then there is the Cinderella Consolidated property, which promises to become the leading mine of the General Mining & Finance Corporation and one of the leading mines on the Rand. During the year the size of the property has been increased from 289 claims to 1719, and is expected to soon attain a total productive area of 2100 claims, representing a stretch of nearly three miles along the strike. The amalgamation scheme when carried out made £680,000 available for further shaft-sinking and development, while the amount available at the end of the financial year was £510,000. Since amalgamation with the adjoining properties a seven-compartment shaft 42 by 6 ft. inside the timbers has been commenced, and at the time of writing has attained a depth of 400 ft.; the permanent steel head-gear having been erected and electric hoists adopted; these are working well and not giving rise to the trouble and inconvenience feared in many quarters. It must not be overlooked that a single-shaft mine is already at work to a depth of nearly 5000 ft., and last financial year made a gross profit of £53,645 despite the drawbacks and limits placed on underground operations by law because of the mine having only one shaft. The working costs during the year have gone up 1s. 4d. per ton, owing to an accident, and expenses incidental to amalgamation, not to mention the fact that only 800 persons are allowed underground at one time, while the mine has only a single outlet. However, it is anticipated that a connection underground will be made with the Angelo Deep in about three months time, when all these restrictions will cease. It is clear from the remarks of the chairman of the company at the annual meeting that the mine is expected to take a leading position among the Rand's largest gold producers; by the end of the year the gold reserves will be increased to a million tons, and in three years time to four million tons. By the time the property is equipped and properly developed, an expenditure of one and a quarter million pounds sterling will have been incurred.

Properties in the area beyond Boksburg and known as the Far East Rand have been causing considerable uneasiness of late, owing to the unsatisfactory showing made in some cases, and in others to water troubles and bad ground encountered in sinking. Two mines and one shaft have already closed down, and, generally speaking, the progress made can not be considered satisfactory. This is much to be regretted, because this section of the Rand represents an area of several hundred square miles; one upon which a good deal of the future of the Rand will depend, as, practically speaking, it is quite undeveloped, having only three milling mines on its outcrop at Van Ryn. The annual meeting of the gold property known as the Rand Collieries, held during the week, at which it was announced that the options held over shares of the company at 45s. had not been exercised, that at the end of the year the available capital has been practically exhausted, is important. Of course when the shares of the company can be purchased on the open market at less than £1, those holding options at 45 and 50s. can scarcely be expected to exercise such options, and it is well that the control of the mine is in such excellent hands as the General Mining & Finance Corporation, otherwise it seems possible that the list of closed mines, waiting the advent of better financial times, might also include the Rand Collieries. Work is to go on as usual, despite the fact that a good deal of the development work done during the year shows values below 4 dwt., which today may be considered as the payable limit on the Rand. During the year no less than £142,320 was spent on equipment and development, the latter being more exploration than development, while the former includes excellent steel head-gears and up-to-date electric hoists, which here also are reported to give satisfaction. It is clear that even after such a large expenditure of working capital the Rand Collieries represents more a prospect than a proved mine, but with those in control of the property the shareholders have every confidence. Other mines in even a less promising condition than the Rand Collieries have by the same control been put on a sound dividend-paying basis.

General Mining News

ALASKA

Copper River

Enraged by the delay in development of the Alaska coalfields, a mob of 300 men stormed the stock-piles of Canadian coal owned by the Alaska Steamship Co. and the C. R. & N. W. railroad at Cordova, on May 4, and dumped the coal into the sea, as a protest against the use of foreign coal in Alaska while the native deposits remain undeveloped.

James Galen, who has returned from the Bonanza mine, says that 40 men are at work, the tramway is running regularly, and the railroad as well as the tramway, but a little trouble is expected when the ground thaws. The first shipment of ore made to the Tacoma Smelting Co. averaged a little more than 63% copper and over 17 oz. silver per ton. The ore is chalcocite. Fifty-five men are at work at the Great Northern Development Co. at Copper mountain, and it is planned to increase the number to 200.

A big ice jam in Copper river on May 7 tore out the wooden spans of the railroad bridge which was just completed last fall. The operation of the railroad and the shipping of copper ore from the Bonanza mine will be interrupted for a week at least.

Ketchikan

(Special Correspondence.)—The Alaska Industrial Co. of Sulzer has made seven shipments of ore since January 1. A new contract has been made with the A. S. & R. Co., which treats the ore at its Tacoma smelter. A small shipment of ore from the Goodrae mine is now on its way to the Tyee smelter. A. A. Wakefield, manager of the Gold Stream mine, is making ready to start the stamp-mill. Several hundred tons of ore is on the dump. Prospecting will not commence until May 15, because of the late spring.

Ketchikan, May 1.

The report last week of the snowslide at the Jumbo mine is correct. The two killed are F. T. Figg and John A. Tomasevich.

Prince William Sound

The adit on the Vancouver-Valdez M. Co.'s property is in 48 ft. on the vein, which is increasing in width. The adit on the Alameda group of claims on the east side of Valdez bay is in 30 ft. on a 12-ft. vein of quartz which assays $9.40 per ton. It is planned to erect a stamp-mill. The last clean-up at the Cliff mine yielded $6500. The new vein found recently has pinched, but assays as high as before; an adit has been driven on it for 25 ft. The cabins and power-plant belonging to S. A. Hemple, on Knight's island, were crushed by snowslides just before the beginning of April.

ARIZONA

Gila County

The fourth unit of the Miami mill was expected to start on May 10. Three are now in operation, treating more than 1400 tons per day. Over 50 tons of concentrate is being shipped daily. The auxiliary raise and sub-level method of stoping has been started by N. O. Lawton, the mine superintendent. The churn-drills on the Inspiration broke all records during April, the four doing 5093 ft., one machine making a record of 2600 ft. Most of the electrical equipment for the haulage system has been received. In the Live Oak the average ore found by the churn-drill runs 2.25% copper. Shaft No. 1 has reached a depth of 445 ft. and the blocking out of the ore has begun. Shaft No. 2 has reached a depth of 102 ft. The leaching plant of the Warrior Development Co. was burned on May 4, but, as it was not in use, the loss is not heavy. The company is shipping 100 to 125 tons of 10% ore per day. The vein found in the cross-cut on the 1000-ft. level of the Arizona Commercial shows glance and oxide. Drifts are being driven east and west on the vein.

Yavapai County

(Special Correspondence.)—Considerable alarm has been worked up around Jerome by the report that the United Verde smelter at that place was to be abandoned and all smelting for the great mine was to be done at Humboldt. It is proposed to build a railroad from Russell station on the U. V. & P. railroad to the smelter at Humboldt, thus saving a heavy haul over the mountains, and cutting out a piece of track on the U. V. road that is very heavy grade and hard to keep in repair. The big compressor for the Arkansas & Arizona company has arrived, the concrete foundation for it is prepared, and it will be put in place within the next few days. Development will be resumed about June 1. The machinery is being overhauled at the Haynes properties preparatory to resuming operations. The stockholders of the Venture Hill Mining Co. are holding a special meeting at Jerome to devise ways and means to resume work on their property. This is a most promising group of claims and should be prospected thoroughly.

Prescott, May 6.

CALIFORNIA

Amador County

The Utica M. Co. has appealed to the Supreme Court for a reversal of the judgment of $54,000 which the Lightner M. Co. recently obtained against it for wrongful extraction of ore, on the ground that an action for trespass is outlawed three years after the trespass was committed. It is probable that the Supreme Court will reverse the verdict of the lower court. Roy Cameron has been endeavoring to reorganize the miners' union at Jackson which went to pieces a year ago, and is meeting with moderate success. C. D. Lane has transferred a one-third interest in the Plymouth Con. Min. Co. to the Lane Investment Co., and the mine will shortly be re-opened.

(Special Correspondence.)—Regular monthly dividends of 7c. are being declared by the South Eureka, and it is rumored that the rate may be increased to 10c. within a short time. At the Central Eureka the management expects to commence the payment of dividends before the close of the year. Although electrical machinery was installed and other heavy expenses incurred, the year's operations left a good profit to the company. At the Lincoln Con. sinking is progressing rapidly. On the 800-ft. level promising stringers of quartz have been found in the cross-cut. It is reported that the Bunker Hill company is about to increase its dividend rate from 5 to 7½c. per month. Pocket mining in Murphy's gulch is attracting considerable attention. Several prospectors report satisfactory results. The Little Amador company has replaced its mule-team by a 5-ton auto truck. Developments at the mine are said to be extremely satisfactory. W. T. Deaner is superintendent.

Jackson, April 29.

Kern County

The Laird mine has a 6-stamp mill in operation in the Sageland district on free-milling ore that runs about $5 per ton. It is operated by the Laird brothers, who have recently made a good clean-up. J. J. Miller and the Watchman brothers have dissolved their working partnership in the King Solomon mine, and recently milled a lot of ore that went over $240 per ton. The shaft on the property will be sunk 100 ft. in depth in the near future. The Merced mine, owned by the Merced Min. Co., has been sold to T. W. Atkinson, who owns the Sunshine mine, but the price has not been given out. The development amounts to 1500 ft., and last year the lessees milled $6000 worth of ore. C. A. Burcham has taken an option on the William R. mine for $15,000. This mine was opened in 1909 and a 2-ft. vein has been developed which yields $45 ore.

Nevada County

W. H. Norton has made a location on the old burying-ground near the county hospital. It therefore is not improbable that his mine will turn out to be a dead one. The first payment of $10,000 on the Cassidy mine has been made by the Cassidy Con. G. M. Co. A strong shoot of $20 ore

was recently found on the 350-ft. level. It is proposed that the Arctic mine shall advance $6000 to the county supervisors to construct a new road from the mine on Canyon creek to the Maybert road, with the understanding that this sum shall be refunded when the company has developed its mine to a valuation of $50,000, but no decision has been reached by the county authorities. The Nevada County Deep Drainage Tunnel Co. has been formed to drive a drainage adit from the South Yuba river, near Jones bar, for three miles toward the Champion mine, where it will drain the district to a depth of 1050 ft. G. W. Starr and T. J. Hooper have taken charge of the Pennsylvania and W. Y. O. D. mines, and it is reported that the transfer of these mines to the California Title & Insurance Co. has

MOUNTAINEER MINE, NEVADA COUNTY.

been perfected. The Union Hill has been unwatered to the 350-ft. level and it is expected to start the 20-stamp mill soon. Arthur W. Hoge was elected president at the annual meeting of the Fairview G. M. Co. The 20-stamp mill, a few miles above Washington, which was damaged by snow last winter, is being repaired.

PLUMAS COUNTY

Charles Schoenwald, while at work cutting away a gravel bank in the Carter mine in East Indian valley, was caught in a slide of snow and earth and drowned by the backing up of the water. The annual meeting of the Haskell Peak M. Co., whose property is situated near Clio, was held recently. J. J. Snyder was elected president and Henry Goering superintendent; the former board of directors were all re-elected.

SHASTA COUNTY

The Mt. Shasta mine, near the old town of Shasta, has been bonded to Theodore Burkhardt of Portland for $50,000, and an initial payment of $5000 has been made. The mine is now owned by the Bank of Shasta County, which foreclosed a mortgage on it that was given by the owners in 1903 when the mine made good profits that were promptly lost in Arizona speculations. It is also reported that the Bully Hill Cave Co., which has been exploring the Michigan mines near Bully Hill, will take up its option and pay over the $100,000 of its bond to the bank. This mine, like the former, was owned by the Phoenix Securities Co. The Mammoth Copper Co. will reopen the Original Quartz Hill mine, near Old Diggings, to supply flux for its smelter at Kennett.

SOLANO COUNTY

Judge Buckles has refused to set aside the order of the Superior Court directing the officers of the Selby Smelting & Lead Co. to appear and show cause why they should not be judged in contempt of court for violating the injunction issued several years ago. The hearing has been set for June 6. The Selby company claims that it is not violating the terms of the injunction.

TRINITY COUNTY

T. Williams and L. Yancey, who last winter took a lease on the Meader property on Trinity river, near the old New York House, have found some good bunch ore that assays from $40 to $100 per ton.

YUBA COUNTY

The gold dredge recently launched at Hammonton, twelve miles east of Marysville, is the largest yet constructed. Its hull is 240 ft. long and its stacker 138 ft., with a displacement of 1600 tons, about double the ordinary dredge. It has a capacity of 300,000 cu. yd. monthly, and can work to an unusual depth. J. C. Campbell has purchased another pump to hasten the work of pumping out the Pennsylvania mine, and expects to be able to resume development work within ten days. A deal is on foot to bond the property to Eastern capitalists.

COLORADO

GILPIN COUNTY

The Anchor mine, in the Russell district, which is operated by the North American company, is shipping 25 tons per day from a 3½-ft. vein on the 400 and 500-ft. levels. M. Daniels is in charge. The Consolidated Mining Co. is getting the shaft-buildings and machinery of the old Concrete mine in shape preparatory to thorough exploration. C. E. Major is manager. The Running Lode mine has resumed operation and a large output is expected to be secured soon. The shaft at the Pillsbury has reached the 1000-ft. point and a sump is being cut at the bottom. William Auger is superintendent. Shaft-sinking at the Chase mine makes satisfactory progress, and H. Willis, the superintendent, has kept the cost down to $13.50 per foot.

TELLER COUNTY (CRIPPLE CREEK)

The Vindicator Con. G. M. Co. has bought the control of the Christmas G. M. Co., which it recently sued for $75,000 for wrongful extraction of ore. The transfer will end the lawsuit. The April production from the main shaft of the Mary McKinney mine on Raven hill was only 8 cars of from $20 to $50 ore, as the lessees have cleaned up and the shaft is only being operated on company account. Mr. Buckles, the superintendent, is now sinking a winze in ore from the 700-ft. level. The production made by lessees and the company from the Lee shaft of the Isabella Mines Co. was about 1000 tons of an average value of $25 per ton. The Ajax mine on Battle mountain shipped 1350 tons of $20 ore during April. The Little Giant M. & M. Co. in Pony gulch expects to have its mill in operation within two months, as soon as the present overhauling is completed.

(Special Correspondence.)—The results so far from the Roosevelt deep drainage adit have not been up to the expectations of most of the people directly interested. The total flow obtained when work was suspended was about 7500 gal. per minute. This was about March 17. Since that time the flow has gradually diminished to about 6000 gal. per minute. The average subsidence of the water over the area drained is probably 35 to 36 ft. During the month of April the average subsidence was approximately 6 ft., or a little less than during the preceding month. The total underground or storage water may be estimated to be about 40,000,000 gal. per vertical foot. It was expected that a much larger flow would be obtained in the Beacon Hill water course, and that the subsidence of the water over a large part of the district would be 10 to 12 ft. per month. In this respect disappointment has been experienced, but nevertheless the enterprise can not be considered unsuccessful, as some claim. It is draining the district. The funds of the tunnel company have been exhausted, but efforts are now being made to raise an additional $50,000 to extend the tunnel to other known water courses in the hope of increasing the total flow and lowering the water more rapidly. This will probably be done in the near future.

Cripple Creek, May 6.

IDAHO

SHOSHONE COUNTY

(Special Correspondence.) — The concentrates being shipped from the Murray district of the Coeur D'Alene amount to 500 tons per month, about 90% of which is supplied by the Monarch mine and mill, owned by the Coeur D'Alene North Fork M. & S. Co. This company has increased the capacity of its mill and will soon be concentrating 200 tons of ore per day. The Monarch concentrate averages 60% lead, and contains 7 to 12 oz. silver per ton; a zinc middling is made, which is reconcentrated, the product being 45% zinc, and 3 to 6% lead. The other prop-

erties from which concentrates are shipped consist of the Black Horse and Terrible-Edith, though the Bear Top mill is reported about ready to operate and when it gets to working at full capacity the concentrate shipments will amount to 8 to 10 carloads per month. Considerable crude ore is being hauled to Eagle station from the Jack Waite mine, which samples about 70% lead and 7 oz. silver. This consists of steel galena. This mine is situated at the head of Tributary creek, 12 miles from Eagle, and it is probable that the Idaho Northern Railroad Co. will build a spur to a place within three miles of the mine.

Murray, May 2.

(Special Correspondence.)—The Snowstorm Mining Co., which operates the Snowstorm copper mine, situated two miles east of Mullan, is shipping 200 tons of ore that samples 4 to 4½% copper, less than 3% iron, and 1 to 2% sulphur, and 90% silica. As this ore runs high in silica it is in demand for use as converter lining, and the company's shipments are made to various smelters. The mine is situated about a mile from the Northern Pacific railroad at Larson station, and an aerial tramway of that length serves to convey the ore from the No. 3 adit to the shipping bins. Most of the ore now extracted is taken from the stopes between adits No. 3 and No. 2. Adit No. 4, several hundred feet below No. 3, has been driven to the ore zone, and it is probable that eventually this may become the main haulage-level. This is the only copper mine in the Coeur d'Alene.

Larson, May 4.

(Special Correspondence.)—The ore-shoot opened in the Hecla mine, on the 1200-ft. level, is identical with the shoot opened on higher levels, and is stated by Jas. F. McCarthy, the manager, to be of about the same width, and to contain ore of similar grade, as existed in the upper levels. The drift started in ore some time ago at the 1200-ft. level has been advanced three-fourths of the length of the shoot. The shaft, now having a depth of 1200 ft., is to be sunk to the 1500-ft. point. Two 425-gal. electric-driven pumps have been set at the 1200-ft. station, and these are required to raise 300 to 600 gal. of water per minute. The mine is opened by levels from the 300, 600, 900, 1000, and 1200-ft. stations, and by levels 100 and 200, which are adits. The Hecla company is shipping about 1050 tons per month of concentrate, and 550 tons of hand-sorted crude ore. This concentrate product results from the milling of over 8000 tons of ore per month.

Burke, May 5.

(Special Correspondence.)—The Gold Hunter Mining & Smelting Co., operating at Mullan, is mining and milling 300 tons of ore per day, and with the additional equipment being put in this will be increased to 450 tons. This ore, which runs 10 to 12% lead, and 16 to 21 oz. silver per ton, is being mined on the two parallel veins, between adit-levels No. 5 and 6. These veins are about 100 ft. apart on No. 5 level, and occur in quartzite. No. 6 adit, part way a cross-cut, has a length of 4300 ft. At a point 3600 ft. from the portal a 3-compartment winze has been sunk to a depth of 200 ft. about midway between the two veins. A station was cut at the bottom of the winze, and from it a cross-cut was driven to the south vein, said to be 8 to 40 ft. wide, and containing ore running 22% lead and 32 oz. silver. The north vein is to be similarly opened at this depth. An Ottumwa double-drum electric hoist is being put in place at the collar of the winze, and as soon as it is ready for service, sinking is to be resumed, with the intention of continuing to a depth of 800 ft. Much of the ore opened by the winze is considered of shipping grade, and a sorting plant is being built at the mill for separating the high-grade from the mill ore. Dennis Ryan is the company's manager, with T. M. Brennan as superintendent.

Mullan, May 5.

MONTANA

Chouteau County

The King & Queen mine, on Spring gulch, near Carter, which was originally located in 1887 by John Cromie of Spokane, and is now controlled by a Pittsburg syndicate, is arranging to ship a car of the ore recently found on the 300-ft. level. A winze, sunk 50 ft., shows high-grade galena all the way, as high as 40% in lead and 60 oz. of silver per ton. The outlook is so promising that the Chicago, Milwaukee & Puget Sound will build a spur to the mouth of the gulch, reducing the wagon haul to three miles. The mine netted more than $50,000 from ore in the upper workings, where the showing was from 4 to 10% copper, with a small percentage of lead.

Fergus County

The Cumberland mine and mill, at Maiden, in Judith basin, are operating successfully and paying a profit of $10,000 to $15,000 per month. The mill and cyanide plant, now having the capacity of 200 tons of ore per day, are being operated on ore that runs $6 per ton. The cost of mining and treatment has been reduced to about $2.50 per ton. The property belongs to James Breen of Spokane.

Madison County

The property owned by J. M. Vineyard in Bear gulch, not far from Twin Bridges, is showing up well in the long adit and gives assays of $12 to $18 in gold. The vein is of good size. The new dredge of the Conrey Placer company in Ruby valley was started in operation the other day. It is the largest in the world working at a placer property, and cost $250,000. The dredge digs 55 ft. below the waterline.

Silverbow County

(Special Correspondence.)—W. A. Clark recently visited Butte, and has made arrangements for enlarging and remodeling the Butte Reduction Works so that the zinc ore from the Elm Orlu mine may be treated more economically. The Corbin Metals Co. has paid the final installment of $20,000 on its property at Corbin. A 500-ft. shaft has been sunk and good ore uncovered. The Butte & Superior is shipping 450 tons per day to the mill, which saves 78% of the zinc content of the ore, making a concentrate that carries about 50% zinc. The general run of the ore in the mine averages 20% zinc, while some rich ore goes as high as 60% zinc. In the Butte-Alex Scott a new 6-ft. orebody has been found on the 500-ft. level. The company is shipping two cars per day of ore that nets $850 to $950 per car, as it carries 5 oz. silver and 7% copper per ton. At the Mountain View mine the new hoist, operated by compressed air, is now in use. The compressed-air plant is operated by electricity supplied from the Great Falls power-plant, and the hoisting plant derives interest from the fact that it is the largest of its kind in America. The machinery was specially built for this plant by the Nordberg Mfg. Co., and has given such satisfactory service that the Diamond mine will next be similarly equipped. The saving in the cost of power will amount to 1c. per lb. of copper.

Butte, May 5.

NEVADA

Esmeralda County

The preliminary estimate of the April production of the Goldfield Con., made by J. F. Thorn, superintendent, shows that approximately 28,253 tons of ore was handled during the month, the gross recovery being $964,000; costs, $210,000; net profit, $745,000. These figures will be revised in making out the regular monthly statement. This brings the total gross earnings of the company for the first four months of the year to $3,740,616, from which net profits of $2,972,245 have been obtained.

Lincoln County

There are more mines now at work in the Pioche district than at any time during 1910. The Day mine of the Nevada-Utah is shipping 100 tons per day and it is stated that it has 40,000 tons of ore blocked out; the condition of the property is excellent. At the Mendha Nevada a winze has been sunk in ore for 50 ft. below the 900-ft. level. M. C. Godbe, manager of the Eastern Prince and Centennial Pioche, reports that good ore has been found in the latter. At the former good progress is being made in shaft-sinking. Good ore is being found in the Demijohn, where development work is in progress.

Nye County

(Special Correspondence.)—The Ferguson lease on Union No. 4 is reported to have opened a streak of high-grade ore. The tunnel at the White Caps has cut 2 ft. of ore reported to assay $75 to $100 per ton. It is reported that operations will be shortly resumed at the Breyfogle. Zeh Kendall has taken a lease on the Joker estate lying east of Big Four. The March yield of the Johnnie Con. mine at Johnnie amounted to $11,842.79, produced from 2000 tons of ore. The total expenses were $10,575.13, leaving a profit of $1767.66. During the month 650 ft. of new development was accomplishment, an extra shift having gone on. Ore is being produced from the 500, 600, and 800-ft. levels. Mining costs have been brought down to $1.50 per ton, development $2, crushing 16c., and milling $1.47. A large feature of the cost is the power and transportation items, the distance of the property from the railroad and the consumption of distillate for fuel reacting against greater economy. J. K. Turner is consulting engineer, and Jerry Rourke superintendent.

Manhattan, May 5.

The Sandstorm-Kendall has sent out a special report showing the receipts from assessment No. 2 and the disbursements for exploration and other purposes. The annual report of the Belmont shows that during the year 21,900 tons of ore was sent to the smelter and 59,159 tons milled, the average value being $34.93 per ton. The gross earnings were $2,314,205, the cost of operation, including depreciation, $811,824, incidental earnings were $19,920, making a total profit of $1,522,301. The individual surplus amounts to $1,185,867. The ore reserve is estimated as 260,324 tons of positive ore and 182,714 tons of probable ore, of an average value of $26 per ton.

White Pine County

(Special Correspondence.)—The Giroux company is finishing its surface plant which it has been engaged in constructing for nearly two years. The property is being developed on the 700, 1000, 1200, and 1400-ft. levels. The cross-cuts from the Giroux shaft to the old Alpha workings on the 1200 and 1400-ft. levels are progressing rapidly. The 1200-ft. cross-cut will reach the Alpha workings in a few weeks, after which the shipping of direct smelting ore to the Tooele smelter will be started, although no announcement has as yet been made to that effect by the management. It is not expected, however, that any effort will be made at stoping out ore, but that taken out in development work will be shipped. It is expected that the churn-drills will soon be started up again on the sulphide deposits. They were out of commission all winter, owing to the scarcity of water, due to the freezing of the streams. From present indications there will be no erection of plant by the Giroux company during the present year. The management is devoting its principal energy to developing high-grade orebodies along the lime contact. Developments at Boston Ely are progressing steadily on the 1245-ft. level. The contact was reached last month by the west cross-cut but no ore was found at that point.

Ely, May 6.

During April the Nevada Con. shipped 5008 cars of ore to the Steptoe mill, a total of 279,000 tons. The largest amount handled in one day was 9300 tons. Eight sections of the mill are now in operation and the production is expected to further increase.

Recent reports from Duck creek are to the effect that very good ore is being found in the Lead King, on the east side of the range and in the Ely Gibraltar on the west side, and the prospects of developing a lead-mining camp at that place are very bright.

OREGON

Baker County

The Rainbow gold mine, situated in Mormon basin, 35 miles southwest of Baker City, has passed to the United States Smelting, Refining & Mining Co., at a price announced to be $750,000, of which $200,000 is said to have been paid. The vendor was the Commercial M. Co., which gave the purchasing company an option several months ago. The mine was opened about eight years ago, since which time it has been well developed and equipped with a mill. During the first five years W. E. King, a stockholder in the company, directed operations. More recently, H. C. Wilmot has been in charge. It is reported that A. P. Anderson and H. S. Lee have taken charge of the property for the purchaser, and that the scale of operations is to be enlarged. The Humboldt mine and mill, also situated in this basin, belong to the Oregon-Idaho Investment Co. It is a promising property. Mormon basin is in the vicinity of the old Malheur camp, where there was formerly considerable placer mining and cyaniding of gold ore. The nearest railroad station is Durkee, situated half way between Baker and Huntington.

UTAH

Beaver County

(Special Correspondence.)—The Copper Mountain property in the Beaver Lake district will begin shipping soon. The South Utah Mines Co. is planning to build a dry concentrator.

Newhouse, May 5.

Juab County

(Special Correspondence.)—The King William company at Eureka has stopped work pending a survey through Grand Central ground to give them a better idea of where to find the ore in their own ground. Tintic shipments were 141 cars for the week ended May 5, as against 166 cars for the previous week. Iron Blossom shipped 23 cars to Centennial Eureka's 28. The rumor that the decreased shipments of the Iron Blossom were due to caving of its stopes is declared to be without foundation by the management.

Mammoth, May 6.

Salt Lake County

The annual report of the United States Smelting, Refining & Mining Co., just issued, gives the following figures of its metal production for the last three years:

	1910.	1909.	1908.
Copper, lb.	28,430,425	36,672,606	32,830,603
Lead, lb.	51,450,985	41,627,995	27,304,347
Silver, oz.	10,776,465	9,637,119	8,340,566
Gold, oz.	113,246	128,393	128,208

The financial statement for 1910 and the year preceding is as follows:

	1910.	1909.
Earnings of all companies after all charges but depreciation	$3,738,540	$4,155,012
Depreciation	1,067,068	810,247
Administration, legal expenses	187,154	198,404
Interest on U. S. Mining 6% bonds.	.....	10.000
Profit for year	2,484,318	3,136,360
Undistributed surplus previous balance sheet	1,715,230	987,704
Total	$4,199,548	$4,124,064

From the profit for the year $1,701,700 has been paid as a dividend on the preferred stock, $702,100 in dividends on the common stock, $852 in dividends to minority of sub-companies, leaving an undistributed surplus of $1,794,895.

Summit County

(Special Correspondence.)—The American Flag has encountered on the 700-ft. level the rich vein developed in the old adit workings. It is now driving for this vein on the 100-ft. level. The Daly-West company, in accordance with contract, has driven its drainage adit to the Thompson-Quincy Consolidated company's lines, and the latter company will now continue the work into its own property.

Wasatch, May 6.

The Daly Judge and Daly-West mills have adopted the 8-hr. shift plan without the workmen having made any demand for it. The new arrangement went into operation on April 26.

WASHINGTON

Ferry County

The McKinley Mining Co. has engaged C. W. H. Swanson as consulting engineer and superintendent of the property in the Orient district. P. Larson, of Spokane, secretary of the company, says the property will be developed extensively during the season, the plans calling for an adit below the first vein to drift on the orebody for 4500 ft. Twenty-two thousand dollars has been expended on underground work. The ore brought out to date ranges from $45 to $5 in gold. There are three veins which unite to form a large one. Mr. Swanson expects to have ore ready for cyaniding within five months and has recommended the erection of a $20,000 plant.

Stevens County

The Germania M. Co. is employing over 100 men at its tungsten mine, situated in Deer Trail camp, 25 miles west from Springdale. A concentrating mill is being operated. The mill product, consisting of concentrate running high in tungsten, is hauled to Springdale, and shipped to market. Other properties in that camp are being developed.

CANADA

British Columbia

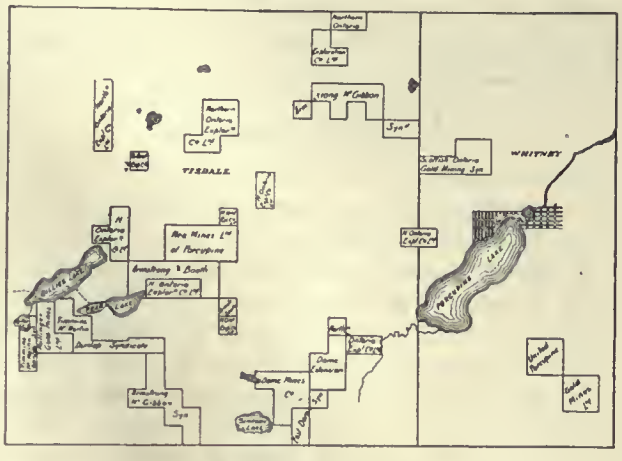
The Standard Silver-Lead M. Co., anticipates having its 100-ton concentrator ready to operate by August 15. The crushing and grinding machinery has a capacity of 200 tons per day, and it is possible that the concentrating equipment may be increased to that capacity in a year or two. The plant is being equipped with Harz jigs, Wilfley tables, and vanners, all machinery to be driven by water-power direct. It is estimated that 30% of the ore is of shipping grade. The principal metals are lead and silver; the small percentage of zinc associated with these metals is to be recovered by re-concentrating. The 8000-ft. tramway, extending from the mine to the mill-bins, is being constructed by the A. Leschen & Sons Rope Co. The mill-site is on Slocan lake, at Silverton, and the ore and concentrate are to be shipped by water.

The McKinley group of mineral claims, belonging to the McKinley Mines Co., situated in Franklin camp, forty miles north of Grand Forks, on the north fork of Kettle river, has been bonded to the British Columbia Copper Co. of Greenwood. The sum named in the bond is said to be $100,000, and the term is one year, during which time the latter company intends to develop the property extensively. The Kettle river branch of the Canadian Pacific Co., which now extends twenty miles up this stream from Grand Forks, may be built to Franklin camp if the McKinley and other groups prove to have large bodies of commercial ore as the result of development.

Members of the executive board of the Granby Con. Mining, Smelting & Power Co., accompanied by Jay P. Graves, general manager, William Yolen Williams, consulting engineer, W. A. Williams, smelter superintendent, O. B. Smith, mine superintendent, M. K. Rodgers of Seattle, and others, are visiting the Hidden Creek copper mine, on Observatory inlet, Portland Canal district, which was taken under bond by the Granby company last November. The property was considerably developed prior to the time the bond was given, and since then the Granby company has had development in progress with a good force of miners, and exploration by diamond-drills has been carried on. Hidden Creek ore is said to sample 2½% copper as a fair average.

Ontario (Cobalt and Porcupine)

Another gold discovery has been reported from Mt. Sinclair, in the Matachewan country, midway between Porcupine and Elk lake. As soon as navigation opens prospectors will start for the new find. It is stated that early in this month a mixed passenger and freight train will be run to Frederickhouse Lake, on the Porcupine line. On the Porcupine Imperial in Deloro a wide quartz vein carrying $40 per ton has been found about 200 ft. from the main vein. The shaft is now down 75 ft. Frank Armstrong has bought the Watson syndicate claims in Tisdale township for $25,000. The temporary break in the service of the British-Canadian Power Co. has been repaired; there is now enough water in the storage reservoir so that a repetition of the water famine is impossible. Mr. Thompson, who has leased the Greene-Meehan, has found a 6-in. smaltite vein carrying native silver. It is reported that high-grade ore has been found at the end of a drift on the 72-ft. level on the Ophir Cobalt. Reports from the Cripple Creek camp continue to be very encouraging.



Map of Porcupine.

MEXICO

Chihuahua

The new pumps for the Apodaquena have arrived, and the transformers are expected soon. About 85 tons per day is the average rate of shipment from this property. In the El Rayo mine, Sta. Barbara, high-grade ore has been found in the northern part of the workings, 250 ft. below the rich find of last year. Carload samples have averaged $35 per ton. J. S. Colbath is manager. The conditions have been somewhat disturbed in Parral, but are quieting down and the mills are in operation.

Jalisco

The first clean-up of the El Favor M. Co. in the Hostotipaquillo district has been made. The concentrate runs about 6 gm. of silver per ton, representing 34½% of the metal in the ore, while 50% of the silver is recovered by the cyanide process. As soon as the two new tube-mills are at work, the 20-mesh screens on the stamp-batteries will be replaced by 8-mesh, and it is expected to raise the stamp-duty from 4 tons to 7 tons per stamp per day. The Casados mine, owned by the Con. Min. Co., shipped ore worth $25,000 during March, and the April production is expected to be greater. The work on the 150-ton mill is well in hand, and it is expected to be in operation before the end of the year. The hydro-electric plant of the Tajo mine in the San Sebastian district will be in operation before the end of the rainy season, and the 100-ton mill will then be started. Drifts on the Tajo vein have exposed ore running from 600 to 1400 gm. per ton.

Sonora

The first lot of concentrate received at Cananea from the Miami mill amounted to 300 tons. Five furnaces are again in operation and the new reverberatory furnace is giving satisfactory service. The March copper production was about 3,500,000 lb. The revolution has not interfered greatly with mining operations in Sonora. During March 243 tons of ore was passed through the customs house of Agua Prieta. But the Las Chispas and the Colorado mines have been obliged to shut down because of the revolutionary activity in their neighborhood. The 66-mile transmission line from Douglas, Arizona, to the El Tigre mine is completed with the exception of the span over the Yaqui river. The transformers have arrived and are at the mine, and it is expected that the new plant will be ready to start not later than June 15.

Personal

Professional men are invited to send news of their engagements and travels. Such news is interesting to friends.

LEE FRASER is at Oruro, Bolivia.

E. B. KIRBY is in San Francisco.

J. HINES has gone to Cordova, Alaska.

GEORGE J. ROCKWELL is in San Francisco.

J. F. CALLBREATH, JR., is in San Francisco.

ALFRED VON DER ROPP has gone to London.

S. B. ELBERT was in San Francisco this week.

E. H. ALLEN sailed on the *Queen* for Dawson.

G. B. STREET has returned to Wilmington, Delaware.

W. E. THORNE left New York on May 4 for Denver.

E. H. BENJAMIN has gone to Hayden Hill, California.

G. F. KAY has been appointed State Geologist of Iowa.

A. A. BOOTH, of Spokane, was recently in Malheur county, Oregon.

LEWIS P. LARSON, of Spokane, is operating a mine at Metaline, Washington.

CHESTER F. LEE, of Seattle, is directing mining operations at Scott's Bar, California.

V. V. CLARK, of Seattle, was recently in New York. He is to be at Nome early in June.

A. I. GOODELL represents the International Smelting & Refining Co. in the Northwest.

COURTENAY DE KALB is examining the Castle Dome silver-lead mine in Yuma county, Arizona.

FERDINAND MCCANN has returned to San Sebastian, Jalisco, Mexico, from Hostotipaquillo.

W. A. KNOL, of Rotterdam, Holland, who was in San Francisco, has gone to Nevada and Utah.

T. J. JONES has gone to Russia to become mine manager for the Kyshtim Corporation, Ltd., at Karabash.

CHARLES F. SPAULDING has been appointed manager for the Veta Colorada M. & S. Co., at Parral, Mexico.

HAROLD JONES is assistant metallurgist to the St. John del Rey Gold Mining Co., Ltd., at Minas Geraes, Brazil.

R. W. HIGGINS is superintending the operations of the MacQuisten tube plant in the Morning mill, Mullan, Idaho.

C. C. O'Loughlin has taken charge of the assayers' supplies department of Stewart & Holmes Drug Co., Seattle.

J. POWER HUTCHINS and NORMAN C. STINES are drilling dredging ground on the Chusovaya river near Ekaterinburg, Ural Mountains, Russia.

JOHN R. MITCHELL, manager for the Gastineau Mining Co., owner of the Alaska-Perseverance mine, at Juneau, was at New York recently.

LIONEL LINDSAY is examining the Quintera mine at Alamos, Sonora, for Courtenay De Kalb of the Mexican-American Smelting & Refining Company.

E. H. WILSON, who with his associates purchased the Snowshoe mine, near Libby, Montana, is at the property making preparations to begin operations.

C. J. ADAMI, for the past four years superintendent of mines for the Federal Lead Co., has resigned and has been appointed assistant general manager for the Doe Run Lead Co. at River Mines, Missouri.

J. E. MCALLISTER has resigned as general manager for the British Columbia Copper Co., and will join a New York firm of mining engineers. He becomes consulting engineer for the British Columbia company. E. G. WARREN, former smelter superintendent, succeeds Mr. McAllister as general manager.

The SCHOOL OF MINES AND METALLURGY OF THE UNIVERSITY OF MISSOURI will hold its commencement exercises on May 26.

Market Reports

LOCAL METAL PRICES.

San Francisco, May 11.

Antimony	12—12¾c	Quicksilver (flask)	46.50
Electrolytic Copper	14—15¼c	Tin	45—46½c
Pig Lead	4.75—5.70c	Spelter	7—7¾c

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

METAL PRICES.

By wire from New York.

Average daily prices in cents per pound.

Date.	Electrolytic Copper.	Lead.	Spelter.	Silver, per oz.
May 4	11.98	4.39	5.36	53
" 5	11.98	4.39	5.36	53¼
" 6	11.98	4.39	5.36	53¼
" 7	Sunday.	No market.		
" 8	11.95	4.39	5.36	53¼
" 9	11.95	4.39	5.36	53¼
" 10	11.95	4.39	5.36	53⅛

ANGLO-AMERICAN SHARES.

Cabled from London.

	May 3. £ s. d.	May 11. £ s. d.
Camp Bird	1 14 0	1 13 6
El Oro	1 4 6	1 4 6
Esperanza	1 13 9	1 12 6
Dolores	1 5 0	1 5 0
Oroville Dredging	0 5 9	0 5 9
Mexico Mines	7 12 6	7 13 9
Tomboy	0 15 6	0 15 6

(By courtesy of W. P. Bonbright & Co., 24 Broad St., N. Y.)

MINING STOCK QUOTATIONS—NEW YORK.

(By wire from Catlin & Powell Co., New York.)

	Closing prices, May 11.		Closing prices, May 11.
Amalgamated Copper	$ 62¼	La Rose	$ 4⅜
A. S. & R. Co.	74½	Mason Valley	8
Braden Copper	4	Miami Copper	20
B. C. Copper Co.	5⅛	Mines Co. of America	5
Butte Coalition	17⅜	Nevada Con	18½
Chino	24	Nevada Utah	¾
Davis Daly	1⅜	Nipissing	10⅞
Dobie	3⅝	Ohio Copper	1⅝
Dolores	5½	Ray Central	1⅞
First National	1⅝	Ray Con	16½
Foley O'Brien	1½	South Utah	⅞
Giroux	6	Superior & Pittsburg	14⅛
Goldfield Con	6	Tenn. Copper	36⅜
Greene-Cananea	6	Trinity	3¾
Guanajuato Con	½	Tuolumne Copper	4⅝
Hollinger	12⅜	United Copper	37⅛
Inspiration	7¾	Utah Copper	44⅜
Kerr Lake	6⅜	Yukon Gold	3⅞

COPPER SHARES—BOSTON.

	Closing prices, May 11.		Closing prices, May 11.
Adventure	$ 5¾	Mohawk	$ 38
Allouez	31	North Butte	27¾
Atlantic	5½	Old Dominion	39½
Calumet & Arizona	50	Osceola	96
Calumet & Hecla	460	Parrot	11¼
Centennial	11½	Santa Fe	¾
Copper Range	60	Shannon	10
Daly West	4¾	Superior & Pittsburg	14
Franklin	9	Tamarack	34
Granby	33¼	Trinity	3¾
Greene Cananea, ctf	6	Utah Cou	14
Isle-Royale	13	Victoria	1½
La Salle	3½	Winona	6¾
Mass Copper	5¾	Wolverine	108½

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

SOUTHERN NEVADA

San Francisco, May 11.

Atlanta	$ .11	Nevada Hills	$3.00
Belmont	6.17	Pittsburg Silver Peak	.65
Booth	.07	Round Mountain	.55
Columbia Mtn	.04	Sandstorm Kendall	.06
Combination Fraction	.08	Silver Pick	.05
Florence	1.55	Tonopah Extension	1.06
Goldfield Con	6.00	Tonopah of Nevada	6.30
Gold Kewenas	.06	West End	.56
Jim Butler	.27	Belcher	.75
Jumbo Extension	.28	B. & B.	.60
MacNamara	.13	Con. Virginia	1.80
Mayflower	.04	Mexican	6.90
Midway	.27	Ophir	2.27
Montana Tonopah	.86	Savage	.54

(By courtesy of San Francisco Stock Exchange.)

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EDITORIAL

THE ADDRESS delivered to the mining students at Berkeley, California, by Mr. J. R. Finlay contains a message that should go to all young men entering the profession. We are glad to hear such good doctrine preached.

MINING machinery is not often exported from California to Germany, but at least one tube-mill is now on the way to Hamburg from San Francisco. This is an incidental result of the activity of the revolutionists at Mazatlan.

LOST HILLS now has an oil well that is a gusher, the Martin & Dudley well having 'come-in' last week. According to the *California Oil World*, the daily production of the four Kern county fields amounted to 118,748 barrels in April.

MASSACHUSETTS seems likely to take the lead in requiring full publicity of all mining corporations whose stock is offered for sale through any mining exchange or newspaper in the Commonwealth. An interesting provision is that on demand of 25 per cent of the stockholders, the management must permit the examination of the property by a mining engineer selected by those making the demand, and that half the expense of the examination shall be paid by the company. The bill has been favorably reported and seems likely to become a law.

IN an interesting address last week before the Finance Forum in New York, Mr. J. Parke Channing pointed out that it was the improved methods of treatment developed at the older mines which had made the porphyry copper deposits valuable. The hill at Butte he cited as practically a porphyry copper mine, though it is usual to think of it as something entirely different. Butte, however, has developed as a result of years of work in the immediate vicinity. At Miami, by spending $4,000,000 and four years time, a mine containing 20,000,000 tons of ore assaying 1½ to 3 per cent copper, has been developed. Here knowledge gained elsewhere has been applied, and in time engineers expect and will doubtless receive liberal contributions to technical science from Miami.

COMSTOCK shares have been increasingly active on the local exchange since the first of the year. The important discovery in the Mexican affords a valid reason for some increase in price of the leading stocks; but the legitimate rise was long since discounted. Monday last prices broke, as was to have been anticipated. With shares that are so completely in the hands of stock manipulators as are the Comstocks, it is always hazardous to make predictions, but on their merits prices should be still lower rather than higher. We have every confidence in the discovery along the Lode of additional bodies of ore that can be worked with profit, but Comstock history is one long record of disaster due to what is really gambling, with shares instead of chips as counters.

BONDING of the Mt. Andrew mine on the south side of Kasaan peninsua, Prince of Wales island, to the United States Smelting, Refining & Mining Company is announced. This calls attention again to the rapidity with which important mines are being developed in southeastern Alaska, as well as to the activity of the excellent company which rejoices in the all-inclusive name. A brief description of the Mt. Andrew mine was given in the *Mining and Scientific Press*, April 15. The deposit is large and may be cheaply worked.

GROSS misrepresentation is charged against the Hydro-Electric Mining Company by the State Mineralogist of California. Mr. F. W. Ford, president and general manager of the concern that proposed to obtain a bullion output of $1,460,000 per annum from the French Hill mines in Eldorado county, with "no tunnels, no shafts, no hoisting, no timbering, no pumping", has been arrested, and will have opportunity to prove in court a few of the glittering promises circulated by the company. False statements about mining properties are much less common than they were a dozen years ago, and we hope to see them made rarer still. We have no admiration for the present State Mineralogist of California, but are glad to commend his recent activity in prosecuting fraudulent promoters.

DECISION of the Standard Oil case by the United States Supreme Court was announced this week and, as has been true of the majority of the important recent decisions of the Court, the results seem somewhat mixed. Now that it is over, everyone wonders why business has so long hesitated for fear of a decision adverse to the company. Nominally the Government wins at almost every point, as was true in the case against the anthracite coal roads; actually it does not seem likely that any great revolution in business methods will result. In both instances the Court has laid down an admirable principle, but in the anthracite fields there is a close monopoly now as ever, and we doubt not that Standard Oil will serve reformers as the horrible example of a 'trust' for many years to come. Many see danger in the statement of the Court that the rule of reason must be used in measuring restraint of trade; that only unreasonable restraint is forbidden. We do not agree that this is a bad rule if it be but lived up to. The evil effects of forbidding any form of restraint of trade are apparent to all familiar with the coal situation in the Middle West. Coal, money, and men are yearly sacrificed because it is easy to open a coal mine and no agreement among operators is legal. The difficulty under the new rule will be to determine in each case what is reasonable and what is not. Approached honestly, it is not an insuperable difficulty; and the reward is worth the effort.

OFFICIAL ANNOUNCEMENT of the sale of the Risdon Iron Works at San Francisco to the United States Steel Corporation has been made, and it is also reported that options have been taken on the Moran shipyards at Seattle, as well as on terminal properties at Portland and other Coast points. The history of the Risdon works is the history of San Francisco. Established at Bush and Market streets in the early fifties by Lewis Coffey and John Risdon, two New York boiler-makers, the plant was later removed to Howard street near First, and at one time had the backing of the four 'bonanza kings', Mackay, Fair, Flood, and O'Brien. In the beginning it was only a blacksmith and boiler-shop, but grew rapidly until it took on the importance of an iron works and at one time during the Comstock excitement was known as the Risdon Iron & Locomotive Works. Only one locomotive was ever manufactured, and this part of the title was dropped upon removal of the plant to the Potrero at Twentieth and Kentucky streets. After the deaths of the original owners the plant became the property of Mr. William Taylor, a steamboat master, who, pleased at the excellent product of the works, bought an interest in them. At his death the ownership passed to his heirs. Messrs. Augustus and W. H. Taylor, his sons, signed the deed which gave ownership to the United States Steel Corporation. At one time the Risdon employed 1500 men and it has been noted for the excellent marine engines and other work turned out. The Risdon works have built much mining machinery, and designed and erected the first dredges used in California. In this line, especially, the company did pioneer work. Purchase by the Steel Corporation of the works follows activity on the part of men connected with it in examining and buying iron ore deposits, of which there are several of value in southern California. There is talk locally of erection of blast-furnaces, though nothing authoritative has been announced, and such a move is unlikely. All the city properties selected are notable for their excellent situation as regards receipt and re-shipment of freight, and it may well be that for the present the move means merely that the Corporation proposes to carry larger local stocks of iron and steel. This enlargement of the local activities of the greatest American business institution is the first tangible sign of the approaching completion of the Panama Canal.

Dredging in Russia and Siberia

Americans have an unusual interest in foreign gold-dredging fields. The heavy 'California type' dredge, developed here from the earlier and lighter New Zealand boats, has made phenomenal records in several of the States and has dominated the dredging industry in the Far North. At the same time the New Zealand type of boat had held almost undisputed sway in foreign countries. In Russia boats have been built on American lines, though nothing comparable to the 'dreadnaughts' recently erected in California by the Yuba Construction Company, and in Montana and the Yukon by the Marion Steam Shovel Company, is in use anywhere abroad. Modern American dredges were shipped last year to Colombia by the Yuba Construction Company, to Burma by the Bucyrus Company, and to Siberia by the New York Engineering Company. It is hoped that the success of these boats will lead to the building of many others. Americans find it hard to believe that conditions abroad differ essentially from those already met economically by the big boats. Mining engineers, machinery builders, and capitalists in this country are all studying the foreign fields with interest. In many particulars the Russian and Siberian goldfields particularly attract Americans. It is known that the placers are rich and extensive, and the climate is not unlike that already familiar in Alaska and Montana. The people and governments of the two countries have always been on friendly terms, and a number of American engineers are personally familiar with Siberia. Last, but by no means least in importance, British capital is willing to go into Siberia, and it is the Anglo-American enterprises in dredging that are most important. Our excellent contemporary, *Zoloto i Platina*, publishes much that is of interest to dredgemen. We print this week a thoughtful general review of the Russian situation, written by Mr. S. I. Littauer and translated by Mr. W. H. Shockley. The original article is too long to be reprinted in full, and we have omitted an extensive table giving additional statistics as to the 64 dredges now in operation. The November number of *Zoloto i Platina* was exclusively devoted to reviewing the dredging industry in the light of data collected by the Permanent Consulting

Board of Gold and Platinum Producers. A special discussion of the advantage and disadvantage to Russia of inviting foreign capital to participate in the dredging industry is promised later. In this issue it is merely pointed out that Russian dredging has made slow progress as compared with the industry in other countries, that capital has generally been insufficient, and that such boats as have been built and operated have been made possible mainly through long credits from the machinery houses or expensive borrowing from banks. "California dredges", says our contemporary, "would unquestionably make it possible to greatly reduce working costs. For economical, local, and technical reasons, such low costs as are attained in California are impossible in Russia, but they show what a vast area of placers might become workable in Russia by the application of proper methods. The number of dredges working in Russia, about 70, is ridiculously small in comparison with the vast area of auriferous placers that might be worked with their aid. One of the most important circumstances repressing and retarding the development of the dredging industry in Russia, is the lack of the necessary capital. Russian capital is on the one hand too immobile, and on the other too careful to enter into the development of the dredging industry in unknown places; a business that offers, as is shown by American experience, one of the most advantageous opportunities for investment. On this account the initial Russian dredging enterprises must largely rely on foreign capital. The Russian dredging industry can only emerge from its present unenviable condition by the help of the large banks, or by the aid of foreign capital; by their aid it can enter upon a brilliant career, alike profitable to the gold industry and the capital employed. This is the more to be wished since the dredging industry has already trodden the thorny path of experience, inevitably strewn with failures and disappointments. But now the results of dredging, as is shown by technical and economical statistics, are becoming more and more satisfactory." Attention should further be called to the fact that free importation of machinery and mining supplies is still permitted in the Amur and Primorsk districts, and that these are the ones most readily accessible to American ports.

Engineering Ethics

The ethics that should govern engineers in their professional relations, have been much discussed of recent years, and it is a welcome sign of a growing professional spirit. As engineers come to recognize the importance of maintaining the highest standards, membership in the profession will bring more of dignity, honor, and remuneration. If a man thinks of himself as but an artisan or mechanic, he is apt to be treated and paid as one; and to get what he deserves. That engineering stands on a higher plane than this, is due to the pioneers who have placed it there. We, for our part, should guard the future, not by clannish exclusiveness, but by quick and generous recognition of talent, and by a nice observance, each for himself, of the canons of ethics that govern the profession. We are glad to present so clear and admirable a summary as has been compiled by the committee of the Philadelphia Section of the Mining and Metallurgical Society. The San Francisco members of the same Society in discussing the report found much to commend and nothing to criticize. That, in brief, is our own attitude. There are, however, a few points we should like if possible to emphasize.

The duty of respecting scrupulously the limitations of our own knowledge, is not always recognized. Engineering covers a broad field and within it there is room for many specialties. Considering mining engineering only, the three fields, geology, mining, and ore treatment, at once come to mind. A man may be a most excellent geologist and yet be poorly equipped to advise regarding either mining or metallurgy. This is by no means to say that the geologist is not useful. Indeed, the demand for exact geological work never was greater than now, and no large mine examination should be undertaken without the assistance of a competent geologist. Mining, however, requires men of somewhat different temperament and of entirely different training and experience. A man may know little geology and yet sink a shaft or open a stope cheaply and rapidly; but such a man is not necessarily competent to decipher an intricate system of faults or to recognize the limits of a secondarily enriched orebody. The metallurgist, in turn, is a most useful member of the profession, but has his own field; one so broad, indeed, as to include a whole range of specialties. The best of cyanidation experts ought not to attempt to advise a client regarding copper smelting, on the basis at least, of his experience with cyanide. The safe rule is never to attempt anything you are not thoroughly competent to do, and in the other cases to call in a fellow engineer for advice and help. If each one does this there will be fewer mistakes, better-satisfied clients, and more work for everybody. One of the best and most successful mining engineers we know, but one experienced mainly in metal mining, had occasion once to consider a question relating to coal mining. The problems of the colliery are different in important particulars from those of even the largest metal mines, and our friend recognized this. Instead, therefore, of attempting to handle the matter alone, he called in another engineer whose experience had been almost entirely in coal mining. On the basis of the second engineer's report and his own knowledge of his client's needs, he advised them excellently, as the result proved. Such men are at the head of the profession because they know how to utilize the services of others. Under most conditions it is as foolish for a mining engineer to attempt to solve geological problems, as to make his own assays, post his own books, and sharpen his own moils. Failure to recognize this fact limits the usefulness of many a good man and too ready a belief in one's own powers often leads to disaster. It is, as the Philadelphia committee has said, the duty of each engineer to secure assistance or decline any commission which calls him beyond the safe limit of his abilities.

Another matter of much importance is the highly unprofessional conduct of an engineer who accepts presents or commissions from those with whom he transacts business for his clients. We are glad to believe that this practice is dying out. It can not disappear too quickly for the good of the profession. In certain countries and districts it is all too common yet, but the fact that no engineer will publicly defend it, shows how widely it is condemned. As to the vexed question of promotions and contingent fees there is as yet no consensus of opinion, though we believe heartily in the dictum laid down by the committee, that all such matters should be open and above-board. Any arrangement of this sort that must be secret is suspicious, to say the least. The duty of engineers to support professional societies, to cultivate friendly relations with their fellows, and not to dodge responsibility when it comes to them, can not be too often emphasized. To the report of the committee we would add one more dictum, namely, that it is the duty of an engineer to give freely of his knowledge and experience to his fellows in part return for what he enjoys as the result of those who have gone before. A profession that does not recognize the benefits of technical writing and of supporting technical publications, can but degenerate into a secret guild or caste and both these belong to the medieval age rather than to the future.

Development of Western Mining

By J. R. Finlay

*I know little about the University of California; no more than what every educated or semi-educated man knows, that it is a large and flourishing institution of learning which has contributed greatly to the advancement of the arts and sciences in California. Not knowing the student life at Berkeley, I fear I may be bringing coals to Newcastle in some of the remarks I intend to make, which are in protest against forming too hasty a judgment of what is worth while—of what is theoretical and what is practical. I have noticed among the students of some isolated technical schools an impatience, almost a contempt, for knowledge, and hope this atmosphere is not present in any department of the University of California. What I mean by contempt for knowledge is a narrowing down of intellectual interest to some object of plain, or so-called, practical utility. A man may exert himself to become an engineer by learning certain things that he is told are necessary for that purpose. His one idea is to acquire what he calls a profession, but which might just as well be called a trade. He takes no interest in information that he thinks he cannot sell. I have seen graduates of mining schools who had learned how to take solar observations in order to get a north and south line, and yet did not know what the solar system was. I remember one such graduate who was filled with genuine impatience at the idea that it might be worth while to know the difference between the planets and the fixed stars. This is not, to my mind, the attitude of an educated man; it is an attitude of exaggerated and mistaken devotion to the practical.

As a matter of fact, it is hard to tell what is practical and what is not; but I venture an opinion that nothing is more unpractical than a method of thought that narrows the interests of the mind. Anything that adds to the efficiency of the human mind, in the smallest fraction, is putting new worlds at the feet of mankind. What is true of the race is true of the individual. The one function of education is to develop the mind. Any system that tries to teach a trade and not to fertilize the brain is not education. I do not for a moment wish to discredit or discourage the most painstaking application to technical details. In that very direction, perhaps, can intelligence make the most fruitful advances in industrial and scientific pursuits. As an instance, see the great field for economy demonstrated to exist in the scientific study of the commonest kinds of labor. It has been shown that in many cases the output of shovelers can be increased three or four fold by making a scientific study of the size and shape of the shovels to be used for handling different materials. All this is the effect of the awakened mind. It is not the stereotyped action of a man who has no interest in anything not approved by commercial custom; it is not, on the other hand, the accomplishment of one who rashly tries to improve something without understanding it. That certainly is unpractical. It is done by analyzing the facts and discovering that because a thing is taken for granted it is not therefore necessarily understood. It has been found that a laborer might shovel 60 tons a day with no more effort than he had used to shovel 16 tons; although it may be assumed as certain that the laborer prided himself on being expert at his art and felt sanctified and entrenched in centuries of 16-ton shoveling.

Has it ever occurred to you that what we usually regard as physical efforts are really mental efforts? We are seated in a building made of wood, iron, and cement. Is it merely wood, iron, and cement? No; it is a human habitation, a structure of the human organism, an output of the human imagination. Without that last the wood would be a tree, the iron an ore, the cement a stone. Similarly, the mining business is a mental business, not wholly a physical one. We hear people talking of the mineral resources of certain localities as if the mere existence of gold ore would make a gold mine. No! it is men who create gold mines. It is their imagination that creates gold ore; for without the curious psychologic phenomenon that makes men prize gold, it would remain forever unnoticed in the rocks. The development of the mining industry of the future will depend entirely on the development of ideas. Ideas create wants, and industry is the effort to satisfy them. The gold of California had lain scattered through the gravels of the Sierra Nevadas since Tertiary times, but it caused no excitement whatever. Undoubtedly many an Indian had picked up an occasional nugget, but it meant nothing to him. The real significance of the rush to California lies in the rush, not in the gold. The gold might as well have remained scattered in useless yellow fragments in the gravel. The gold was merely the spark that ignited the white man's brain, and the great human rush which followed was the significant event. It was one of the capital acts in the building of an immense empire. It changed the face of nature. It tore down the forests, muddied the streams, started a whole chain of activities in the midst of which we are still living and the end of which we cannot foretell. The controlling factors of the incident were not the existence of gold, but historical events; and the same reasons governed the almost simultaneous exploitation of the Australian goldfields. We must remember that up to the time of the Mexican War, the growth of the United States out of the English colonies had been monotonous, though rapid. The earlier excitements of war and exploration and conflict with the Indians were waning. The main occupation of the people had been to hew out homesteads in the forests. The expenditure of manual labor to do this was frightful. Even after a farm was started, the returns were meagre and slow; the people were poor, and chained to a humdrum pursuit. Nevertheless, they were magnificently prepared for adventure. The youth of the country were all trained in the use of the gun and the ax: they were familiar with the wilderness as well as the farm, and could camp in the woods and cook their own food without any teaching. The Mexican War gave some excitement to the adventurous spirit of these people, and the consequences of the war gave a field for more. A vast stretch of country including California was ceded by Mexico; the West seemed absolutely boundless. The news that California was not only a beautiful, smiling, seacoast country, but that it abounded in gold, was enough to fire the imagination of the plow-wearied youth quite to the exploding point. Nothing could hold them back and the rush that began was unique among the migrations of the white race. It was not only America that was ripe to send her sons to California. Europe had simmered down to a long period of rest after the French Revolution and the wars of Napoleon. The ideas of that time had been repressed, but not extinguished. Steady progress had been made in arts and manufactures, and hopes were secretly growing out of the triumph of democratic ideas. In 1848 revolution broke out in France, Germany, Austria, Hungary, and Italy. In France only were the Republicans successful. In the other countries the old order of things soon triumphed, and hordes of talented, eager, self-sacrificing young men were banished from their homes. What more natural than for these disappointed exiles to turn to a new field where their cherished political ideas were already fully accepted, where there was plenty of room for effort, and where perhaps a fortune might be picked out of the sand? It is true that gold has always had the fascination of romance as well as of value, but it is also true that these circumstances gave to the California goldfields an unparalleled attraction. The effect of this sudden outpouring of the flower of the civilized world upon the development of the West is not, I believe, quite appreciated. It made a great country of California immediately. Before the State was ten years old it was contributing literature that was read over the whole world. From the first it contributed leading men in business and the arts. In mining, the particular industry to which attention was directed, the impress given by the

*Address delivered before the Students' Mining Association, University of California.

'forty-niners' was absolutely controlling. In other countries, from time immemorial, work in the mines was the work of slaves. In our West it was the work not only of free men, but of picked men from many nations. Hard labor underground was gilded by the glamor of romance and enthusiasm. The whole field was at one stroke illuminated by a light of generous enthusiasm which enabled men to create success, and which has not yet wholly died out. We do not hear that any great fortunes came from the early placer mines. A competence, or even a good living, was enough for most of the miners, but as soon as they passed beyond the stream placers and began to work quartz gold mines and the silver ores of Nevada, the business became more complex and needed more thorough organization. It was then that large fortunes began to be made from Western mines. As time went on, capital played a larger and larger part. During the three or four decades following the rush to California, there was a succession of discoveries of new and rich gold and silver districts, in which poor prospectors suddenly became millionaires. The whole mountain country remained a region for stirring adventures, filled with golden dreams and generous impulses. The Comstock lode in the early sixties; Eureka, Nevada, and the Black Hills in the early seventies; Leadville, Aspen, Butte, and the Coeur d'Alene in the early eighties; Cripple Creek and Creede in the early nineties; and finally Tonopah, Goldfield, and the porphyry coppers in the last decade have all contributed their quota of fortunes and excitements. It must be confessed, however, that the golden age of Western discovery has substantially passed. The discovery of new mining camps where poor men may dig out a fortune has not kept pace with the increase of population and the means of travel and transportation. It would be rash to say that no new bonanza discoveries will be made; but it is almost unconceivable that such discoveries will play any great part in the economy of the Western States. For example, there was a great mining craze in Nevada a few years ago, but all the discoveries made in that State in ten years are sufficient to give employment to only three or four thousand men. The whole State gained forty thousand people in the decade while California, without any increase in mining activity, gained nine hundred thousand. Precious-metal mining is losing ground rapidly in relative if not in absolute importance. But other kinds of mining are not losing ground.

All this only illustrates more strongly that the enthusiastic traditional period born of the days of forty-nine has passed. Work in the mines is once more the work of slaves. I speak figuratively. I mean that work in the other man's mine is no longer a stepping-stone to working your own mine which is surely waiting for you in the hills. It is only a stepping-stone to a lease, a farm, or to some other kind of work. Work in the mines is no more hopeful than work on the railroads, and not so healthful. The growth of the Western Federation of Miners is a dumb recognition of this fact. Mining is no longer a cheerful scramble and gamble for gold; it is a stern, dangerous occupation, a dark and disagreeable occupation, in which advancement is slow and competition keen. There is hardly an outlook more gloomy than that of the average prospector on Government lands. The future growth of the mining business will be mainly based on deposits already partly known and on land already owned by private individuals or by corporations. This view of affairs is not by any means so discouraging as it sounds. In part it merely recognizes what has always been true. The fact is, that even in the palmiest days of the West, the percentage of adventurers who actually realized their hopes of fortune was small. In the mining business of today there are many opportunities, perhaps not so many for each person as there were at times in the past, but much more varied. The mining business which has grown out of the days of forty-nine is really a business. It has lost its romantic side. A favorite phrase for some people is the 'mining game.' You might as well talk about the 'farming game.' Let no young man go into the mining business expecting to find the conditions described by Bret Harte and Mark Twain. That belongs to the past; a very recent past, to be sure, but just as truly of the past as are the deeds of Achilles and Odysseus.

San Francisco has decided to hold in 1915 a great industrial exposition to celebrate the completion of the Panama Canal, which the Government engineers promise will be opened year after next. This is the crowning chapter in the long book of the opening up the North American Continent by a complete system of transportation. Forty years ago, one transcontinental railroad had just been completed which allowed travel from San Francisco to New York. Now we have in the United States alone, seven or eight through railroads, every one of which takes passengers from coast to coast in four days. Canada will shortly have three such systems, and Mexico two or three. It is not too much to say that the whole Pacific area is as well provided with transportation today as the region east of the Mississippi was thirty years ago. The country is no longer a wilderness, but is like the rest of the civilized world in all essential respects. This means that business and industry are on practically the same footing as in the rest of the world. The year that saw the Panama Canal definitely undertaken saw also, on the other side of the Pacific, a still more significant event—the Russo-Japanese war. That was a swing of the pendulum of history which marked a great epoch in the progress of mankind. Ten years ago the resistance of any Asiatic nation to any leading European power looked like a fantastic dream. In 1905 the victory of Japan over Russia settled probably for hundreds of years some very important questions. It showed some limits to the dominance of the white race, stopped the disintegration of China, and caused the world to do a vast amount of thinking. That war was as important to the United States as to other nations. It brought home to us the truth that we could not expand farther in Asia; it made our continued possession of the Philippines seem doubtful; it showed us that our future development must be in the territory already occupied. The agitation against the Japanese in California a few years ago was a compliment to that people, for the underlying motive of the agitation was not contempt, but fear, and aversion based on fear.

There are many features of our present-day progress that are affecting industry profoundly, but I will confine myself to just one more, the general acceptance of the corporation as a means of doing business. The reason is that the corporation is economical. It accomplishes results with a less expenditure of capital and labor than individuals can. Corporations are accused of growing larger and larger, of absorbing more and more of the resources of the country. That is true, but who owns the corporations? The United States Steel Corporation has, I believe, 65,000 to 70,000 stockholders. Even Goldfield Consolidated has 7000. The fact is that corporations are performing two apparently opposite functions. They are removing property from the control of the individual and at the same time making it easier for the individual to get property. Few men ever were rich enough or fortunate enough to own a mine as an entirety. Very few are so poor that they cannot own a share in one. There is a significance in this. The mining business of the future will be more and more a business of corporate investments. The mining engineer of the future, or of the present for that matter, must know the value of mining stocks if he wants to make money. He must invest his money in mining stocks. It is just as much his business to do so as it was the business of the son of the pioneer farmer to acquire a farm. If the mining business is not good enough for you to invest in, it is not good enough for you to work in. Every man of consequence should own some property. You are certainly better qualified to own property in a business that you understand than in some business that you do not understand. It has been so much a practice to sell worthless wild-cat stocks to a gullible public that to many people mining stock is a joke. The real growth of corporate mining will end this. A strong move-

ment is under way to cause mining companies, as well as other corporations, to publish such reports on their property and operations as will allow any competent man to have a fair idea of what their property is worth. The outcome of this movement is inevitable; the reports will surely be better than they used to be. Furthermore, men in charge of corporations are put there mainly because their associates can trust them. There are few men who will be honest in private and liars in public; if a man is honest to his associates he will be honest to the public, and if he makes a public report it will be an honest report.

Let me point out one or two directions where mining, or at least its cognate industries, is likely to make great expansion. It seems to me that the manufacture of cement and fertilizers will greatly increase. The last few years have seen an enhancement in the value of agricultural land. This has come to stay. The rise has been due to the rising price of farm products and to the realization that the supply of new land no longer exists. All of the Pacific States gained in population from 60 to 100% in the last decade. California is nearly as large as France; San Francisco will one day be as big as Paris. The State can hold easily fifteen or twenty million people. The wealth of the country is mainly in its soil, and its soil must be made productive by irrigation and kept productive by fertilizing. If we realize that there are in California twenty million acres of arable land which has undergone an enhancement of fifty dollars an acre, we have an additional property valuation of a thousand million dollars. That is worth maintaining, though it may easily mean the use of fifty million dollars a year in fertilizers. At the same time, the regulation of streams by means of reservoirs for the purpose of securing water for irrigation and for power, and the building of millions of houses and thousands of miles of roads, will require a prodigious amount of cement. I believe that there will be required somewhat more cement per capita on the Pacific Coast than in the East. If San Francisco is to be as large as Paris, it must be built so that it will be secure from earthquake and fire. Time and the increasing cost of timber will see it built of concrete and steel. You may say that the manufacture of fertilizers and cement is not mining. If you say that, it is because you are thinking of the traditional underground precious-metal mine. Copper and iron ore are being mined by steam-shovels. Cement rock and phosphate rock belong to the crust of the earth just as much as does gold quartz. You might as well work in a cement mill as in a copper smelter; as well in a fertilizer plant as in a quartz mill. Your technical education equips you as well for one as for the other. All mining is in a sense manufacturing; productive mining certainly is. Unproductive mining, merely looking for something, is different. Unfortunately, that is what many people understand by mining. They think it means merely looking for something until you find it, as if a fortune could be picked up as easily as a quarter of a dollar, when once you run across it.

Gold will be sought in the future as in the past, in the wild places of the earth. Canada, Siberia, the middle part of Africa, South America—these are the countries where new discoveries are being made, or rather, in some cases, old discoveries are being re-made. The gold output of Europe is insignificant; that of the United States and Australia either on the decline or soon to decline. This means that gold supplies do not last many generations in the regions most desirable for human habitation. The problem before the rising generation is not to find new resources, but to utilize wisely the old ones, or at least the known ones. It is the very time for the educated man with the alert mind. Reorganization is the order of the day. It may be reorganized along any one of many lines. It may be political, financial, technical, or industrial. Mining is one of the great businesses of the country and of modern civilization. It is certainly undergoing a rapid financial reorganization. They say we are becoming a nation of employees. So we are—let us recognize that fact. But we are also becoming a nation of employers, for we are becoming a nation of stockholders.

Sand Filling

By R. W. Schumacher

*The plan of commencing sand-filling in several of the subsidiary mines was mentioned at the last annual meeting, and, during the year under review, further proof has accumulated that a comprehensive system of filling worked-out areas is desirable. Sometimes other methods of supporting the ground, such as reef pillars and waste packs, are useful in holding up thin layers of hanging wall a few feet thick, but they fail entirely when enormous pressure takes place from the overlying strata, as in the neighborhood of the Ferreira Deep, where a large area of ground is gradually settling. Experience has shown that reef pillars under these circumstances usually punch into the hanging wall or crumble away, thus diminishing their support and allowing the ground to fall in. Waste packs, again, crush to about half their original width, and often collapse altogether. A sand pack flushed in by water will also have to give way to some extent under such heavy pressures, but, as far as is yet known, the compression will not amount to over 5 or 10% of its thickness, and then the sand will be left in a condition of solidity almost approaching the natural formation of the rock. One of the main differences between sand-filling and other methods of supporting the hanging wall lies in the size of the packs used. Pillars or waste packs may measure 40 by 40 ft. square, but, owing to their heavy cost, they would almost necessarily be scattered and at considerable distances from one another. A sand pack, on the other hand, has practically no limit as to dimensions, and will, as mentioned, after a slight compression, solidify every part of a worked-out area. On the Ferreira Deep a sand pack has recently been completed measuring 700 by 300 ft., and even larger packs will soon be started, the idea being to fill the entire space between incline shafts in the upper workings. Since June 1910, when filling started at this mine, 130,000 tons of sand have been deposited, and recently the plant has been duplicated, so that the process of filling can be further accelerated.

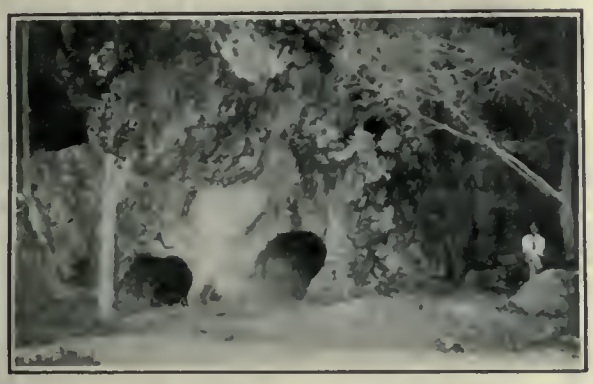
At the Crown Mines three plants are being constructed to fill certain exhausted areas. Actual filling commenced in the middle of November 1910, and it is expected that in a few months the company will be able to flush into the mine between 50,000 and 60,000 tons of sand per month. At the Geldenhuis Deep, where sand filling is now just commencing, there are two objects in view; the first is to lend support to two of the vertical shafts, and the other is to assist in the recovery of a large number of pillars under the railway line, which can be extracted only on the condition laid down by the Government that a considerable area be packed with sand. At the Rose Deep, where preparations for sand-filling are nearing completion, the conditions are again different. The plan at this mine is to secure cleaner and cheaper mining in the main reef leader and bastard reef which overlie exhausted main-reef workings in close proximity to them. The waste parting is sufficiently large to have rendered it uneconomical to mine the upper reefs together with the main reef in one stope, and is sufficiently narrow to make it difficult to support in the ordinary way when mining the reefs separately. It will be gathered that at most of the mines operated by this company this method of sand-filling is in vogue. Other mines, as it becomes necessary, will probably also adopt the same practice, and it would appear likely that, in the future, sand-filling will in many cases gradually form a portion of regular mining operations, partly in order to afford more safety to the underground workers, and partly also to enable cleaner mining to be done; the expensive work of cutting pillars will thus be avoided and the extraction of the entire reef in the locality stoped will be rendered possible.

*Abstracted from report of the annual meeting of the Rand Mines, Ltd., published in *The South African Mining Journal*, March 25.

Mina Grande, Sonora, Mexico

By T. B. Sweeny

One of the most interesting of the famous *antigua* mines of Mexico is the Mina Grande, in the Baroyeca mountains, District of Alamos, State of Sonora, about thirty miles easterly from the town of Esperanza, on the Southern Pacific Railroad of Mexico. The known history of the mine dates back to the year 1792, when the first bonanza, afterward known as the Dolores, was discovered by Padre Don Francisco Joaquin Valdez, curate of Baroyeca. Various lodes in the immediate vicinity, however, had been worked for generations previously, and Baroyeca was already a town of considerable importance. After the discovery of the Dolores bonanza the great wealth produced thereby made Baroyeca famous through Mexico and Spain, and the place eventually became the capital of the District of Sonora, which at that time included, in addition to the present State of Sonora, all of the State of Sinaloa and a large part of California and Arizona. The town at this time is estimated to have had a population of from eight to ten thousand people, all of them dependent for their support, directly or indirectly, upon the mines. The extent of the industry is plainly evidenced even now by the ruins of the *rasos*, or small native smelters, scores of which are



Old Dolores Adits.

scattered over the site of the old town. It is conservatively estimated that the mine must have produced at least ten million pesos of silver since 1792, and this notwithstanding that none of the old workings go to any considerable depth.

The famous cathedral of Baroyeca, erected by Padre Valdez shortly after his discovery of the Dolores bonanza, was for many years considered one of the finest church buildings in Mexico. The walls of the sanctuary and the altar were literally covered with massive silver plates, and it is stated that the value of the church vessels alone was over two hundred thousand pesos. The belfry with its chime of bells and parts of walls five feet thick are still standing, although the building has been set afire half a dozen times, and everything of value long since carried off by bands of Indians or by the revolutionists who have time and again raided that part of the State of Sonora. In addition to building this cathedral and endowing it liberally, Padre Valdez provided generously for all his relatives and intimate friends, leaving at his death a fortune which must have amounted to several millions of pesos. After his death the mine was worked for many years by his relatives, who finally disposed of it to Don Jose Maria Almada of Alamos, who some years later died, having meantime accumulated a fortune estimated at half a million pesos. In 1840 the property was taken over by Don Salvador Esquer of Baroyeca and his two brothers, who for various reasons were unable to operate the mine to advantage or continuously, but who nevertheless retired in fifteen or sixteen years with a capital of about two hundred thousand pesos each, selling out to Don Jose Maria Lopez. The latter worked the mine more or less constantly until about 1880 and met with considerable success, although handicapped by lack of ventilation at depth, which prevented him from following up the richer lodes.

Between 1880 and 1900 the mine was worked with fair success at different times by several small companies, none of which, apparently, were possessed of sufficient capital to work the property to the best advantage, and they all collapsed sooner or later through this cause or on account of bad management, inability to get proper machinery into the mine over the almost impassable trails, or other difficulties. Their work was often interrupted by Yaqui Indian raids, which made mining in Sonora a particularly hazardous occupation during that period. Finally in 1900 the property was taken over by Don Alejandro Esquer, grandson of Don Salvador, and two or three associates, and they, although handicapped as all the others had been by lack of capital, obtained good results during the short time they owned the property. Don Alejandro had somewhat better luck than his associates and was very loath to sell, but when finally compelled to do so through the pressure brought to bear on him by his partners, stipulated that he should have the privilege of working freely in Tiro de Dolores from then until the date when actual delivery of the property to the new owners should take place. In the twelve days which elapsed, working with only fourteen men and in the crudest possible fashion, he managed to extract over seven thousand pesos' worth of metal. He had also previously found in the old workings several small pillars of rich ore.

Native Vaso in Operation.

Samples which he recently gave to Boston men assayed as high as 4000 oz. silver per ton.

Senor Pareda, one of the few survivors of the last years of *antigua* mining in Mexico, now a very old man, and who was manager of the Mina Grande in his younger days, states that the rich bonanzas frequently yielded ore running anywhere from 500 to 7500 oz. silver per ton, and that at the bottom of one of the winzes in El Tajo tunnel streaks of sulphide were found running as high as 50% silver; so rich as to be almost malleable. In those days he affirms that the old bonanza workings were often filled with what was regarded as second-grade ore of no value, although it ran as high as 50 oz. per ton, and that quantities of this ore are there still. With modern methods, ore one-half as valuable could be worked to good advantage. Since the time of Senor Don Alejandro little work has been done on the property until within the past year or two. Recently, however, Boston and New York men have done more or less exploratory work, with very encouraging results. Small veins of ore running as high as $80 per ton in silver and lead were found in the new Tempisqui tunnel, which was driven within fifteen or twenty feet of the abandoned Dolores tunnel, and these veins had been followed for about one hundred feet, up to the time when the disturbed political conditions in Mexico made it seem advisable to discontinue mining operations for the present. Enough work was done, however, to warrant the belief that with adequate capital and proper machinery this wonderful old mine could be made to duplicate, if not to greatly exceed, the success which has attended the efforts of British and American capital to develop many other Mexican *antiguas* along modern lines.

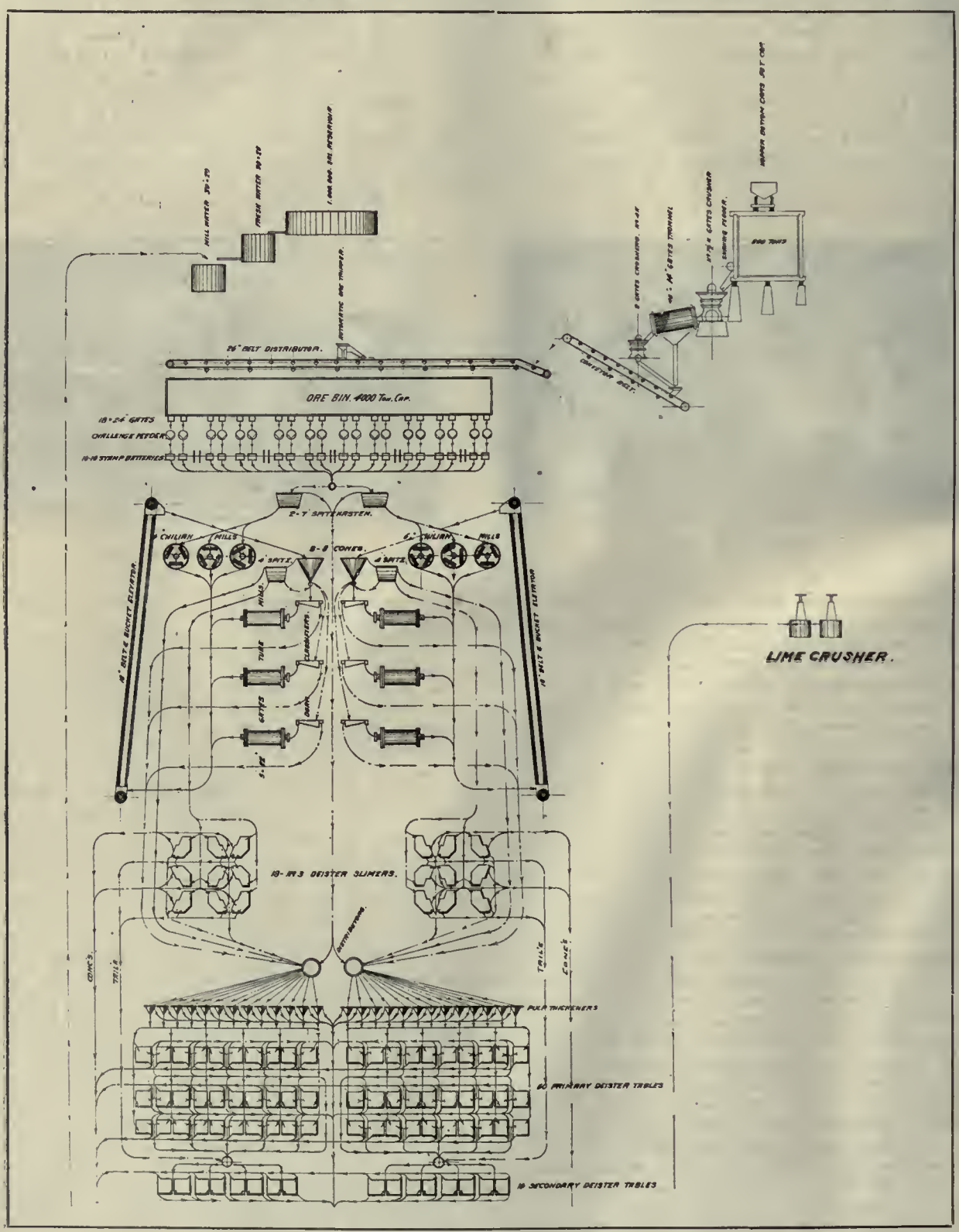
Operation of the Goldfield Consolidated Mill

By J. W. Hutchinson

(Continued from page 652.)

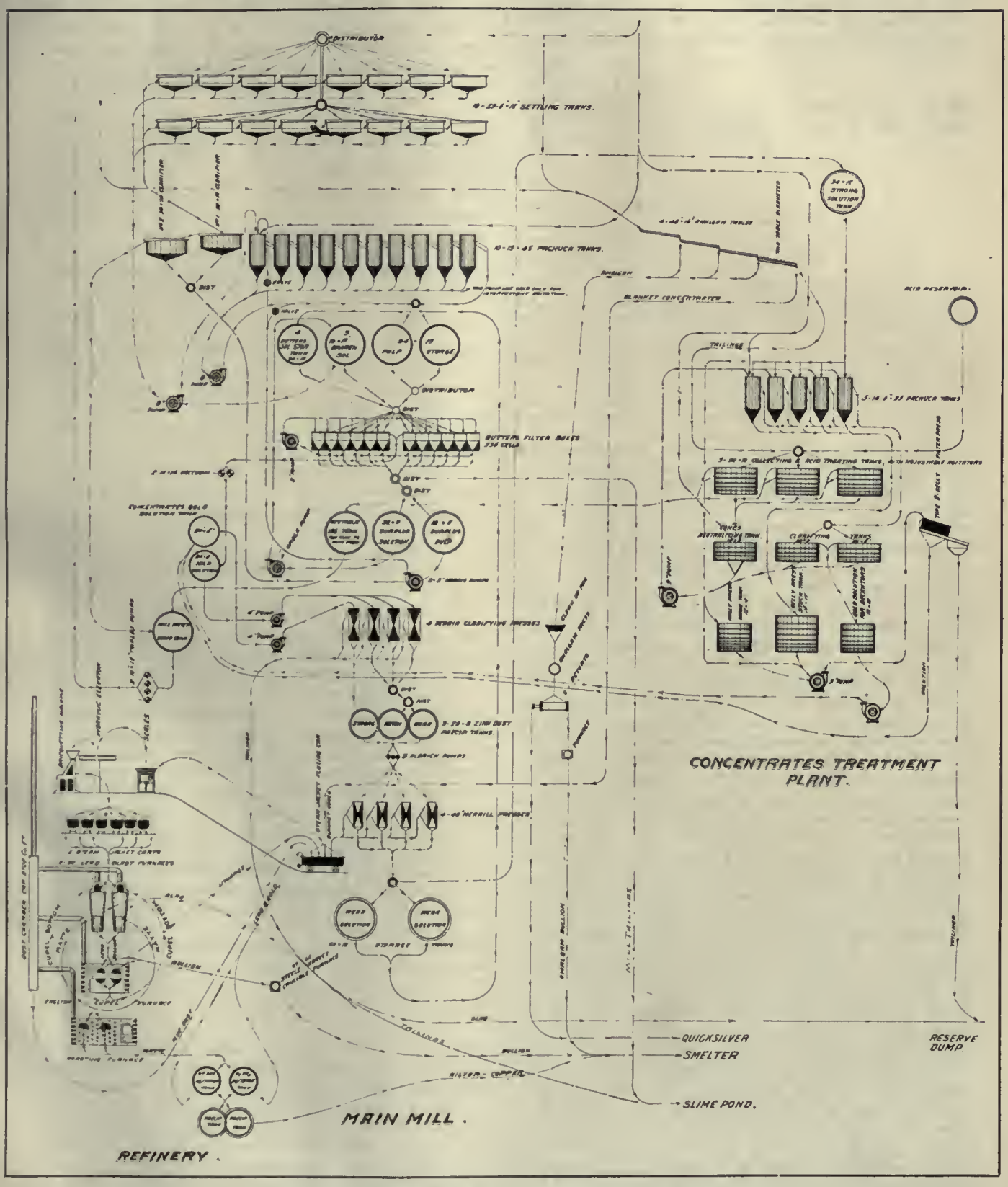
FILTERING

From tank No. 10 of the agitator series the pulp gravitates to two 34 by 12-ft. pulp-storage tanks fitted with mechanical stirrers. These tanks are situated about five feet above the top of the filter-boxes. On the same level are two wash-solution tanks which will be called 'No. 3 and No. 4 above' in the following description. Reference to the flow-sheet will assist in following the cycle of operations. From the pulp-storage tanks through a 16-in. pipe-line the pulp gravitates to two steel filter-boxes with 6 hoppers each. The boxes contain 168 leaves each and are worked as one unit. All valves on the 16-in. filling and emptying line, are actuated hydraulically with levers from a central switchboard. After the cake has been formed the excess pulp gravitates through a 16-in. line to an excess-pulp tank from which it is elevated to the two filling tanks by means of 5-in. Morris pumps. Wash solution is run in from 'No. 4 above', which tank is filled with precipitated solution direct from the barren sump-tanks. After washing and dropping the cake, the supernatant solution is decanted to the excess-solution tank, from which it is elevated to 'No. 3 above' by means of 4-in. Krogh pumps. The solution for diluting the charges from the dewatering



Flow-Sheet of Goldfield Mill *(Continued on Opposite Page).*

tanks is drawn from 'No. 3 above' and discharged into No. 1 Pachuca of the continuous system. In this way, by using the solution which has been in contact with the filter-cake once, for agitating the new charges, the accumulation of gold in wash solution, which is the main 'talking point' of the opponents of submerged vacuum-filtration, is avoided. The value in wash solution here is directly dependent on the efficiency of the precipitation, and while absolute recovery of dissolved metal is not claimed, the loss is unavoidable. Furthermore, it has been demonstrated beyond a doubt that additional extraction is caused by the leaching action of the wash solution through the cake, which cannot be accomplished by means of agitation unless the tailing from the agitator is treated with a freshly precipitated solution. The amount of gold dissolved on the filter may be *reduced* by longer agitation, but the point has never been reached where the wash solutions do not dissolve gold in appreciable quantities. Ordinarily, this amounts to 30c. per ton. During June of 1910, when the plant was running at 70% capacity on account of the loss of 30 stamps by fire, the pulp was agitated for six hours longer than had been customary with full tonnage. The tailing from the Pachucas assayed lower, but the filters still gave additional extraction, though to a less degree than was normally the case, indicating that all the gold dissolved by longer agitation would have been recovered on the filter. The following comparison, taken from the June records, is interesting:



FLOW-SHEET OF GOLDFIELD MILL *(Continued from Opposite Page).*

	Oz. Au.
Tailing samples of 91 charges from Pachucas to filters (thoroughly washed with water)	0.095
Samples of 200 Butters filter discharges from same pulp	0.088
Extraction on filter	0.007

It is also believed here that the completeness of the displacement of dissolved gold in the cake, as well as the additional dissolution of gold on the filter, is not as dependent on the quantity of wash solution passed as on the length of contact. Consequently, I prefer to wash for a longer period with reduced vacuum. The time allowed for this operation ranges from 85 to 100 minutes. During this time 1⅛ tons of wash solution per ton of ore is passed through the cake, of which solution the following are typical assays, the moisture in discharged pulp being 33⅓%:

	No. 1. Oz. Au.	No. 2. Oz. Au.
Effluent solution making cake	0.192	0.20
Effluent wash at end of 10 min	0.17	0.19
" " 20 "	0.166	0.185
" " 30 "	0.164	0.182
" " 40 "	0.158	0.168
" " 50 "	0.08	0.092
" " 60 "	0.04	0.03
" " 70 "	0.03	0.025
" " 80 "	0.025	0.022
" " 90 "	0.015	0.015
" " 100 "	0.006	0.015
Sample solution in hoppers 10 min	0.001	0.008
" " 20 "	0.001	0.008
" " 40 "	0.001	0.007
" " 60 "	0.002	0.007
" " 80 "	0.002	0.010
" " 100 "	0.002	0.010

Assuming that the amount of solution discharged during the 10-minute intervals is constant, which is perfectly fair, the average value from the assays of the effluent wash for test No. 1 is 0.085 oz. gold, and for test No. 2, 0.092 oz. gold. Naturally this average value is not correct, since the solution is sampled intermittently during a process of gradual reduction in grade, but for the purpose in view it is sufficiently close. It will be noticed from the tables that only between the 40, 50, and 60-minute samples is there a decided drop in value. At the end of the fiftieth minute, in both cases given and in numerous tests made, 87% of the total value of the effluent wash has been picked up. The last fifty minutes and 50% of the total solution passed, are required to accumulate 13% of the total value. In both cases, based on the original assumption that the flow is constant for each 10-minute interval, only 1c. per ton of ore is removed from the pulp during the last ten minutes of washing. In test No. 1, assuming that the total moisture of 33⅓% is of the same value as the one-hundredth minute sample, which, on the face of it, is unfair to the filter, the unwashed gold left in the pulp amounts to 0.003 oz., or 6c. per ton. In test No. 2, in which the wash solution is high, due to the higher value in the barren sumps, the unwashed value is 0.0075 oz. gold, or 15c. per ton. By referring to the subject of precipitation, it will be noticed that during the whole time of operation the barren sump solutions have averaged 0.004 oz. gold; from which fact it is safe to state that the soluble gold left in the discharge pulp has not exceeded 6c. per ton, discharged. When the filter is credited with the additional extraction obtained on it, which cannot be obtained with those filters passing large volumes of wash solution in a short period of time, the adoption of the submerged vacuum-filter has certainly been justified on this ore. The filter plant contains 33,600 sq. ft. of filter surface and averages 50 lb. of slime filtered and 120 lb. of solution recovered per square foot of filter per day. The usual Butters automatic acid-washing apparatus is used to circulate a ½% solution of HCl through the leaves to remove the carbonate of lime. Ten leaves are acid-treated each day, which makes a complete cycle in 34 days. It is worthy of special mention that the original filter-cloths are still intact after 27 months operation, and that they will undoubtedly wear 12 months longer. The tailing is discharged through twelve 12 by 12-in. flat Wheeler gate valves at the bottom of the hoppers into a tunnel, through which it gravitates to the slime pond. For the information of a certain distinguished gentleman who writes an annual review of cyanidation, and for the attention of his readers who may be misinformed, I beg to state that never, since the beginning of operation, has wash-water been added to the tailing discharged from this plant to be settled and returned to the mill for subsequent precipitation, and that the percentage of moisture in the discharged pulp does not now exceed and never has exceeded 35%. Any excess solution built up from the incoming moisture from the de-waterers is carefully precipitated, stored until the assay-value has been determined, and wasted only when the value does not warrant further expense. The following data is representative of normal operations:

Filter Cycle.	Min.		Min.
Filling boxes with pulp	10	to	10
Making cake	60	"	80
Emptying excess pulp	14	"	14
Filling with wash solution	10	"	10
Washing	85	"	100
Decanting and discharging	20	"	20
Total time per cycle	3 hr. 15 m.	to	3 hr. 50 m.
Tons per cycle	125	to	150

COST OF FILTERING, INCLUDING UP-KEEP OF SLIME-POND

Year	1911	1910	1909
Tons	850	850	600
	Cents.	Cents.	Cents.
Labor	3.6	4.1	4.3
Supplies	1.2	1.7	1.9
Power	2.2	2.6	3.1
Total	7.0	8.4	9.1

(To be continued.)

April Copper Review

By Misha E. Appelbaum

The copper market during the greater part of April was in a stagnant condition; most sales were made at 12¼c., delivered thirty days, for both Lake and electrolytic. The domestic consumption showed a sharp shrinkage, but the export shipments were on a fairly large scale, and this with 12,000,000 lb. smaller production than the month before, resulted in an increase in the visible supply of only 3,500,000 lb.; however, the net result for the month was a decrease, since the shrinkage in the European visible supply was greater than the increase in the domestic surplus. May 11 the market is weak, and sales have already been recorded as low as 12⅛c., delivered thirty days. I can only repeat, that unless there is a sharp improvement in business, or a radical curtailment in the production takes place, lower prices will be made. It becomes more and more evident that the real curtailment will come if the price of metal should fall to 11c. A lot of smelters which do custom business with small mines, will then have a smaller production, and it is hoped, for the good of the trade, that this decline will take place as quickly as possible.

Missouri has become the State which produces the largest quantity of lead, having passed Idaho in 1907. In 1909 it produced 40.46% of the total, compared with 27.57% furnished by Idaho, 18.30% by Utah, 8.32% by Colorado, and 1.33% by Nevada, the other States contributing less than 1% each. Missouri produces over 94% of the supply of soft lead in the United States. In 1910 Missouri produced 161,659 tons out of a total of 372,227, according to the U. S. Geological Survey.

The Dredging Industry in Russia

By S. I. Littauer

(Translated by W. H. Shockley.)

*As early as 1906 the Permanent Consulting Board of Gold and Platinum Producers began collecting details as to the working of Russian dredges. In No. 17, 1910, of *Zoloto i Platina*,† was published the fourth of a series of tables (for 1909) showing the production of Russian dredges, and in the present number is published a combined table for the operations of the last four years. This table gives sufficient data to critically appraise the industry in general, and to point out the future importance of the business in Russia.

As the following statistics show, the dredging industry plays an unimportant part in Russian gold and platinum mining.

	1906. Troy oz.	1907. Troy oz.	1908. Troy oz.	1909. Troy oz.
Gold and platinum.				
Total quantity produced in Russia	1,377,019	1,392,239	1,518,002	1,730,555
Total amount produced by dredges	43,027	53,138	70,307	77,417
Percentages	3.1	3.8	4.6	4.5
Gold.				
Total quantity produced in Russia	1,191,271	1,218,657	1,360,851	1,566,242
Total quantity produced by dredges	36,602	47,977	59,643	58,352
Percentages	3.0	3.9	4.4	3.7
Platinum.				
Total quantity produced in Russia	185,748	173,582	157,151	161,313
Total quantity produced by dredges	6,425	5,161	10,664	19,065
Percentages	3.5	2.98	6.8	11.6

The production of some districts for 1909 is obtained by doubling the official figures for the first six months of 1909.

It is seen from the table opposite that Yenisei—where nearly all the gold accessible to hand-labor has been worked out—would be dead were it not for the development of dredging. The number of dredges built and working on Russian gold and platinum mines is shown by the following:

Year.	Existing.	Working.
1906	32	32
1907	54	51
1908	57	51
1909	64	50

The number of dredges has doubled during the last three years, the greater number having been constructed in 1907. It is very characteristic that of the 64 dredges already constructed only 50, or 78%, were working in 1909. The reason for this abnormal phenomenon is that in 1905-1906, when many dredges were built, they were placed on the claims without proper preliminary prospecting. The results obtained from the working of these dredges were so poor that a number of the claims have stopped working and the dredges are now idle. Besides, the construction of many of the dredges proved to be unsuitable for the gold deposits they were to work, and the dredges are now idle during the period of reconstruction.

According to the size of the buckets, the existing dredges are classified:

Dredges.	Cubic feet.
1	1¼
1	2
2	3
1	3½
2	4
16	4½
13	5
2	5½
1	6
22	7
61	

Zoloto i Platina, Nov. 1, 1910.

†See *Mining and Scientific Press*, Dec. 10, 1910, for a translation of this article.

There is no information relating to the three remaining dredges. On the mines of the Moscow Forest Co., Putiloff Works, Imperial Cabinet, and the Brothers Yacoleff, have been placed dredges of the American type, with close-connected buckets. These dredges with 3 to 3½-cu. ft. buckets compare in productiveness with a 5-ft. bucket, and the 5 to 5½-cu. ft. buckets compare with a 7-ft. bucket dredge of the ordinary New Zealand type.

Although the absolute amount of the precious metals extracted by dredges increased in four years by 34,390 oz., or 80%, yet the increase compared with the total gold and platinum production was but 1.4%; this is because of the rapid growth of the gold production, which amounted to 374,971 oz., or 31%. If it be remembered that this increase in the production of gold has been due in great part to the output of the Lena district, and other regions where there is no gold dredging, then the rôle of gold dredging in the industry appears more important. Indeed, in some districts dredging assumes a predominant rôle, as is seen by the data in the annexed table. The product of the Lena district for 1906 was 301,768 oz.; for 1907, 315,263; 1908, 364,478; 1909, 432,178.

	Troy oz. 1906.	Troy oz. 1908.	Troy oz. 1909.	Troy oz. 1907.
Northern Verkhoturia district:				
Total gold and platinum	34,838	29,834	33,010	17,142
Dredge gold and platinum	6,257	3,665	6,941	5,072
Percentages	17.9	12.3	21.03	29.6
Southern Verkhoturia district:				
Total gold and platinum	142,201	131,914	195,503	85,448
Dredge gold and platinum	2,317	2,080	3,870	6,846
Percentages	1.6	1.6	3.7	8.01
Northern Ekaterinburg district:				
Total gold and platinum	35,601	29,139	35,986	52,480
Dredge gold and platinum	11,139	7,494	9,559	6,889
Percentages	31.3	25.7	26.6	13.1
West Ekaterinburg district:				
Total gold and platinum	10,706	12,234	9,785	3,929
Dredge gold and platinum	779	.....	779	1,106
Percentages	7.3	.....	7.9	28.2
Southern Ekaterinburg district:				
Total gold and platinum	30,588	34,485	34,890	36,339
Dredge gold and platinum	.....	.....	.....	26
Percentages	.....	.....	.....	0.07
Verkneuralsk district:				
Total gold and platinum	18,317	15,289	20,055	29,413
Dredge gold and platinum	.....	53	.....	.....
Percentages	.....	0.31	.....	.....
Altai district:				
Total gold and platinum	13,482	12,481	10,338	22,698
Dredge gold and platinum	1,132	842	700	579
Percentages	8.4	6.8	6.8	2.55
Yenisei district:				
Total gold and platinum	34,759	40,067	47,951	49,136
Dredge gold and platinum	20,276	33,326	41,199	48,609
Percentages	58.3	83.2	85.9	98.9
Bureinsk district:				
Total gold and platinum	80,407	102,817	109,358	102,764
Dredge gold and platinum	.....	121	1,306	1,280
Percentages	.....	0.12	1.2	1.25
Primorsk district:				
Total gold and platinum	48,767	37,813	43,306	29,482
Dredge gold and platinum	.....	.....	.....	1,359
Percentages	.....	.....	.....	4.61

In Russia dredges of small capacity, with buckets of 4½ to 5 cu. ft., predominate. Among the recent dredges those with 7-ft. buckets are the rule; this is justified; for, with the short summer season and relatively low-grade gravels, the profit of working such dredges is greater. The difference in cost of maintaining a 4½ and a 7-ft. dredge is relatively small, while the difference in productiveness is about 50%. The existing dredges are found in the following gold districts: Northern Verkhoturia, 7; Southern Verkhoturia, 6; Northern Ekaterinburg, 9; Western Ekaterinburg, 1; Southern Ekaterinburg, 1; Verkneuralsk, 1; Altai, 1; Yenisei, 34; Bureinsk, 2; Primorsk, 2; total, 64.

Technically speaking, the dredges do not work satisfactorily. A well constructed dredge, properly repaired during the winter, ought to give a working day of not less than 18 hr., allowing 6 hr. daily for running repairs, and for the clean-up. A working day of this length is reached by the American dredges. On studying the tables, it is seen

that such an average is only attained by the following dredges:

	Hours.
Maria, Neviansk Works	22.6
Savvinix A. A.	20.4
Verx-Isetskix Works	19.6
No. 1, Moscow Forest Co.	19.3
Mechta, Borovinsk Co.	19.2
Spassky Co.	19.1
No. 2, Moscow Forest Co.	18.9
No. 3, 'Draga' Co.	18.2
No. 2, 'Draga' Co.	18.2
No. 1, Nijni Tagil Works.	18.0

Hence, of 64 dredges, only 10, or 15.6%, work normally. Bearing in mind that the unsuccessful working of the first years ought to be ascribed to the inexperience of the administration, and of the dredge managers, and that by 1909 many of these defects had been overcome, the working in 1909 should show better results. This is the case, and the following table shows an average working day of 18 hr. for the following dredges:

	Hours.
Savvinix A. A.	21.0
No. 2, Moscow Forest Co.	20.1
Spassky Co.	20.0
No. 2, Spassky Co.	19.4
Maria, Neviansk Works.	19.2
No. 1, Moscow Forest Co.	19.2
Mechta, Borovinsk Co.	19.0
Verx-Isetskix Works	18.8
No. 1, Nijni Tagil Works.	18.8
Fedorov G. M. Co.	18.7
Neviansk, Neviansk Works	18.6
No. 3, 'Draga' Co.	18.5
No. 2, Heirs of Count P. P. Shuvalov.	18.3
No. 2, Heirs of Count P. P. Shuvalov.	18.3
Zauralsk Mining Co.	18.2
Alexandrov Co.	18.0

This shows that in 1909 the number of satisfactorily working dredges had doubled, and was 16, or 25% of the existing dredges, or 32% of the dredges working.

The ideal work of a dredge may be calculated on the assumption that a rate of ten buckets per minute is kept up, and that each bucket is two-thirds full. Under these conditions the hourly product should be:

Bucket capacity, cubic feet.	Cubic feet per hour.
2	800
4	1,600
4½	1,800
5	2,000
6	2,400
7	2,800

Such an average, or a greater production, is shown only by the following dredges: Maria, Neviansk Works; A. Ermolov, Neviansk Works; No. 2, Neviansk Works; No. 4, Draga Co.; No. 6, Draga Company.

The following dredges show 75% of the theoretically possible production: Sosvinsk Co.: No. 1 and 2, Heirs of Count P. P. Shuvalov; Bogoslovsk Mg. Co.; P. Yacolev, Neviansk Works; D. Konovalov Works; Neviansk Works; P. Boklevsky Works; Von Cruz Works; Spassky Co.; No. 2 and 3, Fedorov G. M. Co.; No. 1, 2, 3, 4, and 5, Draga Co.; Imperial Cabinet; Mechta, Borovinsk Co.; Uskovoe U. K.; Zauralsk M. C.; No. 1 and 2, Nijni Tagil Works; Northern Yenisei G. M. Co.; Putilov Works Co.; Yacolev Bros.; Savelev & Sons & Company.

The following dredges show 50 to 75% of the theoretical production: Tibo-Brinol, Neviansk Works; No. 1 and 2, Moscow Forest Co.; Verx-Isetskix; Alexandrov Co.; No. 1, 4, 5, 6, 8, 9, 10, and 11, Fedorov G. M. Co.; Nadesda, Borovinsk Co.; Alexandrov, Central Siberia Co.; Alexander-Ivanov-Savvinix A. A.; Solomirsk and Heirs Trchaninov; P. V. Mordin, two dredges.

The above classification shows that 5 dredges, or 7.8%, worked up to the theoretical production; 27, or 42.1%, to 75%; 18, or 28.2%, to 50 to 75%; 14, or 21.9%, to less than 50% of the theoretical production. Such a result can not be considered favorable.

In 1909 the number of dredges working up to full production did not increase, and, in view of the greater experience, this failure must be attributed to faults of construction. A measure of the economic working of a dredge is given by the relation between the value of the gold and platinum won and the expenses of production. In the absence of the latter, estimates may be guided by the normal expenses; these were worked out for the Urals at about $15,437, and for the Yenisei at about $19,553 by the Commission reporting on the Utility of Dredges in Russia.‡ In these expenses, amortization of the dredges, their installment, and the cost of the claims, are not taken into account. Gold is valued at $18.08 and platinum at $22.48 per ounce. On this basis the following dredges worked profitably: Platinum Co. (2); Heirs of Count P. P. Shuvalov (2); Bogoslovsk Co. (1); Neviansk Works (6); Moscow Forest Co. (2); Verx-Isetskix Works (1); Alexandrov Co. (1); Tr. Savelev & Co. (1); Spassky Co. (1); Yacolev Bros. (1); Fedorov G. M. Co. (7); Draga Co. (7); Borovinsk Co. (2); Central Siberia Co. (2); Savvinix A. A. (3); Northern Yenisie G. M. Co. (1); Uskovoe U. K. (1); Zauralsk M. Co. (1); Nijni Tagil Works (2); total, 44.

Thus 44, or 70% of all the dredges constructed, should have worked profitably. However, the returns of the dredge owners do not give such brilliant results; this is accounted for on the one hand by the royalties paid to the owners of the claims, and on the other hand by the excessive general expenses. If the amortization of the cost of the dredges and the preparatory expenses be taken into account, the results are still less brilliant. The average cost of fitting up a claim for a 7-ft. dredge, including costs of buildings, supplies, and preparatory work, may be assumed at $77,185. For commercial success of such an enterprise the amortization shond be taken yearly at 10% of the cost. Hence the value of the precious metals extracted should be: In the Urals, $23,156; in the Yenisei, $27,272; in Eastern Siberia, $30,874. Under these conditions the following dredges have made a profit: Platinum Co. (2); Heirs of Count P. P. Shuvalov (2); Neviansk Works (2); Moscow Forest Co. (2); Alexandrov Co. (1); Tr. Savelev & Sons (1); Spassky Co. (1); Yacolev Bros. (1); Fedorov G. M. Co. (4); Draga Co. (1); Borovinsk Co. (1); Central Siberia Co. (1); Savvinix A. A. (1); Northern Yenisei G. M. Co. (1); Uskovoe U. K. (1); Zauralsk M. Co. (1); Nijni Tagil Works (2).

In all, 25 dredges, or 40% of all, have made a profit. If attention is given to the royalty paid (especially heavy in the Yenisei district) several dredges must be excluded from the above list.

These disquieting results account for the coolness felt toward the dredging industry. The profitable working of dredges depends as well on the amount of the precious metals in the material dredged as on the technical conditions. According to the data given by the above-mentioned Commission, in order to repay the expenses for running a dredge, not counting amortization, of fitting up the claims, it is necessary to work ground that contains, per cubic yard:

	Urals. (Cents.)	Yenisei. (Cents.)
For dredges with 4-cu. ft. buckets	9.10	11.59
" 5 "	8.13	10.28
" 6 "	7.21	9.25
" 7 "	6.50	8.51

The following table shows the amount of gold per cubic yard needed to repay the expenses when amortization is allowed for:

Bucket Cap. cu. yd.	Urals.	Western Siberia.	Eastern Siberia.
	(Cents per cubic yard.)		
2	22.96	28.04	32.72
4	15.15	17.96	20.40
4½	13.77	16.25	18.43
5	12.18	14.35	16.24
6	10.59	12.62	14.14
7	9.55	11.56	12.98

Such or a greater amount of gold has been obtained by the following dredges: Platinum Co. (2); Sosvinsk Co. (1); Heirs of Count P. P. Shuvalov (2); Bogoslovsk Co. (1); Neviansk Works (4); Lobvinsk Co. (1); Moscow Forest Co. (2); Alexandrov Co. (1); Tr. Savelev & Co. (1); Spassky Co. (1); Yacolev Bros. (1); Fedorov G. M. Co. (10);

‡*Mining and Scientific Press*, May 7, 1910.

Draga Co. (1); Borovinsk Co. (3); Central Siberia Co. (2); Savvenix A. A. (3); Northern Yenisei G. M. Co. (1); Tetiarsk G. M. Co. (1); Uskovoe U. K. (1); Mordin P. V. (2); Zauralsk M. C. (1); Nijni Tagil Works (2); Novo-Udilsk G. M. Co. (1); Amgunsk G. M. Co. (1); total, 46.

Hence there are 46 dredges, or 72%, extracting material whose tenor of precious metal is such that these dredges ought to be commercially profitable gold-mining enterprises. But many of the dredges in the above list are working at a loss; this can be entirely ascribed to technical faults.

Secondary Enrichment in Gold Veins

By R. L. Mann

There is one subject pertaining to practical mining which should be of great interest to those who prospect for and develop new properties; that is the rôle which erosion plays in relation to secondary enrichment. This subject has been but lightly treated in our time-honored textbooks, and only lately has it received a limited amount of attention. It is still held that the richest zone of secondary concentration in gold-bearing veins is at or close to the surface. The reason given for this is that surface waters have little effect on the solubility of the gold. Since time, however, is unlimited in nature, it can not influence the result, and atmospheric waters, given the right conditions, can and do in many instances completely dissolve the gold in the upper portions of veins, leaving nothing but a mere trace of the precious metal. These enriched solutions filter downward in the vein and deposit the gold at or close to water-level. During the time that this occurs climatic conditions must be ideal for the accomplishment of this leaching process; that is, warm with just sufficient precipitation at long intervals to supply the moisture for leaching, but not enough to favor rapid erosion. This may be called the first stage of surface alteration. The second stage begins when through terrestrial causes the climate changes. A cold or a torrid climate with frequent torrential rains favors rapid erosion, which, acting on the outcrop, removes the upper barren portion down to the enriched zone, which now becomes the surface. There remains a vein the upper portion of which is the richest, although the climate may have changed again. Should, however, the climate remain nearly constant after the leaching process, an impoverished outcrop will result. Any vein showing in the quartz on the surface the former presence of sulphides in the form of casts or cavities, but without gold in profitable amount, is very favorable for an enriched zone at a lower level. Massive white blocky quartz, showing no trace of former mineralization, does not fall under this heading, since secondary enrichment depends on primary mineralization.

A good case in support of the above contentions came to my notice in Idaho. The outcrop consisted of a white porous quartz resembling scoria without even a stain of iron oxide. The cells in the quartz were perfectly clean. Assays gave a trace in gold. The vein was tapped by an adit 50 ft. below the outcrop. Here the cells in the quartz were partly filled with iron oxide, and assays gave $20 per ton in gold. This gold was free but fine flour gold. Another adit tapped the vein 20 ft. above water-level and 150 ft. below the outcrop. The cells in the quartz here were completely filled with oxide of iron; the gold was coarse and free and averaged $45 per ton. The wall-rock is uniform in composition from the surface.

In my opinion, too much stress is laid on outcrop enrichments in gold veins. A miner will cheerfully sink through a barren iron gossan with only a few copper stains to encourage him in hope of finding rich ore below, but he looks with apprehension on a nearly barren white cellular quartz outcrop, even if it is in a known gold-bearing district. If gold can be dissolved slowly by sulphuric acid, generated by the oxidizing of the sulphides, then the only factor to be taken into consideration is time—and time in nature cannot be measured.

Monazite

By A. L. Sweetser

Until a few years ago monazite was considered a rare mineral of no commercial importance. When the incandescent properties of the oxides of cerium and thorium were discovered they were utilized in the manufacture of incandescent gas-mantles. Monazite, which contains these oxides, became of commercial importance and deposits of it were sought. Monazite is widely distributed throughout the United States, but only a few deposits have been found large enough to be of commercial value. These chiefly occur in North and South Carolina, Georgia, and Idaho.

This mineral occurs chiefly in gneisses and schists of Archean age. Only the gravel deposits from these rocks can be profitably worked, as they can be handled on an extensive scale by sluicing and washing. The color of monazite varies from a light yellow to reddish and even greenish yellow. It possesses a vitreous lustre, and is translucent, brittle, of a conchoidal fracture, and crystallizes in the monoclinic system. A simple test for monazite is to dissolve the substance in sulphuric acid, filter off the residue, and then add a little oxalic acid, which causes a precipitate to be formed. On igniting, this precipitate becomes a brick-red color, due to the presence of the oxide of cerium.

The commercial deposits occur in gravel beds of streams, and the distribution of the monazite is richer near bedrock, as in the case of all heavy minerals. The soil and gravel are washed into shaking hoppers and then through sluice-boxes, the oversize being thrown out by means of a revolving screen, the sand being then fed to Wilfley tables. In some cases a rough concentrate is obtained and the product is then reconcentrated. The concentrate from these mills contains sometimes as high as 80% monazite. The concentrate must then be dried, two methods being in use. Small producers spread the concentrate in a thin layer on an oiled cloth and the sun's heat removes the moisture. The larger companies use drying furnaces. A traveling belt then carries the dry concentrate, in a thin layer, beneath a large horseshoe magnet which removes the magnetite. The other minerals are removed by electrolytic-magnetic separation. The final product then contains about 98% of monazite and represents the sand that is shipped to the manufacturers of incandescent lights. In the reduction of monazite a large number of by-products are obtained, one of which is the oxide of didymium. This is of a dark-brown color, and a nitrate solution made of it is used to brand incandescent gas-mantles. Another mineral often associated with monazite is zircon, in the form of small, clear crystals with a brilliant lustre. Zircon is used in the manufacture of the Nernst lamp. The final process in the treatment of the monazite sand to remove the thorium and cerium, is a commercial secret and requires four months to render the thorium sufficiently pure for use in gas-mantles.

The cheaper gas-mantles are made with cheap grades of cotton, but the best use only Egyptian cotton. All traces of grease are first removed from the cotton by immersing it in large tanks filled with distilled water and ammonia. After agitating for some time with mechanical devices the cotton is removed and drawn through rollers to remove the excess water and then dried by revolving fans. Knitting machines then make network cylinders which are cut into strips long enough to make two mantles. These strips are then saturated in the 'lighting-fluid,' which consists of a solution of about 99% thorium and 1% cerium nitrates, in distilled water. The fabric is then dried, cut to the required lengths, and shaped on a form. The cotton fibre is then removed by heating the hood over a hot Bunsen-burner flame, leaving the thorium and cerium as a network. In order to protect this during transportation to the retail trade, the mantles are dipped in collodion and this collodion must be burned off before the mantle can be used for lighting purposes. Last year there were over fifty million mantles used in the United States.

Engineering Ethics

A committee consisting of H. M. Chance, F. L. Garrison, E. S. Hutchinson, R. A. F. Penrose, Jr., and R. H. Sanders, appointed by the Philadelphia Section of the Mining and Metallurgical Society of America, has submitted the following preliminary report, which is now being debated by various sections of the society.

Principles of Engineering Ethics

Many engineering functions are of far-reaching importance, involving matters affecting the health and safety of individuals, the welfare of communities, and the security of large investments, and it is therefore essential that the public should have entire confidence in the efficiency and integrity of the engineer and in his methods of thought and work. As the engineer is thus under obligations to maintain a standard of conduct in harmony with high ideals, it is right and proper to formulate a definite expression of these obligations, and,

Whereas, the Mining and Metallurgical Society of America, as stated in its constitution and articles of incorporation, aims to encourage high standards and to promote good fellowship among those professionally engaged in mining, metallurgy, and allied pursuits, it is therefore

Resolved, That the Society hereby recommends to those so engaged the adoption of the following precepts and principles. In so doing the Society has endeavored to present a statement of principles, the observance of which will promote the best interests of the profession and of those whom it serves. The endorsement of this summary is not intended to be exactly equivalent to its enactment as a code, but rather as the presentation of a suggestive and advisory document which may be useful to engineers in these and allied fields of activity. The word 'Engineer' is herein used to include those professionally engaged in mining, metallurgy, and allied pursuits, whether as engineers, chemists, geologists, metallurgists, managers, or superintendents.

Obligations of the Profession

1. *Maintain Dignity and Honor.*—It is the duty of the engineer to maintain the honor and dignity of the profession and of its members by all proper means.

2. *Criticism.*—Unnecessary criticism of others engaged in like work is detrimental to the interests of the profession.

3. *Membership in Societies.*—As an evidence of professional interest and of a desire to assist in placing the profession upon the highest plane, the engineer should, if possible, maintain membership in some technical or professional organization.

4. *Assistance and Consultation.*—If any work be beyond the ability of an engineer, his duty to himself, to the profession, and to his clients requires him to secure assistance to perform the service properly, or, if this be impossible, to decline the commission.

5. *Co-operation.*—The engineer should give freely of his knowledge and experience to other engineers, but when engaged in active competition, or employed by business rivals, such obligation cannot always be recognized.

6. *Good Fellowship.*—The best interests of the profession require that each should extend to every other member kindly and courteous consideration. Employment by business rivals should not prevent friendly relations between engineers, for although fidelity to employers may require them to become partisans, it should not engender personal enmity.

7. *Litigation.*—As litigation between engineers is detrimental to the profession, differences which cannot be settled by personal negotiation should, if possible, be adjusted by arbitration.

8. *Retaining Fees.*—When uncertain as to payment for his services, the engineer should obtain a substantial retaining fee.

9. *Gratuitous Services.*—Performing professional service gratuitously, except for other engineers, or as an act of charity, should be discouraged as unprofessional, in that it tends to reduce the compensation of other engineers.

10. *Underbidding.*—The engineer should not bid a price for performing a service which will not be fairly remunerative, especially if other engineers are bidding for the same work, but an engineer may accept employment at an unremunerative price if the experience or other advantage gained may compensate for the inadequacy of the monetary consideration.

11. *Commissions.*—It is unprofessional to offer compensation for securing the selection of an engineer for any service, but this should not apply to fees paid to reputable employment agencies; and it is likewise unprofessional to demand compensation for performing such service for others.

12. *It is unprofessional* to accept presents, fees, commissions, or compensation of any kind from those with whom the engineer transacts business for an employer or client.

Duties to the Public

13. *Protect Against Fraud.*—It is the duty of the engineer to discountenance the promotion of fraudulent schemes, and the exploitation of visionary processes and projects.

14. *Loyalty vs. Duty.*—When loyalty to employer or client conflicts with the engineer's sense of duty, he must be guided by his own judgment; but so long as he remains in the employ of another, or is retained in an advisory capacity, his first duty is to such employer or client. If the performance of this duty cannot be reconciled with proper observance of his obligations to the profession or the public, his connection with such employer or client should terminate.

15. *Reports.*—In the preparation of reports likely to be used for publication, the engineer should be careful to make all important statements in precise language. If a report is to be published, the engineer should have the right to revise the proofs prior to publication; if a portion only of the report is to be published, it is important that the engineer insist upon and exercise this right.

16. *When Engineer Is Interested.*—If an engineer be asked to report upon a property in which he is interested, or to undertake any work when he has an interest at variance therewith, he should state the facts to his client before accepting the commission, and if such report is to be used publicly, a statement of these facts should be embodied in the report, or his interest should be indicated in some equally effective manner.

Relations to Employers and Clients

17. *Devotion, Diligence, Fidelity.*—The engineer owes to his employer or client diligence and fidelity in the execution of matters entrusted to him.

18. *Confidential Relations.*—While the knowledge and experience gained by the engineer are his personal property, merging with and becoming a part of his professional capital, he should guard with scrupulous care those business and technical secrets with which he may become familiar by reason of confidential relations with employer or client.

19. *The obligation* to serve his employer or client loyally and not to divulge his secrets or confidences, requires the engineer to decline employment from others in matters wherein knowledge of such secrets or confidences will adversely affect the interest of said employer or client; in many cases such obligation may be held to exist after the termination of relations with said employer or client. The same obligation forbids the engineer from acquiring any interests that in the slightest degree may be adverse to those of his client.

20. *Expert Witness.*—When an engineer is called to testify as an expert witness, his duty will be completely discharged by fully and truthfully answering the questions put to him by the Court and by the attorneys in charge of the case. Although called upon to testify and paid for such testimony by one of the parties to the controversy, the engineer incurs no obligation to act as a partisan nor as an adviser to such party, unless it be distinctly under-

stood that he is called in as an adviser as well as an expert witness.

21. *Advisory Reports.*—In preparing advisory reports, the engineer should be careful to use language not readily capable of more than one interpretation, and plainly to distinguish between demonstrated facts and those hypotheses or matters of personal opinion which may have been factors in reaching the conclusions upon which his recommendations and advise are based.

22. *Contingent Fees and Contingent Interests.*—Experience has amply shown that an agreement by an examining engineer to accept a compensation or fee, the amount of which is contingent upon the nature of the report, or upon its value or usefulness in raising capital or in effecting the sale of a property, is likely to prove detrimental to the best interests of the engineer and of the profession. While some of the objections to such agreements do not obtain when all of the parties in interest understand and agree to the arrangement, the practice must always involve some risk to the reputation and standing of the engineer. In the development of mineral properties, if the employer or client desires to have the engineer personally interested in the outcome, such interest often may properly be made contingent upon the measure of success attained, but before making such an arrangement the engineer should be careful as to the character of those who will thus become his business associates, and should be sure of his ability to perform his part of the contract.

23. *Expert Witness Contingent Fee.*—The making of an agreement to accept for services as expert witness a fee which shall be contingent upon the result of the trial, may place the engineer in a painful and embarrassing position, entirely discredit his testimony, and seriously damage his reputation as an engineer. If such agreement be necessary, it should be made openly and not secretly.

24. *Duty to Warn.*—It is the duty of the engineer to give timely warning to employer or client of any matter that may threaten danger, loss, or damage to such employer or client; and further, to endeavor to reduce to a minimum all risks of loss or of damage to property, or of danger to life, from causes within his control.

25. *To Advise Adversely.*—When called upon to examine into any proposition, if, from a preliminary investigation, it appears that further examination is not warranted, the engineer should advise his client to drop the matter.

26. *To Assume Full Responsibilities.*—An engineer should not evade the responsibility of definitely advising his client for or against any project. In reaching his conclusions he should avoid being either too optimistic or too pessimistic. An over-enthusiastic engineer may lead a client into an investment that should not have been recommended, while an over-cautious engineer may keep a client out of a good investment by his excessive conservatism. While an engineer may often be unable to convince himself with absolute certainty that a project is good under existing circumstances, this doubt does not justify him in unqualifiedly condemning it, any more than the fact that it might possibly be good would justify a more sanguine engineer in unqualifiedly recommending it. If unable to reach a definite conclusion, he should explain to his client the conditions as they exist, and let him decide whether or not he will take the risk involved.

27. *Estimates of Quantities.*—In reporting upon the quantities and values of ore or mineral, the engineer should state with sufficient clearness the facts upon which the estimates are based, and the method adopted in making the computations.

28. *Fees, How Determined.*—The following paragraph defining the principles which should govern the engineer in determining what constitutes a proper charge for his services, is taken (with slight changes in wording) from Paragraph 12 of the Canons of Ethics of the American Bar Association: In fixing fees, engineers should avoid charges which overestimate their advice and service, as well as those which undervalue them. A client's ability to pay cannot justify a charge in excess of the value of the service, though his poverty may require a less charge, or even none at all. The reasonable requests of other engineers and of their widows and orphans without ample means, should receive special and kindly consideration. In determining the amount of the fee, it is proper to consider: (1) the time and labor required, the novelty and difficulty of the questions involved, the physical risks and discomforts, and the previous experience necessary, to render the required service; (2) whether the acceptance of employment in the particular case will preclude the engineer's employment by others in cases in which there is reasonable expectation that otherwise he would be employed, or will involve the loss of other business while employed in the particular case, or will produce complications with other clients or engineers; (3) the customary charges of engineers for similar services; (4) the amount involved and the benefits resulting to the client from the services; (5) the contingency or certainty of the compensation; (6) the character of the employment, whether casual or for an established, constant client; and (7) whether the character of the employment is such as to be beneficial or detrimental to the engineer. No one of these considerations is in itself controlling. They are mere guides in ascertaining the real value of the service.

29. *Controversies Over Fees.*—Controversies with clients over fees should as far as possible be avoided, and lawsuits resorted to only as a last recourse.

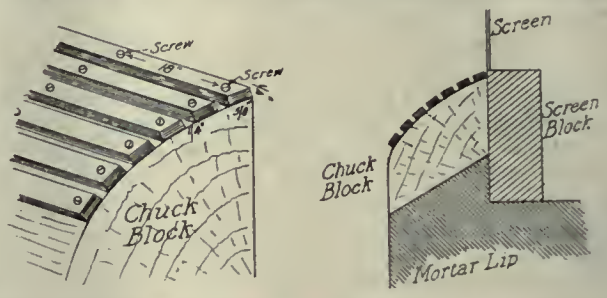
MacQuisten Tubes in Idaho

The Federal Mining & Smelting Co. has erected and put into operation 119 of the MacQuisten tubes at its Morning concentrating plant at Mullan, Coeur d'Alene district, Idaho. These tubes are manufactured by the American Direct Concentrator Co. of Salt Lake, and are designed to recover the metals from certain classes of ore which are difficult to treat by ordinary wet concentration. The process involves the reverse of gravity concentration, inasmuch as by this method the gangue settles, and the sulphide metal floats and overflows from receptacles. The ore taken from the Morning mine contains lead, zinc, and silver, associated with siderite and barite. The greater part of the lead is recovered by Hancock jigs, tables, and vanners; the tailing and part of the middling from the tables and vanners, consisting of a 40-mesh product containing zinc, siderite, and barite, are pumped to the tube plant, elevated to the top of the building and dewatered by Dorr and Akins classifiers, by which the moisture is reduced to 10 or 15%. It is then passed to storage tanks, and thence by discharge pipes to three distributers, the pulp from each distributer passing by gravity to a unit of 40 tubes, divided into five sets of 8 tubes each. Each tube consists of an iron cylinder, 7 ft. long, 8 in. diam., the interior surface being spirally corrugated. The tube revolves at about 30 r.p.m., and has a horizontal position. At one end is a receptacle into which the feed is received from the distributer; and this receptacle discharges into the tube, the feed end of which has an enclosing rim to keep the pulp from wasting. As the tube revolves the spirals carry the pulp and slime to the opposite end, discharging them into a 2-compartment iron settler; the compartment nearest the tube end contains a hopper-like outlet through which the settled gangue and its accompanying mineral pass to another receptacle, from which it is fed into a second revolving tube placed immediately below the first one. The spiral creases in the tube tend constantly to lift the particles of metal to the surface of the water, and the film of air which forms around each bright metallic particle causes it to float. When once afloat, the metallic substance is carried by the current of water over the first compartment into the second, and the water and slime overflow from the one into the other. The outlet at the bottom of the second compartment leads to a small tank which holds the concentrate thus recovered. The pulp and slime, before being introduced into the tubes, are passed through an acid bath containing 0.5% H_2SO_4. In addition to this the water in the circuit contains 0.05% H_2SO_4. It is explained by O. B.

Hofstrand, in charge of the work of putting in the equipment, that the percentage of acid used may be varied according to the character of the ore; that some particularly lustrous ores may require no acid at all. The purpose of introducing the acid is to cleanse the particles of ore and expose their surfaces so as to better induce flotation. Each stand is made up of eight tubes, or four pairs. The two tubes of the first pair are parallel, and are about 10 in. apart; in each of these, first concentration by flotation is performed. The second pair rest immediately below the first, and reconcentrate the tailing from the first pair. In like manner there is a third pair that re-treat the tailing from the second, and this is followed by a fourth pair in which is effected the final separation, the tailing from the last pair of tubes being pumped to Callow tanks, and the settled slime being put through other sets of tubes for the recovery of the finer particles of metal. The 15 stands of tubes in this plant are expected to treat 50 tons per day of table tailing and middling, the metal of principal value therein being zinc sulphide. This part of the plant was put in operation about May 10, and actual results on this class of ore are awaited with unusual interest. The first mill using MacQuisten tubes that was operated in this country was that of the Glasgow & Western at Golconda, Nevada, three years ago. Here the ore consisted of copper-iron sulphide in a gangue that was mostly epidote.

A Riffle Chuck Block

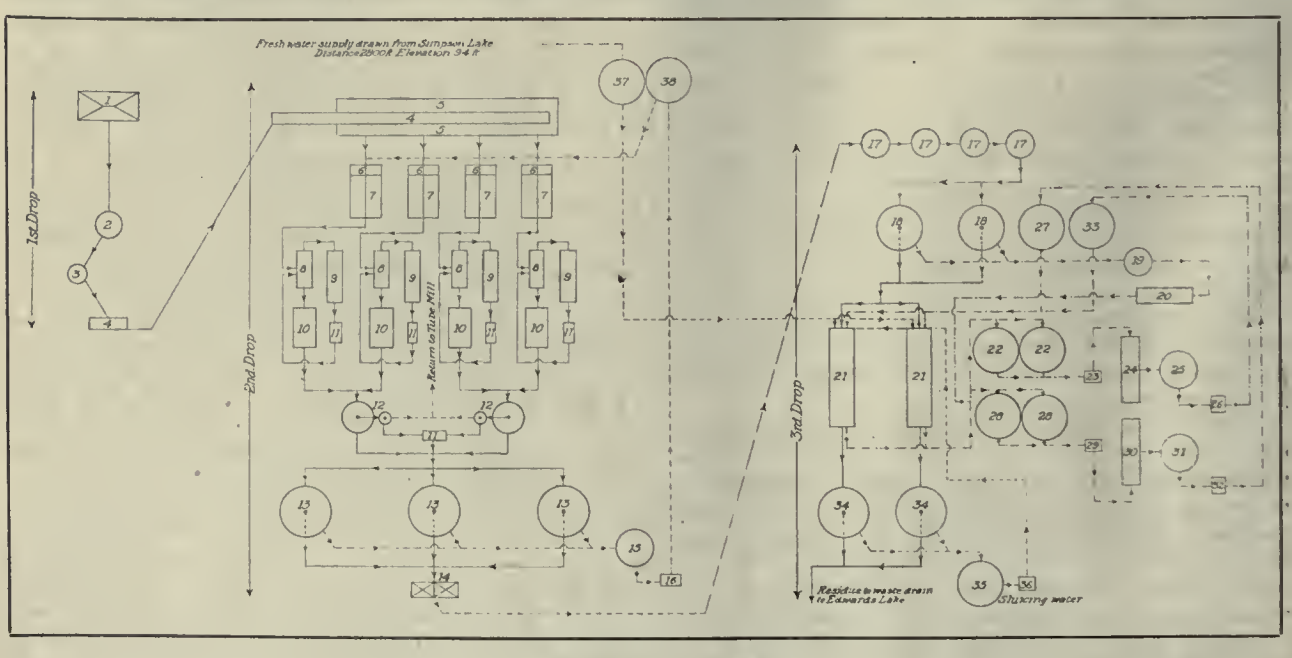
Chuck blocks of various shapes and material have been used as long as stamps. Ordinarily they are covered with copper plates and are depended upon to catch a considerable part of the gold recovered by inside amalgamation. Along the Mother Lode of California, as the stamps have



been speeded up, and more effort directed toward obtaining capacity, inside amalgamation has become less and less important. The chuck-block plate, being set immediately below the screen, is exposed to much wear and with heavy, rapid-dropping stamps has little chance to accumulate amalgam. A riffle plate has therefore come into use. One form is illustrated in the accompanying sketches.

The Dome Mill

Below is presented the flow-sheet for the 40-stamp mill now being erected for the Dome Mines Co., by the Merrill Metallurgical Co. It is of especial interest as being the first, other than experimental mills, to be erected in the Porcupine district of Ontario. The ore so far found has proved easy to treat. The figures in the illustration correspond to machines and data as below: (1) hoist; (2) Kenedy No. 7½ gyratory crusher; (3) Kenedy No. 5 gyratory crusher; (4) belt-conveyor to mill-bins; (5) battery storage-bin; (6) four 10-stamp batteries, 1250-lb. stamps, 102 drops per minute; (7) primary amalgamating-plates, 54 by 144 in., slope 1½ in. per foot, plates in two sections; (8) four duplex Dorr classifiers; (9) four 5 by 22 A. C. tube-mills, El Oro lining, scoop feed, spiral discharge, 31 r.p.m.; (10) secondary amalgamating-plates, 108 by 144 in., slope ½ in. per foot, in two sections; (11) five Frenier pumps, 8 by 54 in.; (12) two concentrating-cone units; (13) three Dorr thickeners, 30 by 10 ft.; (14) duplex bucket-elevator, centre to centre 70 ft., buckets 7 by 16 in.; (15) return battery-water sump, 20 by 10 in.; (16) return battery-water pump, Aldrich vertical triplex, 350 gal. per minute, 15-hp. motor; (17) four continuous agitators 8 by 40 ft.; (18) two Dorr thickeners 25 by 10 ft.; (19) thickener overflow tank 10 by 10 ft.; Merrill clarifying-press; (21) two Merrill slime-presses, 76 four-inch frames, Dome type; (22) two strong-solution precipitating-vats, 25 by 10 ft.; (23) strong-solution precipitation pump, Aldrich vertical triplex, 175 gal. per min., 7½-hp. motor; (24) strong-solution (Merrill) precipitation-press, 52-in. press, 20 two-inch frames; (25) strong barren-solution sump 20 by 10 ft.; (26) strong barren-solution pump, Aldrich vertical triplex, 175 gal. per minute, 7½-hp. motor; (27) strong barren-solution storage-tank 25 by 10 ft.; (28) two weak-solution precipitating-vats, 25 by 10 ft.; (29) weak-solution precipitation-pump, Aldrich vertical triplex, 100 gal. per minute, 5-hp. motor; (30) weak-solution (Merrill) precipitation-press, 10 two-inch frames; (31) weak barren-solution sump, 20 by 10 ft.; (32) weak barren-solution pump, Aldrich vertical triplex, 100 gal. per minute, 5-hp. motor; (33) weak barren-solution storage-tank, 25 by 10 ft.; (34) two Dorr thickeners, 30 by 10 ft.; (35) sluicing-water sump, 25 by 10 ft.; (36) sluicing-water pump, Aldrich vertical triplex, 700 gal. per minute, 50-hp. motor; (37) fresh-water storage-tank, 25 by 20 ft.; (38) battery-water storage-tank, 25 by 10 feet.



Flow-Sheet, Dome Mill.

Texas Coal Production

William B. Phillips, director of the Bureau of Economic Geology and Technology of the University of Texas, has collected statistics of the production of coal and lignite in Texas for the year 1910. These may be summarized as below:

The production of coal was 1,128,947 short tons, valued at $2,829,389, or an average value, at the mines, of $2.51 per ton, an increase of 14c. per ton over the average value in 1909. In 1908 these figures were 1,047,407 tons, valued at $2,580,991, and in 1909 1,144,108 tons, valued at $2,714,630. During the last ten years the total production of coal has been 8,844,207 short tons, valued at $19,576,335. The coal-producing counties are: Erath, Jack, Maverick, Palo Pinto, Parker, Webb, Wise, and Young. The Rio Grande coalfield, comprising the counties of Maverick and Webb, produced, in 1910, 215,328 tons, valued at $503,867, or $2.34 per ton. The North Central coalfield, comprising the counties of Erath, Jack, Palo Pinto, Parker, Wise, and Young, produced 913,619 tons, valued at $2,325,522, or $2.55 per ton. In 1910 the production of lignite was 979,232 short tons, valued at $941,700, or an average value per ton, at the mines, of 96c. The average value per ton increased over that for 1909 13.2c. The 1910 production was by far the largest in the history of the industry. In 1908 the production of lignite was 847,970 tons, valued at $838,490. In 1909 it was 715,151 tons, valued at $592,421. The lignite-producing counties are: Bastrop, Fayette, Hopkins, Houston, Leon, Medina, Milam, Rains, Robertson, Van Zandt, and Wood. The total production of lignite during the last ten years has been 5,311,902 tons, valued at $4,718,841. The total production of coal and lignite during the last ten years has been 14,156,109 tons, valued at $24,295,176.

The Nakanosawa Gold Mine

By Yoshikatsu Yamaguchi

This mine is situated in a state forest at Tosawa, Sankawa village, in the province of Yechigo. It is five miles from Kamikoya on the highway to the city of Aizu from Yechigo, this being the most convenient road, although there are several. At the mine there are several excavations of unknown age. In 1905 they were examined and found to contain rich gold ore, since which many rich quartz veins have been discovered in different places as the result of exploration. The metallurgical treatment of gold ores was commenced in 1907, and bismuth ore was discovered a year later. The mine is 1150 ft. above sea-level, in the valley of Nishito, a branch of the Nakanosawa valley. The present underground workings are open to a depth of 350 ft. In the vicinity of the mine there are many outcropping veins, and there is also an old mine where molybdenite was worked. A high peak east of the mine consists of old granite. The area about the mine is covered with Tertiary tuff and later liparite. The liparite chiefly forms the peaks of the district, while the tuff predominates in the basins. The two rocks can not be easily distinguished on account of their having undergone extensive metamorphism. The gold veins usually occur only in the liparite. Molybdenite is frequently found forming fissure veins in granite. Somewhat larger veins of gold and bismuth ore may be divided into two vein groups, those striking northeast and those trending north. The veins have various widths, from 0.05 to 0.3 ft., and frequently over 2 ft. The larger veins now being worked number 15, and extend about 200 ft. Three of these have been followed in depth for more than 120 ft. Five veins are now being explored.

In the Yamanokami vein old workings are found containing much quartz, and the weathered country-rock contains gold. Throughout the country-rock in certain places there are many veins and veinlets, most of them having not as yet been explored. The same occurrence is seen wherever the rock is uncovered over an area of 25 acres, including Tosawa and Sangaitaki, the most important portions of the mine. The minerals found in the form of veins and impregnations, are quartz, pyrite, chalcopyrite, and bismuthinite, frequently intermixed with mica in small quantities. The parts of the veins which are rich in chalcopyrite are workable for auriferous copper ore. Bismuth is found in almost every vein. The bismuthinite is fibrous and usually of lead-gray color. It is associated with quartz, pyrite, and chalcopyrite. It occurs usually in the lower part of the veins instead of in the upper, and in certain stopes in the No. 2 and No. 6 veins. The bismuth oxide is fine granular with grayish-white lustre, or white and earthy, or massive. It is intergrown with quartz and chalcopyrite. This is especially the case with the No. 4, the No. 5, and the No. 13 veins, and the Yamanokami vein.

In all the veins gold is included in the minerals. From its mode of occurrence, both primary and secondary gold seems to be distinguishable. Much of the ore contains 0.01 to 0.1% gold. Nearly every vein has at least one bonanza, its length being sometimes one-fifth or one-third of the length of the vein. Generally the bonanza is also rich in bismuth. The total depth of the present workings is 300 ft. between the highest level of the Sanjin vein, 1120 ft. above sea-level, and the No. 3 level of the No. 1 vein. There are 30 levels open in an area of 500 by 600 ft. Eighteen samples of the ore were taken from the important veins and assayed, the results showing that they contain 0.0002 or 0.0003 to 0.02% or 0.05 to 5.8 oz. gold per ton of 2000 lb.; the first figures indicate the contents of three samples only. The gold and bismuth content of the ores taken from the several places is as follows:

	Gold. Per cent.	Gold. Oz.	Bismuth. Per cent.
Average from old workings	0.0034	0.69	.....
Bi and Au ore of the Sanjin vein	0.0286	8.44	3.17
Rich ore from No. 4 level	0.0436	12.72	.....
Rich Bi ore dumped outside stamp-mill	0.0006	0.17	20.00
Bismuth sulphide ore in middle level	....	.....	16.32
Rich gold ore containing bismuth oxide in No. 13 level	0.0746	21.75	27.86
Bi ore (chiefly oxide) from middle of No. 2 level	....	.....	35.43
Bi ore of No. 12 level	0.0190	5.54	5.33

The ores subjected to cyaniding (January 1909) had the following gold content: Rich ore, average, 0.0428% or 12.49 oz. per ton; medium ore, 0.0066%, 1.92 oz.; poor ore, 0.003, 0.87 ounce.

The ores hitherto worked as gold ores have been bismuth oxide from higher portions of the mine, 220 ft. above the water-surface of the Nishisawa valley. In depth the amount of sulphide in the veins increases. Oxidized ores resulting from weathering are abundant, and are of great convenience in metallurgical treatment. The zone of oxidation extends 200 to 300 ft. in depth. The daily output of the ores is about 2.6 tons. The ore is carried down to the cyaniding mill by self-acting wire-rope tramways, where it is classified into lump and fine. The lump ore is crushed to a size of 1.2 to 1.8 in. and sent to the stamps, together with the fine ore. There are five Californian stamps, weighing 330 lb. each. They are driven by an 18-ft. water-wheel of an old Japanese type. The battery-screens are usually 40-mesh wire cloth. The apron-plates are in three rows, each of six amalgamated copper plates 1.2 ft. wide and 2 ft. long. Next, and below the copper aprons, *seriita* (concentrating boards) are used, covered with a woolen cloth. The concentrate is then treated by pan and barrel-amalgamation, while the tailing is sent to a small Wilfley table for the further separation of sulphide. The extraction of gold by amalgamation is 50% for the ordinary ore, and 80% for the rich ore. The sulphide concentrate from the Wilfley tables sometimes contain more than 0.003% (0.87 oz.) gold and 2 to 7% copper. The concentrate is smelted together with other auriferous copper ores. Repeated experiments on cyaniding the gold ores have given excellent results. How to utilize bismuth ores is now under investigation. A year and a half ago the mill was being enlarged, and since that time substantial progress has probably been made.

Western Australia Ore Reserves

Save a couple of companies, ore reserves in the Kalgoorlie mines are only published at the end of the year. Below is a review of the situation at the end of 1909 and of 1910, no account being taken of 'probable' ore.

	Dec. 31, 1909.		Dec. 31, 1910.
Name.	Tons.	Value.	
Associated	483,517	$10.08	Doubtful quantity. Plenty of $5 ore.
Associated Northern	.....	.....	Impossible to estimate.
Chaffers	20,000	9.60	Past year's average, $6.50.
Golden Horse Shoe 1,071,638		10.33	French engineer estimates 750,000 tons at $8 per ton.
Golden Ridge...	60,000	11.52	May be lower account of 500-ft. level.
Great Boulder Perseverance.	380,772	6.60	Mine should continue so.
Great Boulder Proprietary...	751,077	16.32	Bottom levels not estimated.
Great Fingall..	49,460	6.00	The 17th winze may have opened a good deal of ore.
Hainault	100,000	6.96	Indications point to a similar reserve.
Ivanhoe 1,007,798		10.96	Tonnage should be maintained, though ore a little lower in value.
Kalgurli	400,000	12.30	Management does not commit itself to a strict estimate.
Lake View & Star	172,050	6.68	Star leases should keep up average.
Oroya Black Range	107,000	10.08	Will probably be maintained.
Oroya Links...	84,000	8.40	Much development to keep this up.
Sons of Gwalia.	513,000	8.40	Should easily be kept up.
Sons of Gwalia South	61,000	9.73	Estimate this year likely to be lower.
South Kalgurli.	156,939	7.12	Should be much as before.

Late in 1908, and during 1909, the Oroya Links, Lake View & Star, and Chaffers-Main Reef consolidations were made. Large areas of country that could not be profitably worked as separate concerns, were absorbed or merged. The Lake View & Star seems likely to be the one that will be most profitable. Many tributers are in the Oroya Links mine, and active development is under way to open up more ore. It is difficult to predict its future.

Water Diviners in South Africa

The Springs Mines, Ltd., in Far Eastern Rand has been shaft-sinking for over a year, but owing to the bad ground and water encountered, the depth is only about 700 ft. Better strata have, however, now been reached and improved progress is confidently anticipated. As an instance of the dread in which the dolomite—a kind of caverned and jointed magnesian limestone—is held, the appointment of a water diviner by the Daggafontein Gold Mining Co., Ltd., to point out a position for the shafts where water would be avoided ought to be mentioned. Hitherto water diviners have been employed to show where an abundance of water exists, and it seems rather a novel idea for a water diviner to be called upon to show where there is no water underground. Needless to say, the water diviner completely failed to indicate a suitable spot, and the shaft is flooded with water just as though his services had never been called in. There is a feeling that unless circular shafts are sunk and these heavy flows of water shut out, the Far East Rand goldfield will afford several instances of shaft-sinking failures where any thickness of dolomite has to be pierced. At Modderfontein a circular shaft is being sunk, but although it is in the same field dolomite can scarcely be expected to be present. The circular shape has apparently been selected to promote ventilation, and because the consulting engineer, a coal mining engineer from South Wales, has been accustomed to circular shafts. The selection of this shape is giving rise to considerable discussion.

Utah Copper

The annual report of Utah Copper for the year ended December 31, 1910 shows the total production to have been 89,019,511 lb. of copper at a cost of 8.069c. per pound. Of ore mined, 82% was by steam-shovels and 18% through underground workings from the Boston property. The average cost of mining was 40.97c. per ton, of which 13.3c. was charged to development and stripping expense, leaving the total cost for production 27.67c. per ton. The cost per pound of copper stated includes smelting, refining, transportation, and selling expense, and compares with 8.787c. per pound for 1909. The report states that the company's ground in Bingham contains 203,500,000 tons of fully and partly developed ore. Of this, 152,130,000 tons is said to be fully developed and blocked out. Of the fully developed ore, it is stated, 60,000,000 tons have an average copper content of 2%, and the remaining 92,130,000 tons have an average copper content of 1.6%. The Bingham & Garfield railroad, for transporting the company's ores twenty miles from Bingham to the concentrators and smelters at Garfield, will be in operation by July 1. The average price received for copper during 1910 was 12.672c. per pound, as against 12.915c. per pound in 1909. The old board of directors was re-elected at the annual meeting. The Utah Copper has bought the Pay Roll group of 175 acres, filling in a stretch between its original holdings and the old Boston Consolidated territory.

New Mill at Great Boulder Perseverance

The Great Boulder Perseverance gold mine at Kalgoorlie is once more on its feet after having recoverd from its second attack of illness. The first blow it, or at least the shareholders, received was in 1902 when its rich ore suddenly gave out and it became very lean. The energies of Hooper & Speak, the new engineers, were equal to the occasion and put the mine in order. The second adverse episode was the fire in November 1909. The main driving engine, the air-compressors, Griffin mills, Edwards roasting furnaces, and their subsidiary equipments were entirely lost. Rebuilding was commenced immediately and Krupp dry ball-mills were substituted for Griffins. The rebuilt plant went into commission on August 1. During the idleness of the mill development work was actively continued at the mine. The main shaft reached a depth of 2228 ft. by April 1911. A new level has been opened at 2050 ft. where profitable ore has been found in the south drift and cross-cuts are being driven at 2200 ft. On December 31 the reserve consisted of 120,134 tons of broken ore in the stopes (shrinkage stoping being the method employed), with contents averaging 6.55 dwt. per ton, 362,700 tons of proved ore averaging 5.95 dwt. and 289,380 tons of probable ore averaging 5.08 dwt., a total of 772,214 tons, as compared with 629,852 tons the year before. During the five months, August to December, 91,852 tons was milled, yielding 27,013 oz. gold and 3408 oz. silver, having a total value of £115,083. The extraction of gold was 79%, but as gold is always locked up on starting a new plant this figure will improve later. The capacity of the plant is 20,000 tons per month and the maximum is determined by the capacity of the roasting furnaces. During the time the mill was running the working costs averaged 19s. 1d. per ton, and were reduced from 24s. 2d. in August to 18s. 3d. at the end of the year, but owing to the expense of development and management continuing during the rebuilding of the mill, the result of the work during 1910 has been a loss of £20,913. The balance sheet shows an item, "Addition to plant machinery and buildings during 1910, £44,636," and on the other side, "Bankers' overdraft and interest, £42,650." This, together with the announcement made a year ago that £20,000 had been recovered from the insurance company, explains the method of financing the rebuilding of the plant.

Discussion

Readers of the MINING AND SCIENTIFIC PRESS are invited to use this department for the discussion of technical and other matters pertaining to mining and metallurgy. The Editor welcomes the expression of views contrary to his own, believing that careful criticism is more valuable than casual compliment. Insertion of any contribution is determined by its probable interest to the readers of this journal.

Surface Indications of Ore-Shoots

The Editor:

Sir—A protracted field season has delayed until now my opportunity to participate in the discussion evoked by W. H. Storms' interesting article in your issue of October 22, but perhaps I may be permitted, even at this late date, to offer a few points for consideration.

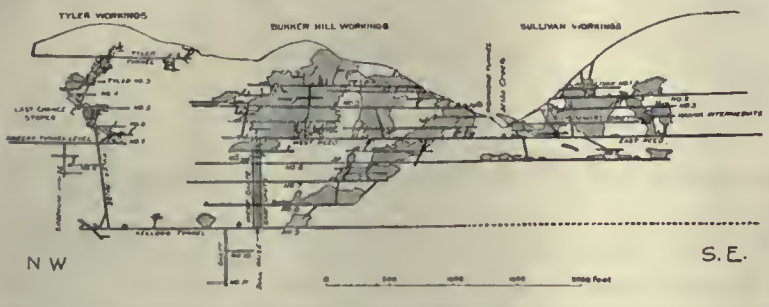


FIG. 1. LONGITUDINAL VERTICAL PROJECTION OF THE BUNKER HILL & SULLIVAN MINE.

That ravines which cross the outcrop-line of a vein are in many instances the topographic expression of transverse faulting subsequent to ore deposition, and that accordingly they suggest underground disturbance of a kind likely to destroy the continuity of the orebody and perplex the miner may readily be granted; but whether this relation is so constant as to be properly termed a law is a question requiring critical examination. The conditions involved are, it appears to me, far more complex than has been recognized in the present discussion, and it may be doubted whether generalization from a few districts suffices in this case to establish an invariable rule or even to furnish a generally reliable guide to the prospector or miner. With the hope of enlarging the scope of the inquiry I shall try to present some factors that appear to preclude a simple solution of the problem. The occurrence of ore-shoots in a number of well-known mines is illustrated in the accompanying figures taken from various published reports of the U. S. Geological Survey.

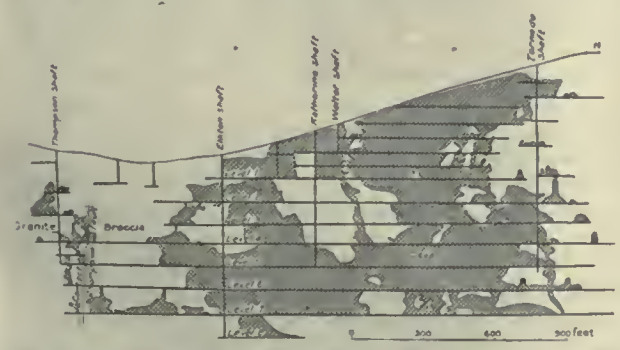


FIG. 2. GENERALIZED LONGITUDINAL SECTION OF THE ELKTON MINE, CRIPPLE CREEK, COLORADO.

In the first place, the facts open to direct observation are to some extent weighted in favor of Mr. Storms' suggestive hypothesis. Veins ordinarily are discovered on the hills, not in the gulches, and the normal course in the development of a mine is the exploitation, by tunnels or shallow shafts, of the ore-bearing ground above the local drainage lines, while deep shafts and pumping are deferred until a comparatively late stage. Consequently, longitudinal sections of many mines show more extensive stopes in the ridges than under the gulches, this arrangement of the workings being quite independent of the actual distribution of the ore. This fact scarcely needs special illustration here, but it may be remarked that the Bunker Hill & Sullivan mine, cited by Mr. Storms in support of his view, is partly at least illustrative of this normal course of development (see Fig. 1), although I admit that as it is about seven years since my examination of the mine was made, I am unable to state from present knowledge whether subsequent development has confirmed the opinion then generally held that the Sullivan ore-shoot pitches northwest under Milo gulch.

In the second place, the facts relating to the distribution of the ore with reference to cross-gulches are in many instances inconclusive, and might be as well cited against as for the supposed rule. In the case of the Elkton mine at Cripple Creek (Fig. 2) and the Helena-Frisco mine (Fig. 3) in the Coeur d'Alene district, for example, the suggested law is not quite clearly applicable. A large number of veins, moreover, contain orebodies in precisely those portions where according to the hypothesis discussed they should be barren, or at least should exhibit a marked change in tenor. The Mary McKinney mine at Cripple Creek (Fig. 4), which Mr. Storms, by the way, cites in favor of his generalization, was stoped extensively under the south branch of Arequa gulch, and it does not appear to me that the Cripple Creek district shows any systematic connection between cross-gulches and lack of ore. The same may be said of the Coeur d'Alene district, where the principal stopes of the Tiger-Poorman mine are directly under Canyon creek. The Georgetown district affords some excellent examples of large orebodies under cross-gulches, as shown by Fig. 5 to 7, taken from Professional Paper No. 63, by Spurr, Gar-

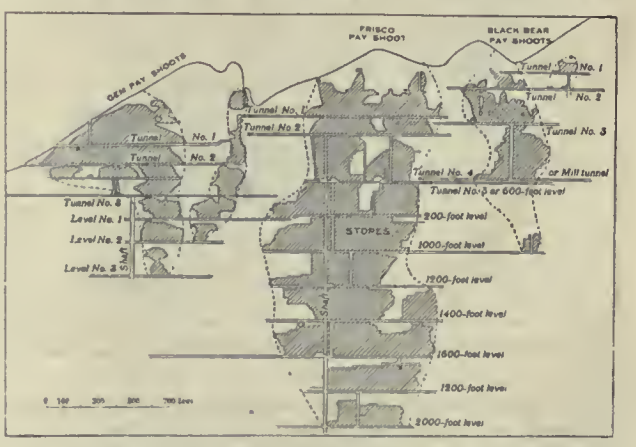


FIG. 3. LONGITUDINAL SECTION THROUGH THE HELENA-FRISCO MINE, COEUR D'ALENE DISTRICT, IDAHO.

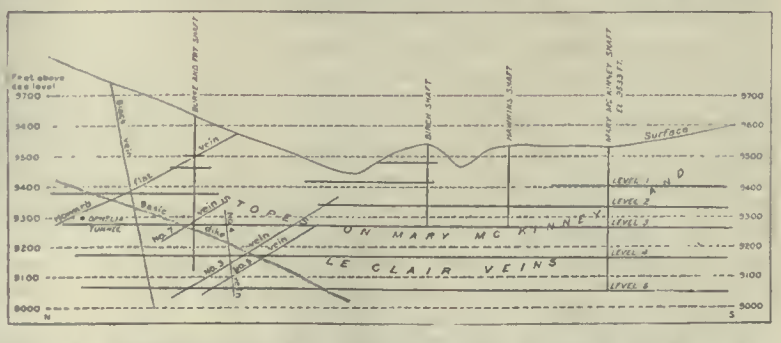


FIG. 4. GENERALIZED LONGITUDINAL SECTION THROUGH THE MARY McKINNEY MINE, CRIPPLE CREEK, COLORADO.

rey, and Ball. The Stanley mine near Idaho Springs has a pay-shoot that extends across the valley of Clear creek, and E. S. Bastin, who has been studying the veins of the Central City quadrangle, informs me that the orebodies occur as commonly under the gulches as elsewhere. At Bisbee, where the deposits, it is true, are not veins, there

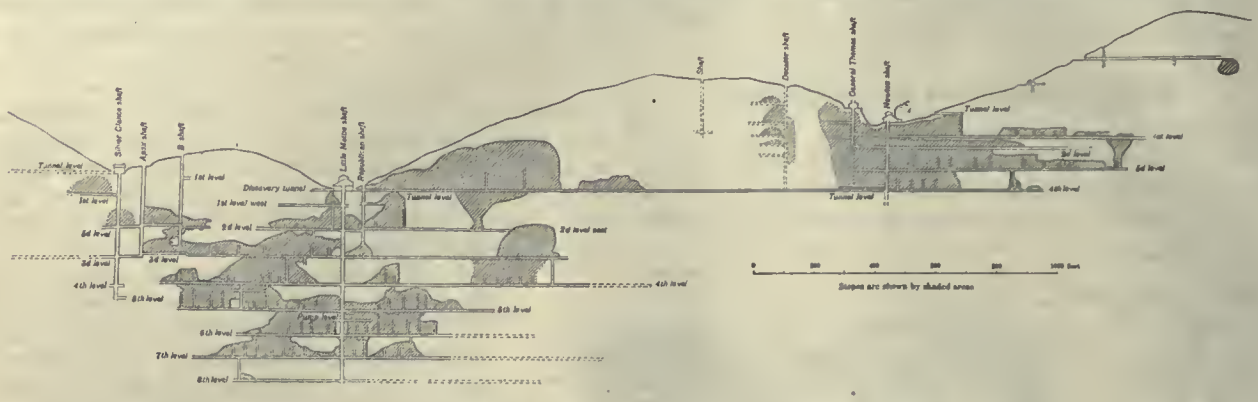


FIG. 5. LONGITUDINAL PROJECTION OF THE LITTLE MATTIE WORKINGS, IDAHO SPRINGS, COLORADO.

is a decided prevalence of orebodies under topographic depressions. Exceptions to Mr. Storms' rule might undoubtedly be found in considerable number by searching through the literature descriptive of ore deposits, but probably sufficient examples have been adduced to show that it certainly is far from being universal. With these facts in

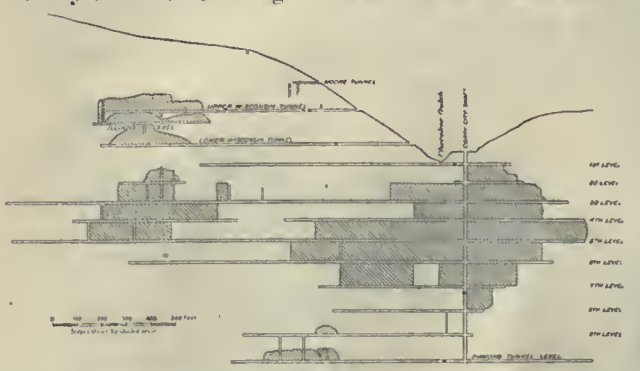


FIG. 6. LONGITUDINAL SECTION OF THE WISCONSIN-CORRY CITY WORKINGS, GEORGETOWN DISTRICT, COLORADO.

mind, a consideration of the conditions controlling the development of transverse gulches will be in order.

Inasmuch as the ravines are cut by erosion, their courses in a general way are determined by structural or textural weakness in the underlying rock. This determining factor, however, may be neither direct nor local. In other words, although a stream may follow a course that as a whole is determined by ease of erosion, yet there is a limit to its minuter adjustments to varied resistance, and at certain places the stream may cut through rocks of exceptional hardness where such obstacles are less formidable than would be a change of channel. Thus it is not safe to conclude that a gulch is necessarily coincident at every point with a line of underlying weakness, and it follows from this that the place where a ravine crosses a vein may have no connection whatever with the structure or character of the vein at that particular place. Along the Mother Lode belt, which Mr. Storms knows so well, the relation of erosion to the veins and their enclosing rocks is exceptional. The Mother Lode itself is a remarkably continuous chain of hard massive quartz veins that run nearly parallel with narrow belts of steeply inclined laminated rocks of a wide range in hardness and durability. The region has a well adjusted drainage of dominantly consequent type, that is the main streams flow down the slope in consequence of its general westerly tilt. They thus traverse the strike of the rocks and are fed by subsequent branches well entrenched along belts of weak rocks. Under these circumstances the Mother Lode veins, as a rule, stand out as ridges, and the conclusion that where the streams cross these the searching action of erosion has found a weak spot in the rampart is a fairly safe one. The condition of weakness may be transverse faulting or may be lack of quartz deposition at a place where the fissure pinches. If faulting has taken place, whether the dislocation is older or younger than the period of ore formation should at least be determined before drawing conclusions as to its economic effect. If the dislocation is partly or wholly older than the period of original deposition or of enrichment (if present), then Mr. Storms' rule may apply, although not infallibly. If the faulting is entirely later than the ore the existence of the gulch may suggest that the miner may have trouble in picking up the dissevered parts of his vein, but it does not indicate absence of ore. If the gulch marks a pinch in the vein, of course, as a rule, there will be little ore at that place. Along the Mother Lode the ore is generally associated with, if it does not occur within, hard masses of vein quartz. Not all veins are of this character, however. In some districts the productive portions of the veins are softer and weather more readily than the barren portions. In such a case a transverse gulch, if it depends upon underlying structure at all, is more likely to coincide with a rich than a poor part of the vein. Many of the deeply worked veins of Clear Creek and Gilpin counties, Colorado, appear to illustrate such conditions. Other factors to be considered in attempting to set up a general rule are downward enrichment and ground-water level. If, for example, a vein owes its importance to downward enrichment and is situated in a humid country where the level of the ground-

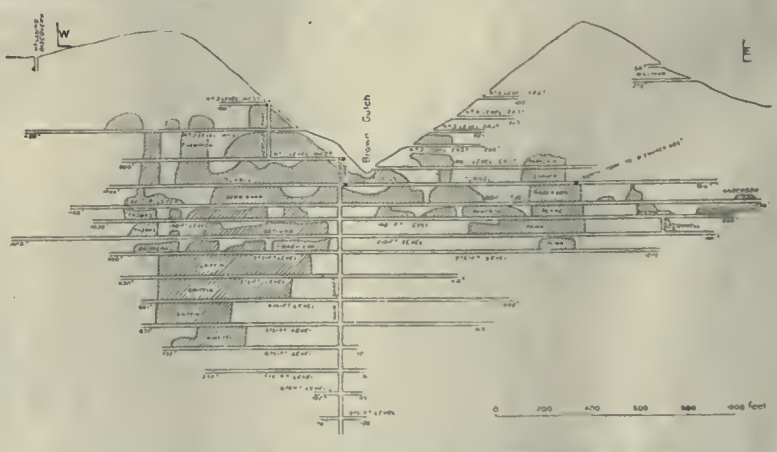


FIG. 7. VERTICAL PROJECTION OF SEVEN-THIRTY WORKINGS, GEORGETOWN DISTRICT, COLORADO.

water is high and has not been subject to great fluctuation, then it is possible that the bottom of a cross-gulch may have been cut down into the unenriched sulphides, while the ridges on one or either side contain good ore, as illustrated by some of the veins at Breckenridge, Colorado. On the

other hand, if the region is an arid one, the gulch may mark a soft and readily permeable part of the vein where the enriching action has been especially active.

I realize that the foregoing suggestions by no means exhaust the factors that should be taken into account in attempting to frame a general law to cover a supposed significant relation between cross-gulches and pay-shoots, but elaborate treatment would take too much of your space, and perhaps enough has been said to show that while Mr. Storms' rule may serve to indicate the probabilities in a district where the relation between ore deposition, faulting, and erosion are clearly understood to have a certain constant character, it is not of universal application and is probably not infallible even in any one district.

F. L. RANSOME.

Washington, D. C., May 1.

American Metallurgical Society

The Editor:

Sir—In an editorial of May 6 you express very pessimistic views regarding the future of the American Metallurgical Society which was recently organized in this city by "a few brave spirits." The society has just issued a call for charter members, and as there is a likelihood of many of the engineers who read your editorial forming a similar opinion without being fully conversant with the movement, to the great injury of the society, I shall ask of you the privilege of presenting to them a few facts regarding the society and what it proposes to accomplish.

The American Metallurgical Society was incorporated under the laws of this State, March 14, 1911, as a technical coöperative society. The organization was accomplished without the fanfare of trumpets, voluminous press notices, and the trimmings which usually accompany the birth of a new organization, and the reason for this was that those having the matter in charge believed that the best way to enlist the support of the engineering profession was to go ahead and do something, leaving the fireworks to come afterward.

The organization was effected, by-laws adopted, officers were elected, committees appointed, and work started in less time than is usually required for the average committee to meet and adopt a set of resolutions. The society is now a living, vital factor in the world of mining and metallurgy. It is not an 'honor' society. It is a society composed of earnest conscientious men who find their livelihood in following the mining and metallurgical professions and who hope by banding together to accomplish good both for themselves and others similarly employed. It is hoped that the movement will be a broad one, and a cordial invitation is extended to all engineers, both in this country and abroad, to join the society and give it their loyal support.

It has been said that there are already enough societies of this kind in the country. I know of only one—the American Institute of Mining Engineers. The American Mining Congress, a most worthy institution, is organized on entirely different lines, and the Mining and Metallurgical Society of America has set such a high standard for membership that the average engineer is not eligible. It is admitted that the American Metallurgical Society is organized on much the same lines as the American Institute of Mining Engineers, but the character of our work will be entirely different from that of the Eastern society. The 'sphere of influence' of the Institute is east of the Rocky Mountains; that of the Society is in the West. An inspection of the transactions of the Institute will clearly show that, aside from the coal interests, that organization is out of touch with the country west of the Rockies. It is proposed to make the new society a purely Western organization. Not Western in the sense that its membership will be confined to the West, but Western insofar as the character of its work is concerned. Western methods, Western ideas in ore treatment, Western mines and minerals; those will be the subjects with which the society will concern itself. A society that will be truly representative of the West, such is the ambition of its founders. It is intended to go even further and to arouse among the members a spirit of coöperation which will find its expression in a desire to help one another, particularly in the matter of securing employment. The society will father this idea by appointing a committee to receive applications from disengaged members, and by advertising and other means will endeavor to procure appointments for them. It is believed that mining companies will heartily approve of the plan and will give it their earnest support. The need for some such plan of coöperation has been dwelt upon at length by a number of writers in the technical press during the past few months. I believe that the engineering profession will heartily approve of the efforts of the society in this direction.

Returning to the subject of supporting technical societies, I wish to draw attention to the tendency of engineers to ignore the small organization and to crowd into the Institute. This is not for the best interests of the profession. Competition is the life of trade, and it is also the life of an organization. The swollen membership roll of the American Institute of Mining Engineers is not conducive to the best interests of that organization. If the Institute had an active competitor, the friendly rivalry which would naturally spring up between the two organizations would result in a great deal of good accruing to the profession. The disbanding of the Western Association of Technical Chemists and Metallurgists is a case in point where a most worthy organization was permitted to go out of existence because of the tendency of engineers to confine their support to a single society. It is not so long ago but that man can recall the time when mining and metallurgy was not recognized as a profession. The 'mining expert,' now a picturesque memory of the past, was the representative of the craft. To what can be attributed the raising of mining and metallurgy to the dignity of a profession? For one thing, to the influence of technical societies. An organization of men for any purpose commands attention, and when that organization stands for high ideals, it commands respect not only for its members, but for the profession to which it stands as a living monument. But what of a profession which can support but a single prominent society? Is the layman likely to be impressed with the importance of such a profession? If there were a dozen active societies, would not our interests be still further advanced than they are today?

The American Metallurgical Society was organized after several months of careful thought had been given to the details of the organization and the financial problem carefully worked out. Headquarters have been secured in this city at 61 Fremont street, without cost to the society. While not large they are sufficient for our present needs. The publication of the transactions has been provided for in a way which will relieve the society of the burden of cost. This has enabled the society to make the entrance fee ($3) and the annual dues ($2) nominal. There is an additional charge of $1 per year for the transactions. In the case of the charter members who are now being admitted, the annual dues are remitted for the year 1911. For reasons already stated, the society was organized without the usual pyrotechnic display, and consequently there are many engineers who are unaware that such a society has actually been formed. Literature has been sent to those whose addresses are available, but there are many others with whom the secretary would like to get in touch. If there are any who, on reading this, would like further details regarding the society or would like to become identified with it, I would be pleased to forward to them literature and the necessary application blanks.

CARLOS P. GRIFFIN.

San Francisco, May 9.

[We are sorry the friends of the new society consider our comment unduly pessimistic, and we take pleasure in publishing this full statement of the plans of its organizers, by the secretary. With their ideals and purposes we are, as already stated, in full accord and we gladly wish them the best of good fortune.—EDITOR.]

Concentrates

Most of these are in reply to questions received by mail. Our readers are invited to ask questions and give information dealing with the practice of mining, milling, and smelting.

STAMPS are the most common crushing machines used in milling gold ore in California. At present there are 6033 in commission in the State.

CHROMITE is the only commercially important ore of chromium. It is a mixture of chromic oxide (Cr_2O_3) and ferrous oxide (FeO) in various proportions, the former averaging 40 and 60%, though occasionally running as low as 10, the latter running to 50%. The theoretical composition of chromite is $Cr_2O_3.FeO$ (Cr_2O_3 68%; FeO 32%). The price is based on 50% ore.

TO CLARIFY muddy water that does not become clear when allowed to stand, place some lumps of alum in a little tin shaker such as serve in kitchens for utilizing small pieces of soap, and stir the water with it for a minute or two. The water will quickly settle clear, and the amount of alum which is thus introduced has no deleterious effect even if the water is afterward used for cooking or drinking.

BAUXITE BRICK have been used in lining reverberatory copper furnaces and also in lining lead-refining furnaces. For this latter purpose they give satisfactory service, lasting much longer than silica brick, which are badly corroded by the basic oxides which rise to the surface as 'skims.' It is claimed that the lining of bauxite brick lasts five to six times as long as ordinary silica brick.

THE DEEPEST WELL in the United States, according to Isaiah Bowman of the U. S. Geological Survey, is near West Elizabeth, Pennsylvania. Its bottom is 5575 ft. beneath the surface. The deepest well in the world is in Germany and is 6572 ft. deep. A more remarkable well, perhaps, reaching a depth of 3600 ft. was drilled for petroleum in western China by primitive methods and by means of such crude appliances as a cable made of twisted strands of rattan.

TROY OUNCES contain 480 grains, while avoirdupois contain but 437½; since there are 12 troy ounces, but 16 avoirdupois ounces, per pound, there are 5760 grains (troy) per pound, or 7000 avoirdupois. The grain is the fundamental unit in both systems and was originally taken as the weight of a plump grain of wheat. To convert per cent of gold, therefore, to troy ounces per avoirdupois ton of 2000 lb., multiply by 29,176 and point off the appropriate decimal.

BLISTER COPPER which is too low in precious metals to make it worth while to attempt to recover them, and carrying impurities in too small quantities to be objectionable, is refined by the furnace process and cast into ingots. Such copper has too low conductivity to be used for electrical transmission purposes and is rather too impure to be desirable for brass making or rolling. Possessing certain desirable physical properties, however, it makes good copper castings, and is chiefly used for this purpose.

WET CONCENTRATES are hard to handle and many plans for drying them have been devised. At the North Star mine, Grass Valley, California, a sheet-steel side-dump concentrate car is used that is U-shaped in cross-section. This has been bored with numerous quarter-inch holes. Inside is placed a thickness of burlap, covered and held in place by coarse wire netting. Concentrate, after being loaded into this car, is allowed to stand and drain a few minutes before being trammed to the bin and dumped.

WATER is present to some extent in all rocks, but some formations, such as the granites, carry only an inappreciable amount. Sandstone, on the other hand, has an absorptive capacity of a gallon or more of water per cubic foot of rock and is the best water bearer of the solid rocks. Wells sunk in sandstone are usually drilled and the water derived from that rock is seldom polluted. To those who are contemplating sinking wells or increasing their water supply from underground sources, Water-Supply Papers 255 and 257 of the U. S. Geological Survey will be of especial interest.

CHURN-DRILL work must often be conducted when cold weather or steady rain interferes with the comfort of the men. In the Lake Superior region drills are often housed in, but where the drill is moved frequently this is expensive and difficult. At the El Oro dredge at Oroville, California, a housing has been devised that is portable. The sides and roof are made of frame covered with galvanized iron and built in sections. It is the work of but an hour or two to put the sections in place, and the time is more than made up because of the increased comfort of the men. Designs for such a structure must necessarily be made to fit each machine and varied somewhat according to conditions.

WIRE CABLES used in hoisting should be dressed with a mixture of 7 parts soft tallow and 3 parts of plumbago. A convenient way to apply this is to saw a 4 by 6 through diagonally, after having bored an axial hole a little larger than will take the rope, and make, by screwing four thin boards to the upper edge of the 4 by 6, a box large enough to hold several pounds of the dressing. This device is then clamped around the cable by means of a couple of bolts and secured in place by means of a scantling placed across the head-frame just below the sheave, and the cavity filled with the dressing and the cable run through. If old rope be shipped around the cable, it will catch on any broken strands and thus reveal defects. Standing wire rope which is exposed to the weather should be painted with a mixture of linseed oil and Spanish brown.

GOLD is commonly associated with arsenic, and especially with the mineral arsenopyrite. A remarkable association of native gold with native arsenic has been found in the Tokatea area, New Zealand. The arsenic forms hollow geodes with concentric shells that are easily broken off in succession. In the hollow interior are numerous interlacing dendritic threads of gold, which may in the aggregate weigh several ounces. The geodes often weigh several pounds and may be 6 to 8 in. diam. Gold is not found in the division planes separating the concentric spheres of growth. In the rich pay-shoots the gold is generally finely distributed throughout the quartz matrix. The minerals associated with the gold are native arsenic, stibnite, pyrite, chalcopyrite, and arsenopyrite. The frequency of association of arsenic minerals with gold would perhaps suggest that there must be some genetic relation involved, but the study of such deposits has not yet revealed the nature of such relations.

VANADIUM, which is used in the form of ferro-vanadium in making alloy steels, is obtained from carnotite (an impure vanadate of uranium occurring chiefly in Colorado) by agitating the crushed ore in a revolving barrel for one hour with a boiling solution of sodium carbonate. Both vanadium and uranium are extracted by this treatment. Sodium hydroxide precipitates the uranium as sodium uranate, which is filtered out. Slacked lime is then added to the filtrate, precipitating calcium vanadate, mixed with lime. There are several other processes in use. The vanadium assay presents little difficulty and does not require much time. The ore is fused with sodium carbonate, leached with water, and the fusion repeated on the residue. The combined filtrates are acidified with sulphuric acid, arsenic and molybdenum being precipitated in the hot solution by hydrogen sulphide, whereby the V_2O_5 is reduced to V_2O_4. After filtration and expulsion of hydrogen sulphide by boiling, the vanadium is titrated in hot solution by permanganate. It is then reduced by sulphur dioxide gas, and after boiling this out the titration is repeated. The results are exact, and they are not affected by the uranium that may be present.

Special Correspondence

NEW YORK

BRADEN COPPER.—GUARDED INTEREST IN PORCUPINE.—SELLING COBALT TO BUY PORCUPINES.—TONOPAH-BELMONT MEETING.—OKLAHOMA INVESTIGATION BUREAU.—KING PHILIP MERGER.—BLACK HILLS MINERAL PRODUCTION.

Robeson T. White, who built the plant of the Balaklala company in Shasta county, California, is to take charge of the construction work on the Braden. Pope Yeatman, now in Chile, is expected to return June 1. Evidently, from the requirements of this property, J. B. Haggin and his associates are not to own the only costly copper mine in South America. The Cerro de Pasco company in Peru has been requiring some vast sums to bring it to production, but Cerro de Pasco is not in the hands of the public, being rather a close corporation consisting of Mr. Haggin, the D. O. Mills estate, the H. McK. Twombly estate, J. P. Morgan, and some other associates. It is announced that the Braden Copper Co. will have to do some further financing. An additional bond issue of $2,000,000 is to be made, and the capital stock, now $12,000,000, is to be increased to $14,000,000 to provide for conversion privileges. Of the Braden's present authorized capital, $12,000,000, one-half is outstanding and one-half is in the treasury against the bonds of $6,000,000 already authorized and issued.

BLAST-FURNACE BUILDING, CERRE DE PASCO, PERU.

The general public is marking time so far as the new Canadian gold camp is concerned. The Eastern press is making a united stand against any and all publicity in behalf of Porcupine. The buyers of mining shares are almost invariably making scattering investments of hundred-share lots. The merits of the camp, beyond the two or three properties already demonstrated,' are unknown. It is clear that the East is ready for a mining boom, but Porcupine lacks the lodestone of high-grade ore to create the furore and excitement of a full-fledged mining boom. Just at this time, the Canadian trails are at their very worst, and development will be unimportant and news scarce until travel can be freely resumed. The Cobalt shares are almost wholly neglected, so far as market is concerned. The only activity in the Cobalt list during the past few weeks has been in the selling of shares to go into the new goldfield. Nothing could better illustrate the position of the lay mind toward mining exploitation as a whole. Cobalt shipments, just at the moment, are breaking records, but the fact that a wonderful 'poor man's camp' has made good in so large a way, and is making enormous returns on a comparatively insignificant investment, does not equal the anticipated glory of a new find. There is one feature of Porcupine's future, however, that is worthy of great consideration. If the field develops into a low-grade district with large orebodies, and an assurance of long life, the experience will do more to put mining on a high-class basis with the American public than all the booms of the various camps in the Rocky Mountains have ever done. If we can have a gold-mining district similar to the Rand, it will be an education for the American public, an education in the right direction, and away from pyrotechnics and questionable financing.

The directors of the Tonopah-Belmont held a meeting this week in Philadelphia. Plans are to be considered for a new mill of 450 tons daily capacity, which will be expected to eliminate smelter charges and effect some very large savings in other directions. Richard G. Parks, president of the company, resigned his office, owing to ill health, and is succeeded by Clyde G. Heller, former secretary of the company.

Speaking of questionable financing, it may be noted that Oklahoma is going a step farther than the projected law in Massachusetts. Oklahoma is proposing to establish a bureau for the investigation of corporations. Information is to be given to all inquirers concerning business enterprises, the principal idea being to protect investors against fakes. It is at least a hopeful sign that the way of the 'get-rich-quick' promoters is becoming a little harder to travel all the time.

The King Philip Copper Co. is to be absorbed by the Winona Copper Co. on a basis of two Winona for three shares of King Philip. Both of these Lake properties are practically close corporations. Copper Range is to absorb the Atlantic on a basis of ten Atlantic for one Copper Range.

One by one, the independent companies of Butte are losing their old identity. The Alice Gold & Silver Mining Co., one of the old companies of the camp and listed on the New York Stock Exchange, is about to give up its charter and be dissolved.

An echo of the old Harney Peak tin enterprise was heard this week in the application of the receiver for repayment of money paid to the United States Land Office. The Black Hills of South Dakota have produced several mining booms and one big mine. The various products sought have included copper, tin, gold, mica, porcelain clay, and marble. The richest 'hundred square miles on earth' is now sometimes spoken of as a country of samples.

TORONTO, CANADA

Rise in Rea Shares.—Prospecting the Timmins.—Find on the Jupiter.—Cyaniding Porcupine Ores.—Resumption of Normal Production at Cobalt.—McKinley-Darragh Dividend.—Blairton Iron.

The most noteworthy recent feature of Porcupine share dealings has been the demand for Rea shares, which yesterday touched $7.45 and will apparently contest the leading place with Hollinger. The cheaper issues have fluctuated considerably, but the general trend has been toward a higher level, though any marked advance is usually checked by a rush of profit-taking. At the Rea a station is being cut at the 200-ft. level, from which a cross-cut will be run to tap the vein. At 85 ft., before the vein left the shaft, average assays gave $65 per ton. Hand-drilling will be continued in the shafts put down by Bewick, Moreing & Co., Mr. Williams, who has charge of the work, stating that he finds it easier and cheaper to put down a shaft by hand until a good depth is reached, so that the compressor-plant will not be used for some time. On the three Timmins claims, east of Pearl lake, operated by Bewick, Moreing & Co., a camp known as camp No. 4 has been established for the accommodation of 75 men, with a six-drill compressor-plant and two hoists. Two drills will be used in prospecting. At camp No. 2, in North Tisdale, trenching and stripping are proceeding, to find quartz deposits that may indicate ore-

Eastern Canada.

bodies with depth. Sinking has just been started. The two shafts on the West Dome are down 46 and 75 ft. and diamond-drilling in several places has been done to the depth of 300 ft. On the Babyan claim, on the bed of Gillies lake bordering on the Hollinger, diamond-drilling has shown a 28-ft. vein. The Royal Porcupine, in which New York capitalists are interested, will begin operations as soon as possible on a location south of the Vipond, where three strong veins have been found. The Porcupine Imperial has a shaft down 80 ft., and when the 100-ft. level is reached cross-cutting will be started to pick up three veins showing on the surface. A good find was recently made on the Jupiter property, comprising the two Shillington claims north of Pearl lake, where free gold shows plentifully in a streak of quartz seven feet thick.

The question of whether Porcupine ore will require to be treated with cyanide is beginning to receive some attention, though hitherto it has been rather overlooked or relegated to the future, owing to the more pressing problem of proving large orebodies. The Hollinger and the Dome have arranged for the erection of cyanide plants in connection with their stamp-mills, but the general opinion of engineers is that the camp will furnish large quantities of free-milling ore, and that the introduction of cyaniding at this stage may be premature.

The increased shipments from Cobalt indicate that the difficulty arising from power shortage is being satisfactorily overcome. Many of the plants which were forced to close down or greatly restrict operations have resumed their normal production. The management of the La Rose is opening up a third level in the main shaft at a depth of 270 ft., the deepest point so far attained in the workings. A station has been cut, and driving is being done along the main vein. Developments on the second level of the Lawson mine show much improvement as compared with the first level, and this property now furnishes a large proportion of the high-grade shipments. The Crown Reserve has adopted a policy of deep mining. In the winze on the Carson vein, sunk from the 300-ft. level a depth of 150 ft., or a total of 450 ft. below the surface, has been reached. The Nipissing is also going deeper. A winze is being put down 75 ft. below the third level of shaft No. 64. The McKinley-Darragh has declared a quarterly dividend of 10%. This brings the total amount returned to shareholders to $1,706,000. The Silver Leaf property is being worked by the Crown Reserve. The shaft which is down to 420 ft. will be sunk lower so as to cut the Keewatin. Green-Meehan appears to be coming back. About 1000 ft. of driving has been done since A. W. Thomsen took charge and the ore extracted solely in the process of development has more than repaid the $30,000 expended. Charles A. O'Connell has been appointed manager of the Trethewey in place of George MacNaughton, who resigned to look after his interests in Porcupine.

The Blairton iron mines in Belmont township, Peterborough county, Ontario, have been sold by the Pearce company of Marmora, to the Blairton Iron Mines Co., Ltd., of Toronto, for $75,000. The latter company has had the property under option for three years, during which time its value has been thoroughly tested by diamond-drilling. The mine was operated many years ago, but the enterprise was abandoned on account of the expense of transportation. The company has also secured two large iron mines in North Hastings and will build a mill at Trenton.

ELY, NEVADA

Progress for Year of Nevada Con.—New Pits Opened.—Reorganization of Ely Central and Ely Centennial.—Good Progress in White Pine County.

The statement of the Nevada Consolidated Copper Co. for the quarter ended March 31, which has just been filed with the county assessor and tax collector, presents some very interesting figures. During the quarter 653,385 dry tons of ore from Copper pit were treated at the concentrating plant of the Steptoe Valley Mining & Smelting Co., an auxiliary company of the Nevada Consolidated. The gross yield of the ore was $2,296,036, which showed a net profit above transportation and treatment charges of $490,739, or 75c. per ton. Transportation charges amounted to $174,908, or 27c. per ton. The extraction amounted to $379,615, or at the rate of a little more than 58c. per ton. The reduction charges for the quarter amounted to $1,250,772, or a little less than $2 per ton. These figures are made on dry ore, while the cost of transportation is based on wet ore. The cost of transportation from the mines to the plant is 25c. per ton, which includes the moisture, while the treatment charges are for dry ore, which makes the cost run up to 27c. per ton. The loss in concentrate and smelting amounts to about 30%. The management experienced much trouble, which materially reduced its output, during the first quarter of the year, caused by the ore freezing in the cars and also by water shortage due to the cold weather, which affects the water-supply for about two months in the year. The output for the present quarter will probably be nearly 20% greater than that for last quarter. The physical condition of the property is most excellent. A daily production of about 10,000 tons is now maintained, which could be largely increased without much additional expense, if there was a demand for the ore at the plant. Seven sections of the concentrating plant are kept in constant service, while one section is usually down

undergoing repairs. The new Liberty pit, about a half-mile west of Copper pit, has produced some ore, but no effort is made in that direction at the present time. The ore produced is being taken out in development work. However, the new pit could be drawn upon for a considerable tonnage if desired.

The Ely Central company is about to be reorganized, with a treasury fund sufficient to thoroughly test the property. The committee on reorganization has been successful in raising the money to pay off all liabilities of the company, and as soon as the receiver has been dismissed and the property transferred to the new company, development work will again be undertaken. The Ely Centennial company has also recently been reorganized, and its stock made assessable, which will permit the company to raise money as needed for development work. The company's holdings lie immediately north of the town of Ely, near the eastern end of the mineral belt. The company has done more than 2000 ft. of development work during the past year and a half, which demonstrated a leached-iron zone 200 ft. in width. It is expected that a winze will be sunk in this vein to water-level, where the secondary enrichment should be found.

There is considerable activity in mining throughout the country at the present time. The eastern end of the county, especially, has taken on new life during the past year. The Amalgamated Nevada company has erected a 10-stamp mill for the treatment of its ores at Blackhorse, and will also treat custom ore, which will materially assist in livening the old gold camp. A plant is being erected at Sacramento pass, near Osceola, by the Ohana company, and will go into commission within a few weeks. Considerable tungsten ore is also being treated near Osceola, the concentrate from which has a value of about $500 per ton. The concentrate is shipped East for refining.

DENVER, COLORADO

NEW DESIGNS FOR ELECTRIC TRANSPORTATION.—LINE PROJECTED IN MONTEZUMA AND ARGENTINE DISTRICT.

An interesting and rather novel feature in electric transportation will be utilized by the Automatic Transportation Co. of Buffalo, N. Y., which has signed contracts with the mine owners of Montezuma and Argentine, to

AUTOMATIC TRANSPORTATION IN WINTER AT BLOSSBURG, PA.

transport their ore to the railroad, a distance of six to eight miles. It expects to begin in May the work of building its electric tram road, probably completing it by November 1, 1911. The new features are that the rails carry the power for the operation of the cars, and do away with the third rail, or overhead trolley, and can be operated with 220 or 440 volts, which is a low voltage, considering the distance; they use a direct-current motor, which means a low cost of operation for power. The cars are run in small units, each car carrying a motor, though operated by one motorman to a train. The construction of this line is also a new departure in mountain railroad building, and consists of a 4 or 6-in. post of common iron pipe, with a square base, set in concrete, 3 ft. deep by 18 in. square; the grade of the road is maintained by shortening or lengthening the poles as required; this saves excavation for a grade, which is an expensive item in the Rocky Mountains, and at the same time it leaves the rails 5 to 12 ft. above the ground, out of the snow, which falls to an average depth of 4 ft. in winter. The 30-lb. rails used are hollow, and made in the form of a fish-hook, being bolted to an insulated fastening, which rests on a malleable cross-arm weighing about 120 lb.; thus the whole railroad is constructed of iron and steel. A brush contact is made underneath the hollow part of the rail from the motor, so that neither ice nor sleet affects the operation of the road. On account of being able to operate on a 10 to 20% grade for short distances, the road can be built almost straight, so that a line can be run direct to a mine or mill which could not be reached by a railroad. It requires about 100 tons of steel and iron to the mile to build the road, the posts being set 10 ft. apart. The cars being 12 ft. long, no more than one car at a time can rest on one pole. These are capable of sustaining 63 tons, and as the cars carry only from one to three tons each, the maintenance of such a road will be very cheap. Another marked advantage is that the cars all dump automatically, and can be loaded the same way; the trains are operated at a speed of about 20 miles per hour, the passenger coach seats eight people comfortably, and can carry as many trailers as necessary; they are electric-lighted and heated. Flat cars to carry lumber and machinery are used as well as the automatic dumping ore cars. What this road means to the mines of Montezuma and Argentine districts can only be appreciated by one who has hauled over mountain roads twelve months in the year. The Montezuma and Argentine districts have the ore, but have been under great disadvantages, soft coal costing from $12 to $16 per ton, delivered at the mines, and the cost of hauling ore from the mines and mills to the railroad being from $3 to $5 per ton; but with the advent of the Summit County Power Co. in the district, which supplies electric power equal to the cost of steam-power with coal at $2 per ton, and the fact that the Colorado & Southern Railroad Co. has cut its freight rate from $3.25 to $1.75 per ton on ore to Leadville, with a promise of even a lower rate on low-grade ore in the near future, this district will be able to ship low-grade ore direct to the smelters at Salida and Leadville.

LONDON

CONCENTRATION BY FLOTATION.—DEMONSTRATION OF THE PROCESS AT NEW YORK.—COPPER CARBONATE MINES AT CHESHIRE.

I have so often written in your columns on the subject of concentration by flotation that I am particularly interested in the news that the Minerals Separation Company has established an office in New York under E. H. Nutter's charge with the object of giving American metallurgists a practical demonstration of the working of this process. I may say that Mr. Nutter is fully conversant with the intricacies of this principle, having been for over a year engaged in Australia and elsewhere in studying its application and getting to know all its details. It is highly desirable that Mr. Nutter should have had this opportunity for absorbing past experience, for flotation is one of the most ticklish problems within the domain of the mining engineer and metallurgist. The physical principles involved are obscure, and it is difficult to predict the results obtained on any individual ore. It is therefore essential that experimental work on its application to particular mines should be in the hands of an expert. Another point which I wish to press home is that American metallurgists should not be in too great a hurry to pass an opinion as to the efficiency of this method. Americans have a reputation for making quick decisions and of not having too much patience. A quick decision on the subject of flotation is to be deprecated. Also, the fact that many

ores will not be responsive to this treatment must not be used as an argument against its general value. The standing in law of the various owners of flotation process has been impunged recently by our distinguished contemporary in New York, which argues that the processes are free to anybody and that not a single patent could be substantiated. The two cases of anticipation quoted by the *Engineering and Mining Journal* do not give a lucid idea of the question as to the validity of the patents. To give one point only: Minerals Separation Co. relies on its discovery that only small proportions of thin oil are necessary when used in a certain specified way. It will be remembered that the MacArthur-Forrest cyanide patents were upset because the patentees did not expressly show that cyanidation was made a commercial success by their discovery that weak solutions had a special virtue. The Minerals Separation position seems to me analogous to this, and for that, if for no other reason, it is best for American metallurgists to make further enquiries before taking the *Journal* as guide.

A few weeks ago I recorded the attempts to re-open some of the old lead mines in the Carboniferous limestone in Derbyshire. Since then another similar project has been placed before the public, being a proposal to re-open the old carbonate of copper mines at Alderley, Cheshire, not far away. This ore is found in the Keuper sandstone of the Upper Trias, and some galena and cobalt compounds are associated with it. The deposits have been worked from time immemorial, and the extent of the workings shows that large amounts of ore must have been extracted. The proximity of the Lancashire chemical manufacturing districts makes acid cheap, and leaching processes are therefore applicable. My own recollection of the mine, judged by repeated visits twenty years ago, is that there is difficulty in obtaining a continuous supply of ore averaging more than 1% copper in any quantity; but the present sponsors quote a higher content, and are confident that they can make sulphate of copper at a profit. About £4000 cash has so far been subscribed, but this is not enough.

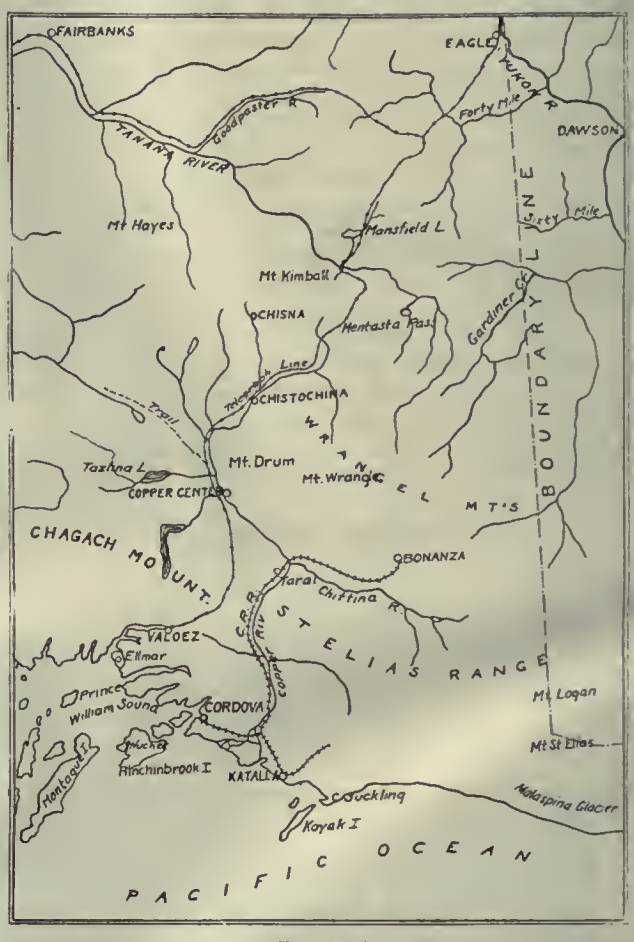
WASHINGTON, D. C.

THE CUNNINGHAM LAND CASES.—CLAIMS IN CHUGACH NATIONAL FOREST.—APPEAL OF THE STRACEY CASE.—MINING LEGISLATION.

Decision in the Cunningham coal-laud cases is expected in about two weeks. The attorney for the claimants has attempted to prove that there had been no thought of combination among the various entrymen prior to the time when their rights to their claims had been acknowledged by the Government's acceptance of the purchase price for the lands. Walter Fisher, Secretary of the Interior, sat with the board. The Secretary is putting much time and thought on the Alaska coal-land situation, and, seeing the necessity for an early adjustment of the difficulties, is bending every effort in that direction. The reply to the resolution calling for information as to the claims in the Chugach National Forest, in Alaska, shows that four locations, based on 'soldiers' additional homestead scrip' have been filed at Juneau by R. S. Ryan, promoter of the Controller Railway & Navigation Co., and three of them are now under consideration by the Land Office.

The Government has appealed the case of the Stracey group of claims to the United States Supreme Court. Judge Hanford of Seattle quashed the indictment against the men involved, on the ground that, under his interpretation of the coal-land laws applicable to Alaska, the indictment had not stated an offense. The appeal involves the indictments against Charles F. Munday, an attorney of Seattle, Washington; Archie W. Shiels, employed by Algernon Stracey, and Earl E. Siegley, formerly secretary to Michael J. Heney, who built the White Pass railroad and the Copper River railroad in Alaska. It does not include that against Algernon Stracey, who was indicted along with Munday, Shiels, and Siegley, but who was absent when the others were arraigned. It was from the alleged interest of Stracey and his brother, Sir Edward H. Stracey, an English baronet and Liberal member of Parliament, in the land, that the name 'Stracey group' or 'English group' was given to the claims. The Government charged in the indictment that Munday, Shiels, Siegley, and Algernon Stracey entered into a conspiracy to defraud the Government out of 6000 acres of coal land, valued at $10,000,000, just west of the so-called Cunningham coal-land claims.

Asle J. Gronna, the new Senator from North Dakota, has introduced three bills affecting the land laws. The first provides for the classification of the public lands of the United States; the second for the disposal of coal and coal lands; and the third seeks to authorize the disposal of phosphate, oil, asphaltum, or natural gas. Robert La Follette, Senator from Wisconsin, has introduced a bill providing for the valuation of the segregated coal and asphalt lands and the surplus lands in the Choctaw and Chickasaw nations, and of the surplus lands in the Creek nation, in the State of



COPPER RIVER, ALASKA.

Oklahoma; and for the sale of the surface and the disposition of the mineral rights therein. William H. Andrews, delegate from New Mexico, has introduced two mining bills, the first to authorize the exploration and purchase of mines within the boundaries of private land claims, and the second to authorize the Secretary of the Interior to sell and convey the unappropriated nonmineral desert lands of the United States. Richard W. Austin and M. D. Foster have introduced bills to appropriate from the sale of public lands $5000 for the first year, $10,000 for the second, $15,000 for the third, $20,000 for the fourth, and $25,000 for the fifth and each succeeding year, for the maintenance of a school or department of instruction in mines and mining in each State and Territory.

J. A. Holmes, director of the Bureau of Mines, has been chosen to represent the Government in settling the smelter-fume troubles at Anaconda, Montana. L. D. Ricketts will represent the company, and J. H. Hammond will arbitrate where necessary. Preliminary to considering the particular problems at Anaconda, Mr. Holmes will visit other plants throughout the country. F. G. Cottrell will act as one of his special advisers. Sumner S. Smith, of the Bureau, will assume his new duties as mine inspector in Alaska July 1.

General Mining News

ALASKA

Copper River

The Great Northern Development Co. the operations of which at Copper mountain, near Kotsina river, are in charge of E. F. Gray, formerly of Ely, Nevada, has kept a force of 40 men at work for the past year or more, and has a 600-ft. adit and 20 cross-cuts into the ore, which is reported to assay 12 to 17% copper, with some gold. It is claimed a branch is to be built to the property from the Copper River & Northwestern railroad.

Juneau District

The mill report of the Alaska Mexican for the month ended April 15, shows that 17,937 tons of ore was crushed, from which $44,685 was recovered, at a net profit of $11,980. Dividend No. 63 of 20c. per share has been declared by the company, and dividend No. 93, of 50c. per share, has been declared by the Alaska Treadwell. The board of directors of the latter has changed the fiscal year so that it will hereafter end May 31.

(Special Correspondence.)—The Alaska Treasure Gold M. Co., operating on Douglas island, is developing its property by means of two cross-cuts. The first to be driven was the Hudson cross-cut, whereby a body of ore was opened 200 ft. below the vein cropping; a winze was sunk on ore from this level. The main cross-cut, 750 ft. vertically below the Hudson, was driven 3400 ft. At 2600 ft. in from the portal a body of ore was found, and in driving on to the 3400-ft. point other orebodies were opened, the average values of which have not yet been determined. The work now in progress consists in driving from the face of the main cross-cut northerly to get immediately under the workings on the Hudson level. Development is to be continued during this year, and it is probable that a mill will be erected next season. T. A. Harper is superintendent; the consulting engineers are Pearse, Kingston & Browne, of London and New York.

Juneau, May 1.

Prince William Sound

The Cliff mine, situated in the vicinity of Valdez, is being operated by a leasing company, having a lease that runs two more years. It belongs to R. Ellis, to whom royalties amounting to $35,000 have been paid within the last eight months. The stockholders of the leasing company have received dividends aggregating $125,000 since the lease was given. A 6-ft. vein of rich ore was opened on the lowest level last month, and this is said to be a branch of the main vein, which is much narrower. The Valdez M. Co., having an active mine near Valdez glacier, 8 miles from town, has made good progress in development work during the past winter. The adit-level has been driven 200 ft. on the vein, showing the latter to have an average width of about 7 ft. This adit starts on a precipitous mountain slope, 1000 ft. higher than the surface of the glacier. The transportation of supplies to the mine is difficult, the road extending 1500 ft. up the face of the glacier, crossing crevasses over bridges. The top of the glacier is said to be level and smooth.

CALIFORNIA

Amador County

(Special Correspondence.)—It is stated that the run of the Bunker Hill mill at Amador for 26 days in April yielded gold valued at $27,000. Considerable low-grade ore was handled, this quartz being extracted in course of development on the 1950-ft. level. At this point an excellent body of ore is being opened, the quartz showing the same value as demonstrated at the 1750-ft. point. In the mill 40 stamps are in operation. E. H. Harrington is superintendent. It is reported that the famous old Plymouth Consolidated mines, at Plymouth, have passed into the hands of a strong company, and will be re-opened. A deed has been recorded, conveying the property to the Lane Investment Co., said to be composed of Eastern investors. The property was at one time one of the largest producers on the Mother Lode, and was opened to a depth of 1500 ft. At the time of its operation mining and milling costs were high, and the owners were forced to cease work because there was no profit. The mine has been idle for 20 years. The Kennedy, at Jackson, the premier producer of the Mother Lode, continues to maintain a heavy yield. The production amounts to $90,000 to $100,000 per month, much of the ore coming from the vicinity of the 3500-ft. level. The Kennedy enjoys the distinction of being the deepest gold mine in California, and has been the principal factor in proving the persistent nature of the Mother Lode veins. At the Argonaut preparations are being made for more vigorous development

and production. A number of districts throughout the country report increasing activity.

Jackson, May 13.

Nevada County

The Nevada County Deep Drainage & Development Co. has been reorganized, with W. H. Martin, F. J. Sloat, George W. Downey, C. E. Clinch, F. M. Miller, I. W. Hays, D. E. Morgan, and A. W. Hoge as directors. The object of the organization is to drive a drainage adit from near Jones bar, through the Nevada City district. It is estimated that the principal vein system of the district can be tapped at a distance of 15,000 ft. from the portal, and at depths ranging from 1050 ft. at the Champion mine to 1800 ft. at the Pittsburg. The plan contemplates the extension of the adit beyond this vein system to the Town Talk ridge, thence farther on into the Grass Valley district. The finding of new orebodies not exposed at the surface, it is believed, will be one of the advantages attained by driving this adit. The estimated cost of driving to the nearest producing mine is $175,000, and the income to be derived from drainage service, ore haulage, and water-supply, it is estimated, will exceed this sum per year. The directors have chosen as president, Fred M. Miller; vice-president, G. W. Downey; secretary, G. M. Noyes; treasurer, D. E. Morgan. Those who stand as sponsors for the project are interested in mining in Nevada City district.

Plumas County

(Special Correspondence.)—The Four Hills mine, near Johnsville, has resumed operations after a winter spent

in prospecting, and the owners, Hood and Breese, are getting their 20-stamp mill in good condition, 10 stamps of which will be operated this season. It is understood that the present force will be increased, and that the mill will be kept running on the average $6 ore which has been found in the recently discovered ore-shoot. It is reported that a second ore-shoot has been discovered, but the grade of this ore has not been determined. The Jamison mine, near Johnsville, is operating as usual on a good grade of ore, and it is said there is a sufficient quantity blocked out to keep the mill running for a year or more. The Plumas Eureka Mines Co., also operating at Johnsville, is employing about 50 men, the majority of whom are engaged in opening the old workings which were found in bad condition after some 15 years of idleness. The superintendent, D. J. Lawton, states that he intends to resume work in the intermediate levels of the old mine this summer, and that he will develop the mine on the lower or Eureka level, by a cross-cut following in the direction of the upper or Seventy-Six level. The Eureka is running 30 stamps, and it is believed that this additional development work will furnish sufficient ore to feed the 40 stamps with which the mill is equipped.

Johnsville, May 13.

Shasta County

(Special Correspondence.)—Developments at the Balaklala mines are proceeding with renewed vigor. The adit, which will eliminate the use of the aerial tramway by permitting the shipment of ore to the smelter from the mines by cars, is progressing at the rate of 200 ft. per month. Operations have been resumed at the company's siliceous gold-ore property in the Quartz Hill district, with a force of 100 men. The U. S. Dredging Co. expects to place its dredge in operation within a few days. The boat has been thoroughly overhauled and placed in good condition.

Redding, May 7.

In the annual report of the United States Smelting, Refining & Mining Co., Frederic Lyon discusses the bag-house system of collecting furnace fume, and has the following to say relative to the bag-house at the Kennett smelter: "The bag-house was put in operation July 5. It was a success from the very beginning and removed all the deleterious substances from the fumes, just as the bag-house was doing at Midvale. The success is the more gratifying, as this bag-house is the first erected in connection with a copper plant. There being no precedent to guide the engineering department in such problems as filtering area and cooling surface, it was considered wise to be conservative in the construction, so as to avoid an unnecessarily high expenditure of capital. As a result it was found, on completion, that the bag-house was not able to take care of the fumes of four furnaces, but did care successfully for the fumes of two furnaces. In order to comply fully with the decree of the court which permits the company to operate, and in order to live up to the spirit of the understanding with the farmers, it was considered wise to operate the smelter at one-half capacity, in spite of the increase of treatment costs per ton of ore and the material reduction of profits which were the necessary result. Experiments were at once started with a view to finding means to increase the capacity, and before the end of the year these experiments were so successful that a third furnace was started without any addition to the bag-house. By the installation of an auxiliary fan the company will be enabled to operate three furnaces steadily and successfully. The experiments will be continued with a view to further improvements."

Sierra County

Mining operations are more active than usual in Alleghany district. A 10-stamp mill is being built at the Tightner mine; the Sisson mill at the Red Star mine has been continuously operated during the past winter. The Croesus mine, in charge of C. W. McMeekin, has exeellent surface equipment, is developed by about 10,000 ft. of adit-levels, drifts, and cross-cuts; recent work consists in sinking a winze at a point 3000 ft. from the portal of the main adit, the purpose of which is to open at greater depth rich shoots of ore which were mined on the higher levels.

The North Star mine, at Pike City, which has been under development many years by G. A. Houreade, is reported to have been bonded and leased to J. P. Maleville, of Grass Valley, and others. The work performed during the winter resulted in opening ore that runs high in free gold and gold-bearing sulphides. It is said that 70 tons of this high-grade ore is ready for shipment. The Sierra Buttes mill is operating on high-grade ore. It is reported that a stamp-mill is to be built this season at the San Luis, near Sierra City.

The Nonpareil claim, near Alleghany, located two years ago by John Marthaler and Lee McCoy, who bonded it later to the Codd Mines Co. of Reno, has gold ore running $12 to $15 per ton. This was found in a 4-ft. vein on which a 450-ft. adit was driven last winter. The adit is being extended, and within the next 150 ft. the serpentine contact is expected to be reached, where high-grade ore was found on other properties. The adit will attain a depth of 350 ft. at the contact.

Tuolumne County

(Special Correspondence.)—Operations are soon to be resumed at the Omega, a small crew of men, under the direction of Joseph Loney, being already engaged in preparatory work. Some retimbering will be done. It is reported that an examination is to be made of the Porto Fino property mine for Oakland investors, who have in contemplation the bonding of the property. Work has been resumed at the Street mine, near Tuttletown. A gas-engine and pump are to be put in at Mandich mine, on Brown's Flat, the flow of water having increased to such an extent as to cause a temporary suspension of work. The mine is operated by Dan Mandich. Suit to recover $5550 has been brought in the Superior Court of this county against the Big Casino Mining Co., by W. M., S. M., and J. H. Witt, and D. C. Warren, who allege fraud in the sale of the several thousand shares of stock which they purchased in Texas from an agent of the company in 1906. The plaintiffs assert that it was represented to them that the company owned the mine, which is situated near Big Oak Flat; that there was no debt on the property, and that 20 stamps were in operation on ore ranging from $10 to $17.50 per ton, all of which allegations they declare were untrue.

Tuolumne, May 6.

COLORADO

Clear Creek County

(Special Correspondence.)—The Bard Creek M. Co. recently shipped 50 tons of ore from claims on Lincoln mountain, worth $50 per ton in gold, silver, and lead. The Clyde B., owned by James Beshears, has shipped 70 tons of ore, worth from $45 to $50 per ton in gold. Both the above-named properties are situated in the new gold camp of Clear Creek county. Work on a large scale is in progress at the Conqueror mine, on Covode, where a 100-ton concentrator will be built. George Schneider is manager.

Georgetown, May 15.

(Special Correspondence.)—A 6-in. streak of ore has been uncovered in the Little Mattie mine that shows ore running as high as 57 oz. gold and 140 oz. silver per ton. W. S. Leebrick is manager. A streak of ore 8 in. wide has been encountered in the drift being run on the West Lake mine that is worth 2 oz. gold per ton. There is also a 3-ft. body of mill ore that is worth $11 per ton in gold and silver. The New Era mine at Freeland is to be equipped with a mill having a daily capacity of 60 tons. James Cousins, of Freeland, is manager. The Denmark adit of the Consolidated Vindicator M. Co. is now in 820 ft. An ore-bearing vein has been intersected, believed to be the Tom Turk.

Idaho Springs, May 15.

Gilpin County

(Special Correspondence.)—The Anchor mine being operated by the North American S. & M. Co., has become a heavy producer. An average of 25 tons of smelting ore is being extracted daily that is worth $30 per ton. A shipment of 30 tons of ore from the Baker mine, operated by Semmens & Co., sampled $30 per ton. Operations are being carried on through the La Crosse adit, connection having been made with the shaft. The Rover mine has been taken under bond and lease by J. Pintarelli & Co. A gasoline hoist has been purchased, and now driving is in progress from the 220-ft. level. The shaft on the Chase mine has reached about 600-ft. depth, and it is to be completed at 700 ft. The shaft on the Pittsburg mine is now down 1000 ft., and, after providing a sump 20 ft. deep, driving will be started east and west.

Central City, May 13.

Lake County (Leadville)

The Siwatch adit, in Sugar Loaf hill, has reached a length of 3100 ft. and should cut the first known vein in 400 or 500 ft. more. A large flow of water has been met; this is taken to mean proximity to a vein. In the Dolomite shaft, in Adelaide park, the drifts are being driven steadily to the east and west. The Cryolite, on Fryer hill, is now shipping carbonate ore. The Ballard, on Breece hill, is working on a fair orebody, toward the south, and is shipping about 35 tons per day. A number of new enterprises have been started during the past month and several old ones have increased their scale of working. The receipts of ore at the Leadville smelters are heavy and the feeling is general that conditions are excellent.

The Little Johnny continues to produce very rich gold ore, many tons having been produced that run over $100 per ton. In the Star mine, on Carbonate hill, lessees have found a vein of silver ore running over 100 oz. per ton, while prospecting for zinc carbonate. The old Iron mine on Carbonate hill has showed some good bodies of zinc carbonate as a result of the prospecting which has been going on there. In the Chrysolite mine, under lease to Kirk White, a good body of zinc ore has been found, and regular shipments are being made, and a big body of ore has been blocked out.

Pitkin County

An event of much importance in Aspen is the unwatering of the Free Silver shaft of the Smuggler mine, which was allowed to fill with water fourteen years ago. Divers were sent down the shaft and succeeded in starting the pumps. A large area will be drained by this shaft and its influence on the whole district will be marked.

The San Juan

The annual meeting of the shareholders in the Frank Hough mine was held at Denver last week, and steps were taken toward the re-equipment of the buildings that were destroyed by fire recently. During this season the Revenue will do most of its work through the Ophir adit, but ore will be sent down to the mill on the Ouray side, and the concentrate will be shipped from Ouray. The Mono-Baltic M. & S. Co., which has been planning to erect a smelter at Ouray, has made a payment of $50,000 on the property. They have taken over the old Saratoga mill and 50 tons of machinery was hauled up last autumn. The proposed smelter is to have a capacity of 250 tons per day. The Primos Chem. Co., which operates vanadium mines at Newmire, has just received a new air-compressor and will soon have air-drills at work in its mine, where 100 men are employed. The disturbed conditions in Mexico have lessened the production of the properties owned there by the General Vanadium Co., so more dependence is being put on the Colorado mines. G. B. Pickett has obtained control of the old Suffolk properties at Ophir and is developing them. The mill has 20 stamps in running order, and twenty 650-lb. stamps are being replaced by 1050-lb. ones. Men are at work on several levels, but the mill has not been started yet. The Torpedo-Eclipse, which owns 16 claims in the Sneffels district, hopes to have its mill running within a couple of months. Ten men are now at work in the No. 4 adit, and work will be started soon in No. 1. The King mine, near Silverton, has started work. The Iowa-Tiger has found a new orebody on its fourth level. It is hoped that the litigation over the Peerless San Juan may be settled soon, so that work may be resumed. The mill at the Ledge Con., which is being enlarged and will start June 1, will have a capacity of 4000 tons per month.

Teller County (Cripple Creek)

The Favorite mine, on the southwestern slope of Bull hill, which was sold in 1900 to W. S. Stratton for $90,000 and which has long lain idle, has been leased to Howard Sholts, who has incorporated the Cripple Creek Mohawk Leasing Co. The surface equipment has been reconstructed and new machinery put in; the second shipment has been made, and machine-drills are now running on three levels. A rich ore-shoot has been found in the Flying Cloud mine, on the east slope of Bull hill, assays ranging from $16 to $100 having been obtained. The production for April of some of the important Cripple Creek mines is given in the following table:

Mines.	Tons.
Vindicator	3,400
El Paso	2,750
Isabella	1,350
Ajax	1,350
Findley & Shurtloff	675
Doctor-Jack Pot	450
Mary McKinney, main shaft	250

The annual meeting of the Doctor-Jack Pot M. Co. will be held June 14. The quarterly report of the president, A. E. Carlton, shows that 14 sets of lessees are at work, and the royalties paid by them during the last quarter amounted to $2561. Cash on hand amounts to $12,789. The decision of the U. S. Court of Appeals in the Work case has not yet been handed down.

IDAHO

Shoshone County

(Special Correspondence.)—During the last four months the Caledonia M. Co. has been shipping close to 700 tons of ore per month. Some shipments sampled 10 to 15% lead and 100 to 150 oz. silver per ton; others contained

Scene in the Coeur d'Alene.

about 39 to 45% lead and ran 60 to 80 oz. silver. Throughout the mine are lenses and small bodies of ore which are very rich in native silver. Charles McKinnis, the manager, states that the lower adit-level, which is to tap the vein at considerable depth below present workings, has been driven 1000 ft. During March, 333 ft. was driven by working two 8-hr. shifts. Eventually a concentrating mill will be built for the Caledonia, though no definite plans have been made for such a plant.

Kellogg, May 8.

(Special Correspondence.)—The National Copper M.

Co., having a group of claims three miles northeast of Mullan, is believed to have the extension of the Hecla vein. Some time ago a 400-ft. shaft was sunk on the vein, and some driving was done from the 200 and 400-ft. stations; but the excessive flow of water made it necessary to abandon work in the shaft. At the collar of the shaft a drift of 1200 ft. was driven on the vein, the ore being galena and silver. Later a cross-cut was started to open the vein far below the adit level. The heading is now in 1500 ft., and driving is in progress. The vein will be reached at 4500 ft. from the portal.

The Carbonate Hill group of claims, three miles from Mullan, is being developed by George H. Martin, D. K. McDonald, and others of Spokane. They have driven an adit about 1200 ft., by which 500-ft. depth is attained. George Houston, of Mullan, states that this group is on a belt of green chloritic quartzite, associated with several basic dikes; that ore occurs in coarsely-spaced lines of sheeting, cutting vertically through the bedding planes. This zone strikes east and west and is said to be traceable about 18,000 ft. Nearly 8000 ft. of development has been done on various properties of the belt, only a small part of which has been cross-cut work, by which these closely-spaced lines of sheeting are opened, and by which they are shown to be filled with siderite, iron pyrite, galena, and zincblende. Four veins have been intersected by cross-cutting; the lenses of ore in the veins are 2 to 8 in. wide. Some of the samples assayed 60% zinc, and showed a good grade of galena and silver. The Carbonate Hill people are to set up an air-compressor on the property and work with power-drills.

Mullan, May 8.

(Special Correspondence.)—The third vein in the Success mine was opened at 100 ft. above the highest cross-cut and 250 ft. below the surface. It has a width of 15 to 20 ft., and contains lead and zinc ore. The mill level, which is a cross-cut to the system of veins, is 450 ft. lower than the other cross-cut referred to. Between the highest and lowest levels a vast amount of ore is exposed. The entire output of the mine is concentrated, whereby lead and zinc concentrates are produced and shipped to seperate markets. The former product runs 55 to 60% lead and 40 oz. silver, the latter 45% zinc. Shipments amount to about one carload of concentrate per day. The mill is being increased in capacity by adding rolls, jigs, and tables. This property is owned by H. F. Samuels and associates.

Wallace, May 6.

(Special Correspondence.)—The Northern Light M. Co. is developing a vein of lead ore which occurs in quartzite and is situated on Pine creek, two miles west of Wardner. Open-cuts, two adits, and a shallow shaft are said to have shown a 5-ft. vein containing about 1 ft. of galena ore of high grade, and 4 ft. of ore of milling grade. Some samples assayed 70 to 80% lead, and 17 to 20 oz. silver per ton. Among those interested in the property are John H. Nordquist, Rush J. White, William J. Hall, B. N. Barnett, and Leroy Hooper, all of Wallace. A hoist and pump are to be put in and the shaft will be sunk 500 feet.

Wardner, May 10.

MONTANA

Deer Lodge County

(Special Correspondence.)—The activity started a few weeks ago in the Georgetown district still continues, and now nearly every claim is being worked, some with a good deal of success. The Venezuela, a property owned by local people, is the latest to make a discovery of rich ore, and this has caused an additional rush to the district. The roads are now in a fair condition and hauling of ore has been commenced to the Washoe smelter. According to reports from men who have recently visited the locality, the different properties have between 400,000 and 500,000 tons of ore ready for shipment. The revival in the district results in increasing the trade of the merchants of Anaconda. Georgetown is twelve miles from the smelter.

Anaconda, May 12.

Lewis and Clark County

(Special Correspondence.)—The first dredge ever put in operation on the Missouri river has been started up at Lake Sewell, at the mouth of Magpie gulch, twenty miles from Helena. The dredge was built by the Magpie Development Co. at a cost of $150,000, and has a capacity of 120,000 cu. yd. per month. The money for its construction and operation was put up by California and Seattle people. The company owns 400 acres of ground, which is sufficient to furnish work for six years. The dredge is operated by electricity and is being worked continuously with three crews of men. The manager of the company is O. W. Van der Grift, who formerly was in charge of the first dredge in Alder gulch.

Helena, May 12.

Silverbow County

(Special Correspondence.)—The latter part of July will witness the completion of the work of shaft-sinking at the Ophir mine of the Butte Central Copper Co., and W. L. Credon, the consulting engineer, is of the opinion that ore of a high grade will be found by driving. Mr. Credon says there is possibly sufficient silver ore blocked out on the upper levels to warrant the construction of a concentrator, but he is not going to advise the erection of such a plant until he can actually see that there is enough ore to pay for the concentrator at least three times.

R. M. Atwater, general manager for the Butte & Superior Copper Co., states that all the money from the sale of the bonds has been paid into the treasury, and as a result all of the company's outstanding indebtedness has been retired. He states the company's finances are now in a satisfactory condition, and that the problem of building a concentrator will be taken up in earnest. Shipments are at the rate of 400 tons of ore per day to the Basin plant, and the improvements and rearrangement of machinery there are showing satisfactory results. The recoveries since the middle of April have been better than at any time heretofore. The shipments of concentrate during April exceeded 3000 tons.

Butte, May 12.

NEVADA

Nye County

(Special Correspondence.)—A large interest in the Halifax-Tonopah Mining Co. was sold in Salt Lake last week by Thomas Kearns and David Keith of Salt Lake to F. M. Smith of California. The board has been reorganized as follows: President, F. M. Smith; vice-president, Thomas Kearns; treasurer, Christian B. Zabriskie; secretary, Frank J. Westcott; director and resident agent, Malcolm Macdonald. The property adjoins the Tonopah-Belmont on the east and comprises 81.31 acres of patented ground. Extensive development plans will be undertaken at once.

Tonopah, May 13.

The Mercury Mining Co. is developing a quicksilver mine at Ione, 50 miles south of Austin. A vein of fair-grade cinnabar ore is found in a rhyolite dike cutting through a limestone country. The property has been opened by means of a 700-ft. adit that connects with a 180-ft. shaft. A Scott furnace for distilling the quicksilver is being provided. Clifford Dennis is superintendent.

Storey County (Virginia City)

The board of directors of the Mexican Mining Co. has authorized Whitman Symmes, the superintendent, to have plans prepared for a concentrating mill and cyanide plant, to purchase the necessary equipment, and proceed with the construction. Work at the mine during the week ended May 13, is summarized as follows: (1) 2200-ft. level—The north drift from the northeast drift was extended 31 ft. and timbered; the face is in porphyry, with stringers of quartz, the rock sampling about $5 per ton, with a few cars running much higher. (2) 2300-ft. level—North drift No. 2 from east cross-cut was extended 14 ft.; there was mined from this drift 42 mine cars of ore averaging $18.03 per ton; the south drift No. 2 from east cross-cut was extended 12 ft., and from this 50 cars of ore averaged $64.61 per ton.

(3) 2400-ft. level—North drift from east cross-cut No. 2 was driven 31 ft., making a total length of 416 ft. There was taken from this drift 84 cars of ore of an average value of $46.77 per ton; the face is in a porphyry horse lying next to the hanging wall, and assays $9 per ton; a west cross-cut was started at end of north drift, toward the foot-wall; in driving 9 ft., 22 cars of ore was extracted, averaging $8.60 per ton. (4) 2500-ft. level—Work was continued in the raise in ore at end of north drift, which is partly connected with the 2400 north drift from east cross-cut No. 2; from this work there was mined 125 cars of ore averaging $112.83 per ton.

The Con.-Virginia work for the week ended May 12 was as follows: (1) 1465-ft. level—Jointly with Ophir S. & M. Co. the south drift, used as an air-way, has been under repair. (2) 1650-ft. level—At 100 ft. from mouth of the east cross-cut, that was started from the north drift 121 ft. from the centre of the raise, a north drift was advanced 24 ft. (3) 1750-ft. level—Worked on third and fourth floors and extracted 109 cars of ore averaging $12.54 per ton. (4) 1800-ft. level—Mined on third floor in stope and extracted 51 cars of ore of an average value of $4.91 per ton. (5) 2450-ft. level—South drift started from north line of mine was driven 2 ft., total length 282 ft.; face in porphyry, with seams of quartz; at 280 ft. from the mouth of this drift a cross-cut has been driven 11 ft. west. (6) 2550-ft. level—The southwest drift started from the north boundary of the mine has a total length of 100 ft., the face being in quartz, giving low assays; there was mined from the above openings during the week 160 cars of ore, averaging $9.77 per ton; shipped to Sutro mill, 154 tons of low-grade ore.

The Ophir mine operations for the week ended May 11 were as follows: (1) 2100-ft. level—The main northeast drift from west cross-cut was started at 200 ft. north from south boundary of mine, and work was performed on the third, fourth, fifth, sixth, seventh, eighth, ninth, and eleventh floors, from which was extracted 362 cars of ore averaging $39.34 per ton. (2) 2400-ft. level—In southwest drift, at 318 ft. in from its mouth, the west cross-cut was driven 12 ft., the face being in porphyry. (3) 2500-ft. level—The east cross-cut from the station cut out at bottom of the 3-compartment winze was driven 13 ft., total length, 107 feet.

OREGON

Josephine County

The smelter of the Almeda Con. Mines Co., at Galice, is reported in operation. The plant is equipped with a 36 by 72-in. water-jacketed, copper matting furnace that was designed and built under the direction of Frederic Powell of Portland. It has the capacity of 100 to 150 tons per day. One batch of ore from this mine showed as follows, by analysis: Gold, 0.1 oz.; silver, 2.3 oz.; copper, 2.8%; iron, 14.5%; sulphur, 20.9%; silica, 57%. Other samplings and analyses gave 16.5% barium, 26 iron, 28 sulphur, 3.5 copper, 22.9 silica. The property is managed by J. F. Wickham.

UTAH

Juab County

(Special Correspondence.)—The Lower Mammoth stockholders have voted to increase the capital stock from 250,000 shares to 1,000,000 shares. The increase will be distributed July 1 in the form of a stock dividend. Recent assessments have been on a basis of 5c. per share. The change has been made to produce a greater distribution of the stock, which it is believed will not seriously affect the price per share. Tintic district shipments for the week were 156 cars, Iron Blossom leading with 31, and Centennial-Eureka 27. Uncle Sam shipped six cars, including two from the recent discovery made by the Beck Tunnel Co. under their working agreement.

Eureka, May 15.

Salt Lake County

(Special Correspondence.)—J. G. Jacobs has revived his project of a railroad up Little Cottonwood canyon as far as Wasatch, which will greatly reduce the cost of bringing ore from the mines at Alta. He says he has ordered ties and will build the road this year. The Salt Lake Mining & Power Co., which has acquired the old Maxfield mine in Big Cottonwood canyon, announces that it will put in pumping machinery and unwater the mine.

Alta, May 13.

Utah County

(Special Correspondence.)—The Eudora Bell, in American Fork canyon, which was operated many years ago as the Silver Bell by the late Michael Shaughnessy, when it turned out high-grade silver ore near the surface, will soon again become a shipper. Between three and four cars of silver-lead ore, said to run from $75 to $100 per ton, is ready to go out as soon as the roads open.

American Fork, May 14.

CANADA

British Columbia

(Special Correspondence.) — The Mother Lode Sheep Creek M. Co., whose operations on Sheep creek are in charge of William Wilson, is to erect a small plant this season, to be equipped with stamps, a tube-mill, and cyaniding facilities. The machinery is to be operated by water-power. An aerial tramway, 4000 ft. in length, is to be erected to carry the ore from the No. 5 cross-cut to the mill.

Ymir, May 7.

Ontario (Cobalt and Porcupine)

Word has been received of the discovery of a fairly wide vein, running 124 oz. silver per ton, at Kipling, 30 miles from North Bay, 4½ miles from the railroad between that place and Sudbury. Some sixty claims have been located.

The trail to Porcupine broke up about May 1, and travel is now along the right of way of the railroad. The Brydge claim, adjoining the Preston East Dome, has been sold to New York and European interests for $350,000. The Hughes claims have been optioned to a French syndicate on the basis of $250,000 and 10% of the capital stock. It is hoped that regular trains will be running into Cobalt by June 15. The bridge over the Porcupine river is almost completed. The position of the terminus of the railroad has not yet been definitely fixed, and there is much speculation as to whether the line will eventually be carried to the Mattagami.

The shipments from Cobalt for the week ending April 29 amounted to 469 tons, La Rose and McKinley-Darragh leading with three cars each. The Crown Reserve, at Kerr Lake, sent 25 bars of silver bullion, weighing 23,128 oz., to England on May 2. A contract has just been made by this company with the Nova Scotia Cobalt at Peterson lake to mill the low-grade ore of the Crown Reserve. A wire-rope tramway will be built to transport the ore. The Coniagas paid dividends amounting to $350,000 on May 1.

MEXICO

Sinaloa

(Special Correspondence.)—The Jesus Maria Anexas mine, at San Jose de Gracia, out some distance from Casal station, has been closed down, and most of the American employees have fled from the country, on account of the prevalence of guerrilla warfare throughout the State of Sinaloa. Other mines have closed down, and many Americans are getting out of the country in anticipation of more serious conditions. It is reported that, especially at the smaller towns, and in mining camps, the *Insurrectos* are levying tribute on merchants and mining men. According to reports, the *Insurrecto* bands are vacillating and unstable, with no definite policy; also, that numerous instances are seen which demonstrate the disloyalty of the Federal troops. Roy Cohn, of San Francisco, who recently made his way out from the Jesus Maria mine, came to Culiacan, thence to Altata, from which place he went by boat to Mazatlan, where he took passage on another boat to Guaymas. This illustrates the difficulties of travel at present, as the railroads in Sinaloa are partly paralyzed.

Mazatlan, May 10.

Company Reports

INSPIRATION COPPER CO.

The first annual report of this company, covering the period from the beginning of work in February 1909 to January 1, 1911, shows that it has a capital of 1,000,000 shares, of a par value of $10, all of which have been issued. No ore has yet been produced on a working scale, as the mine is still in the development stage. The orebody consists of small seams, veinlets, and sometimes small grains of copper minerals disseminated through silicified schist. This occurs in a bed averaging 155 ft. thick, 3400 ft. long, and 1400 ft. wide (maximum), overlain by 367 ft. of leached capping. The ore has been developed by churn-drilling, the blocks being not over 200 ft. in length and no ore being allowed outside the lines connecting drill-holes. On this basis it is estimated that there are 17,173,000 tons of an average content of 2.02% copper, and 4,029,000 tons averaging 1.90% copper, an average of 543,000 tons per acre of surface. An experimental mill has been erected to furnish the data necessary for the construction of the 5000-ton mill which is planned. The Inspiration mine is at Globe, Arizona. The report of Henry Krumb, the consulting engineer, was reviewed in the *Mining and Scientific Press*, April 22.

THE CONSOLIDATED MINING & SMELTING CO. OF CANADA, LTD.

The fifth annual report of this company, operating mines and smelters in British Columbia, for the year ended June 30, 1910, shows that it has an authorized capital of 75,000 shares of a par value of $100 each, of which 55,552 have been issued. During the year 487,125 tons of ore was produced from the six mines owned or leased by the company (chiefly from the Centre Star, Richmond-Eureka, and St. Eugene) and was smelted at Trail, yielding:

Gold, oz.	137,614
Silver, oz.	2,162,406
Lead, lb.	42,368,816
Copper, lb.	5,974,959

Total value, $5,911,767.

The toal production from 1894 has been:

Gold, oz.	952,056
Silver, oz.	16,999,873
Lead, lb.	220,872,555
Copper, lb.	43,453,814

Total value, $42,646,025.

The receipts from the sale of smelter products and from rents was $6,721,468 for the year. The cost of mining, smelting, and general expense was $2,708,466; the freight cost was $200,950; the cost of development was $495,770; the cost of customs ore, lead, and bullion purchased was $1,666,504; royalties on ore, depreciation, directors' fees, and sundry claims amounted to $235,446; and $1,104,385 is charged to the ore and smelter products in course of treatment at the time of the last report, leaving a profit balance of $309,945. This added to the balance on hand at the beginning of the year gives a balance of $671,011. During the year the La Plata group near Nelson, and the No. 7 group in the Boundary district, have been purchased, and it is expected that these will prove a source of future profit.

NEVADA HILLS MINING CO.

The report of this company for the year ending March 31 shows that 182 tons of ore of an average gross value of $146 per ton was mined and shipped by the company, while 480 tons of an average gross value of $128 per ton was shipped by the lessees. The net return on the company's ore was $21,980, while the royalties received from lessees amounted to $13,178, a total of $35,160. The amount of development during the year was 11,184 ft., the larger portion of which was done on the Nevada Hills vein-system, although the Wingfield and Eagle veins were also developed. It is estimated that 21,500 tons of ore of an average value of $35 per ton is exposed in the mine, and an additional 5000 tons of $30 ore is on the dump. During the year the Fairview Eagle M. Co. was purchased by the Nevada Hills M. Co. on the basis of an exchange of one share of Nevada Hills stock for each six shares of Fairview Eagle stock, and for this purpose the authorized capital of the Nevada Hills M. Co. was increased to 1,250,000 shares of a par value of $5 each. During the year 100,000 shares were sold at 60c. each and 70,000 at 50c. each, making the total number now outstanding 1,061,645. During the latter part of 1910 plans were made for the construction of a 20-stamp mill, of an estimated capacity of 120 tons per day; this is now in course of construction and is expected to be ready for work by August 1911. A contract has been made with the Pacific Power Co. for electric power, and the transmission line should be completed during May. The Nevada Hills M. Co. has advanced $40,000 to the power company to be used in the construction of the transmission line, with the agreement that this sum, with interest at 6%, shall be repaid from the charges for power delivered to the Nevada Hills company. A description of the mill appeared in the *Mining and Scientific Press* for April 8. The property is as yet in the development stage, but gives good promise of becoming an important producer. It is near Fairview, Nevada.

LUCKY TIGER-COMBINATION G. M. CO.

This company, which owns the El Tigre Mining Co., S. A., has an authorized capital of 800,000 shares of a par value of $10 each, of which 715,000 are now outstanding. During the year the latter company milled 37,140 tons of ore and shipped to the El Paso smelter 2367 tons of concentrate and 1775 tons of picked ore. The average value of the ore mined was $36.57 per ton and was treated at the following cost per ton:

Mining	$ 2.468
Development	1.956
Tramming to mill	0.220
Ore-dressing	3.028
Freight on ore	1.134
Management	0.155
Ore expense	0.111
General costs	0.983
Total	$10.055
Less operating profit	1.222
Net cost	$ 8.833

The operating profit shown above was derived chiefly from the profits of the company store and the rent of dwelling-houses. The total profit from operations was $485,303, of which $429,000 was paid in dividends. The ore reserve now amounts to 218,280 tons, of which 67,780 tons is already broken in the stopes. The development to January 1 amounts to 40,708 ft., of which 5950 ft. was done during 1910, adding 27,340 tons to the reserve. As the company has paid 33 dividends, a total of $1,053,000, and is now paying regular monthly dividends at the rate of 5c. per share, it is reasonably clear that its financial position is excellent: there is little else in the financial report that is clear, and the manager's statement that the accounts are self-explanatory may be designated as too-sanguine optimism. If the accounts of the Lucky Tiger-Combination G. M. Co., which has a capital of $8,000,000, were clearly separated from those of the El Tigre M. Co., which has a capital of $15,000, much would be gained; and if the accounts and working costs of the latter were presented in such a way that they might be understood with a reasonable amount of effort, there would be no ground for complaint. The accounts of a small mine may be obscure and complex, for they are not a matter of general interest, and it may not be worth while to go to the expense of presenting them in an easily intelligible form, but a large and valuable mine which, like this, is the object of much general interest, might well set an example in presenting its report in an intelligible form.

Personal

Professional men are invited to send news of their engagements and travels. Such news is interesting to friends.

C. S. Thomas, Jr., is in New York.

R. S. Schlessinger is in San Francisco.

Edward M. Rabu, Jr., is in San Francisco.

Stuart L. Rawlings is in San Francisco.

R. P. McLaughlin has been in San Francisco.

W. G. Swart, of Denver, is in San Francisco.

Whitman Symmes was in San Francisco this week.

H. F. Lefevre will be at Venezuela, Colombia, for two months.

G. H. Garrey has been in Washington, D. C., and is now in Illinois.

R. A. LeRoy will spend the summer at Spanish Ranch, California.

William A. Argall has left Columbia, Nevada, and gone back to Denver.

Charles W. Wright expects to spend some time in Switzerland this summer.

George Wingfield, of Goldfield, Nevada, is at the St. Francis hotel, San Francisco.

Henry C. Beeler has removed his offices to 1004 First National Bank building, Denver.

C. S. Herzig left New York May 5 for an extended trip to Peru, to examine a large concession.

Charles L. Constant, president of the C. L. Constant Co., has been in Cobalt on professional work.

G. S. Rice will go to Europe in June, to investigate mine-filling methods for the U. S. Bureau of Mines.

W. H. Emmons, C. W. Hayes, F. L. Ransome, and Arthur Keith have been at Ducktown, Tennessee.

E. R. Woakes left for Cape Town on May 6, to take temporary charge for the Cape Town Copper Company.

Urban H. Broughton has resigned from the Executive Committee of the Copper Producers' Association.

C. S. Burton & Co. have opened offices at 15 Broad street, New York, to carry on a general brokerage business.

J. B. Tyrrell is making an examination of the property of the Swastika Gold Mining Co., in northern Ontario.

Sumner S. Smith will be at the Pittsburg station of the U. S. Bureau of Mines through the first half of June.

Walter Bunce, who resigned the superintendency of the Sunnyside mine, at Eureka, Colorado, recently, is at Porcupine, Ontario.

John F. Wallace, former chief engineer of the Panama Canal, has become the president of Westinghouse, Church, Kerr & Co., of New York.

Theodore Dwight and Frank H. Probert are returning from Vera Cruz to New York. They have been at the Nueva Luz mine at Guanajuato.

Newton Cleaveland has retired from the active management of The Yuba Construction Co., owing to the pressure of other work in which he is engaged.

S. L. G. Knox is now vice-president and general manager for The Yuba Construction Co. He was formerly vice-president and general manager for The Bucyrus Company.

Lucien I. Blake, of the Blake Separator Co., has been married to Mrs. M. Beroset, of Trinidad, Colorado, and has gone to Europe on research work for the Submarine Signal Co. of Boston.

The Colorado School of Mines will hold its thirty-seventh annual commencement on May 26.

The Missouri School of Mines will hold its fortieth annual commencement on May 26. J. A. Holmes, Director of the Bureau of Mines, will deliver an address on 'The Individual, the State, and the Nation in the Development of our Mineral Resources.'

Book Reviews

Any of the books noticed in this column are for sale by, or can be procured from, the Mining and Scientific Press.

The Practice of Copper Smelting. By Edward Dyer Peters. 8vo. Pp. 693. Ill. McGraw-Hill Book Co., New York, 1911. Price $5. For sale by the *Mining and Scientific Press.*

This volume is written to replace 'Modern Copper Smelting,' by the same author, of which the first edition appeared in 1887 and the last extensive revision was in 1895, fifteen impressions having appeared to date. Meanwhile, the author's volume, 'Principles of Copper Smelting,' appeared in 1907, giving a complete theoretical discussion of the principles of the art. The present volume, therefore, is limited to a discussion of recent copper smelting practice. Since the publication of the first volume, Weed's 'Copper Mines of the World' has appeared, so that the volume under review properly differs somewhat in plan from its predecessor. The initial chapter on the ores of copper has been condensed to half the original space and entirely rewritten, since our notions of what constitutes an ore of copper have largely changed during the last two decades. The discussion of the distribution of the ores of copper is omitted. The chapter on sampling copper ore has been much expanded, while the discussion of assaying has properly been omitted. Only so much exposition of the principles of roasting is given as is required for the understanding of the discussion of roasting practice which follows. Blast-furnace smelting is likewise treated in two chapters, or 88 pages, rather than the four chapters, or 145 pages, in the former volume. Pyrite smelting is treated at double the former length and the discussion of reverberatory smelting, the bessemerizing of matte, and the refining of metallic copper, have been much expanded. The chapter on electrolytic refining has been omitted and new ones added on the treatment of fine ore and the dealing with flue-dust and smoke. With a brief discussion of slags and a chapter on furnace materials and construction, the heating of the blast, and the miscellaneous items of general information the volume concludes. An undeserved criticism is that too much space is devoted to smelting practice at Butte. When we remember that copper and lead smelting in America has almost entirely passed into the hands of large corporations of which many do not encourage the publication of details of technical practice by the engineers in the employ of the corporation, it is perhaps more remarkable that any papers of value on current metallurgical practice appear in the technical journals, rather than that they should be so few. Mr. Peters has therefore been largely restricted to papers in German and to French periodicals (where the larger number of important papers dealing with current metallurgical practice now appear) a few notable papers in English, and notes upon practice at plants managed by friends. It is discouraging to note that American smelting practice, which formerly was a model for the world of the free exchange of technical information, is gradually taking on the aspect of a 'close corporation.' Looking at it from this standpoint the book is quite the best presentation of copper smelting practice that can be expected, and all metallurgists will be most grateful for the gathering together in one volume of the widely-scattered information and the presentation of it in a form which permits the obtaining of an easy grasp. The 'public opinion' among students in the various mining schools has always been that 'Modern Copper Smelting' was the most readable text-book of metallurgy in print, and the present volume follows in the footsteps of its predecessor in this regard. Indeed, its faults are those of its virtue, and it may perhaps be questioned whether the treatment of copper smelting on page 24 as a purely mechanical operation in which the ore is merely melted down, allowing its constituents to separate into different layers according to their specific gravity, will not result in greater confusion of mind than a less general

statement would. Having classified copper ores into native copper, oxidized ores, and sulphide ores, it is strange that this method of classification was not extended to smelting, giving us the simple melting of the Lake Superior 'mineral,' the reducing smelting of oxidized ores, and the oxidizing treatment of sulphide ores. The technology of the smelting of Lake Superior 'mineral' is not profound, but it has much value in leading up to a clearer understanding of ordinary smelting, and the amount of copper produced in this way would alone justify brief discussion. The reducing smelting of oxidized ores to black copper is of little present importance, but a brief discussion of it would be of much value in throwing light on the oxidizing treatment of sulphide ores. For the reasons already discussed, the number of descriptions of plants now in operation is much smaller than is desirable, but the author has furnished new illustrations so far as they are available, a relief from the old diagrams taken from German texts that have been doing duty in America for the last twenty-five years. The book is printed on good paper, with a good index, and the typographical errors are not much more numerous than the employment of the linotype makes almost unavoidable. Such obvious errors as 'coneing,' which is repeated several times on pages 5 and 6, 'sulphides' and 'limestones' on page 91, 'E' in place of 'K' on page 151, 'unturned' for 'upturned' on page 450, to cite only a few, might have been eliminated by more careful proof-reading, and doubtless will be in the second impression, which may reasonably be expected to be soon required. The thanks of the metallurgical profession is due to Mr. Peters for this most welcome and valuable addition to his unofficial series of monographs on metallurgy. T. T. R.

The Reid Smelting System

A new and interesting electric furnace is being placed on the market by REID, LTD., with office in the Pennsylvania building, Philadelphia, Pennsylvania, and a complete testing plant in Newark, New Jersey. This furnace is the invention of J. H. Reid, who spent about six years in its development. While the furnace is essentially the same in design for all classes of ore, certain features are varied in accordance with the character of the ore itself. A descriptive catalogue is being distributed by the company. Some of the many advantageous features claimed for this furnace are as follows: Fusion is unusually quick, taking place within ten seconds after current is applied. The furnace can be started and stopped instantly at will, with no previous preparation and without reference to the charge or withdrawal of the same. Recovery of the metal content in both low and high-grade ores is practically complete, it being demonstrated by analysis of the various slags that they show about 0.1% of metal. It is estimated that the heat attained by the Reid electric furnace is over 6000°F. This is a much higher temperature than can be obtained in a blast-furnace. The manufacturers claim that the extremely high heat results in the production of a metal of great purity and avoids necessity for more than one refining, it then being within a small fraction of 100% pure. No preliminary treatment except crushing is considered necessary. Ore is taken from the mine, crushed, and fed to the furnace. No fluxes of any kind are used. Furnace linings are unnecessary, as in the Reid furnace the charge does not come in contact with the walls. By an ingenious arrangement the fumes and vapor from the ore are drawn off as they form and passed to condensers where by-products are recovered. The furnace is automatic in operation and control. The electric current is regulated within any required limit. Thus the heat intensity and volume are governed as desired. It is claimed that this electric furnace will be of particular advantage for treating small outputs, as the furnace itself can be supplied in small sizes. It is the intention of Reid, Ltd., to license users of the furnaces, royalties being based on tonnage treated. The operating expense will depend entirely upon the cost of the electric current.

Market Reports

LOCAL METAL PRICES.

San Francisco, May 18.

Antimony	12—12¾c	Quicksilver (flask)	46.50
Electrolytic Copper	14—15¼c	Tin	45—46½c
Pig Lead	4.75—5.70c	Spelter	7—7¾c

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

METAL PRICES.

By wire from New York.

Average daily prices in cents per pound.

Date.	Electrolytic Copper.	Lead.	Spelter.	Silver, per oz.
May 11	11.90	4.36	5.35	53⅜
" 12	11.87	4.36	5.35	53¼
" 13	11.85	4.36	5.35	53½
" 14	Sunday.		No market.	
" 15	11.85	4.36	5.33	53½
" 16	11.85	4.36	5.33	53¼
" 17	11.90	4.36	5.33	53¼

ANGLO-AMERICAN SHARES.

Cabled from London.

	May 11. £ s. d.	May 18. £ s. d.
Camp Bird	1 13 6	1 12 0
El Oro	1 4 6	1 4 6
Esperanza	1 12 6	1 11 3
Dolores	1 5 0	1 5 0
Oroville Dredging	0 5 9	0 6 3
Mexico Mines	7 13 9	8 1 3
Tomboy	0 15 6	0 15 0

(By courtesy of W. P. Bonbright & Co., 24 Broad St., N. Y.)

MINING STOCK QUOTATIONS—NEW YORK.

(By wire from Catlin & Powell Co., New York.)

	Closing prices, May 18.		Closing prices, May 18.
Amalgamated Copper	$ 66¾	La Rose	$ 4½
A. S. & R. Co.	80⅝	Mason Valley	9⅜
Braden Copper	4½	Miami Copper	20⅛
B. C. Copper Co.	5⅜	Mines Co. of America	5⅜
Butte Coalition	19⅜	Nevada Con	19
Chino	24⅞	Nevada Utah	¾
Davis Daly	1⅝	Nipissing	10¾
Doble	3⅜	Ohio Copper	1⅝
Dolores	5½	Ray Central	1¾
First National	1¾	Ray Con	16⅞
Foley O'Brien	1⅜	South Utah	⅞
Giroux	6¼	Superior & Pittsburg	15
Goldfield Con	6	Tenn. Copper	38
Greene-Cananea	5⅞	Trinity	4⅝
Guanajuato Con	⅛	Tuolumne Copper	4⅝
Hollinger	12	United Copper	3¾
Inspiration	8¾	Utah Copper	47¼
Kerr Lake	6¾	Yukon Gold	3⅞

COPPER SHARES—BOSTON.

	Closing prices, May 18.		Closing prices, May 18.
Adventure	$ 6½	Mohawk	$ 41½
Allouez	31½	North Butte	32
Atlantic	5¾	Old Dominion	43
Calumet & Arizona	51¾	Osceola	101
Calumet & Hecla	473	Parrot	12
Centennial	12½	Santa Fe	1¼
Copper Range	61½	Shannon	11
Daly West	5⅝	Superior & Pittsburg	14¾
Franklin	10⅝	Tamarack	38
Granby	33	Trinity	4
Greene Cananea, ctf.	6⅞	Utah Con.	16
Isle-Royale	14½	Victoria	1¾
La Salle	3¾	Winona	7⅞
Mass Copper	5¾	Wolverine	109

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

SOUTHERN NEVADA AND COMSTOCK

San Francisco, May 18.

Atlanta	$ .10	Nevada Hills	$3.07
Belmont	6.00	Pittsburg Silver Peak	.65
Booth	.07	Round Mountain	.58
Columbia Mtn	.04	Sandstorm Kendall	.03
Combination Fraction	.07	Silver Pick	.05
Florence	1.45	Tonopah Extension	1.00
Goldfield Con	5.00	Tonopah of Nevada	6.30
Gold Kewenas	.05	West End	.57
Jim Butler	.25	Belcher	.81
Jumbo Extension	.26	B. & B.	.60
MacNamara	.12	Con. Virginia	1.57
Mayflower	.04	Mexican	4.60
Midway	.24	Ophir	2.10
Montana Tonopah	.83	Savage	.40

(By courtesy of San Francisco Stock Exchange.)

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

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EDITORIAL

WATER sufficient to supply San Francisco for nearly three years is to be stored back of the great Calaveras dam recently begun by the Spring Valley Water Company.

EXAMINATION and certification of men trained for mine-rescue work, with a view to their temporary employment in emergencies, has been undertaken by the United States Bureau of Mines.

A SPECIAL committee of the American Institute of Mining Engineers, consisting of Charles F. Rand, Arthur L. Walker, Joseph W. Richards, E. G. Spilsbury, and Karl Eilers, has been appointed to study the question of organizing local sections of the Institute.

LOCAL meetings of the American Mining Congress have been held at Portland on May 16, 17, and 18, and at Seattle on May 20; the meeting at Portland being for the purpose of organizing an Oregon chapter of the parent Society.

SALTING is believed to be responsible for a loss of $75,000 sustained by Sacramento investors in the Bonnie Brier Mining Company; another example of the advisability of having a thorough investigation by competent engineers before investing.

HEROIC treatment was recently given to the new building of the E. I. du Pont de Nemours Powder Company in Baltimore, when, to demonstrate to the underwriters the fireproof character of the building, a fire was kindled within it, the doors closed, and the building left to burn if it would.

MYSTERY deep and dark shrouds the expedition that sailed from San Francisco on the schooner *Eureka,* early in May, for Central America. "Investigation of mining properties in Honduras" hardly necessitates chartering a ship, and there is a suspicion abroad that the motive for the expedition lies rather in the lure of buried treasure or the glint of filibusters' gold.

DISCOVERY of oil at Carlyle, Illinois, has increased the respect in which oil-men have held the work of the State Geological Survey. Leases were taken and wells drilled on the strength of the structure as shown in Bulletin 16, and a new field brought in. Mr. F. W. DeWolf, Mr. R. S. Blatchley, and their associates, are to be congratulated on this quick proof of their good work.

AS a result of an agreement between the Western Union and Anglo-American cable companies, the rate upon non-code messages which may be subjected to a delay of twenty-four hours or less has been reduced to one-half that formerly charged. This step toward the final taking-over of the latter company by the former, is a welcome addition to the increased facilities afforded by the use of 'day letters.'

ASSIGNMENT of rooms in the Customs House and Appraisers Building in San Francisco to the Bureau of Mines is taken as a welcome illustration that the metal mines of the West are hereafter to receive some attention from that Bureau. The excellent work already undertaken in the coalfields has the general endorsement of mining men, but there is a widespread feeling that metal mining problems should also be investigated.

EXCELLENT work is done at the Eagle-Shawmut mine in Tuolumne county by the Edwards furnace, where it is used in roasting a sulphide concentrate preliminary to concentration. The ore is roasted to ½% S with a consumption of 18 gallons of fuel-oil per ton and repair costs of but ½c. per ton. The furnace has a working capacity of seven tons, and when all the work is done on it the total cost is approximately $1 per ton.

THE controversy between German and American potash interests has been settled, and according to the new agreement the Americans will draw their total supply from the German syndicate during the five and one-half years which the arrangement is to last, at prices fixed by the German potash regulations. Unless the difficulties with the Schmidtmann group of firms are settled, the syndicate will take upon itself the solution of the remaining questions.

GRAFTING would soon become dangerous as well as difficult if company officials would all follow the example of Mr. S. P. Eastman of the Spring Valley Water Company. Being approached by an assessor with a proposal to reduce the annual taxes of the company $50,000 in return for a bribe of $25,000, Mr. Eastman laid a trap that resulted in the official being arrested with the marked bills in his possession. It is thus made clear that in the case of the larger corporations at least, a determined officer can protect his stockholders and the public too, if he really wishes to do so.

MUCH is heard nowadays of 'dollar diplomacy,' and while this excites little admiration as an ideal standard of foreign relations, yet it has its value in indicating that intelligent effort is now being applied to the securing of wider markets for American products. An excellent example of this is seen in the recent action of the Department of State in extending to the Commercial Bureau Company permission to supply each consulate with a filing cabinet filled with cards giving brief abstracts of the catalogues of American manufacturers, printed in the appropriate foreign language. Consulates have heretofore kept files of catalogues in an unsystematic fashion, but these were of comparatively little service to the foreign enquirer. The systematic and complete service thus afforded should result in much good; and it is noteworthy that the increased facilities are secured at no cost to the Government.

VOLATILIZATION of gold at high temperatures is a well known fact, but there is a tendency to exaggerate its importance. In the roasting of gold precipitates and telluride ores even the mechanical losses may be kept very low by careful conduct of the operation. This is emphasized by the results cited by Mr. J. W. Hutchinson in the part of his description of the operation of the Goldfield Consolidated mill which we print this week. In smelting the briquetted precipitate from the refinery in a small blast-furnace, it was found that the loss in the flue-dust amounted to one-eighth of one per cent of the precious metals, practically all of which was afterward recovered. The fine material caught by filtering the escaping gases through bags had a value of only $20 per ton, while the ordinary flue-dust had a value of $2500 per ton. The recovery is therefore complete from a commercial standpoint. In roasting Cripple Creek ores the usual loss in the flue-dust is one per cent, most of which is afterward recovered.

LIGNITE was discussed in an address before the American Philosophical Society, May 5, by Mr. J. A. Holmes. As is well known the Western and Southern States contain immense quantities of this low-grade fuel. The outlook for its utilization lies in further development of the gas-producer, in design of special boilers and fire-boxes, and in briquetting. In the first two lines rapid progress is being made. The excellent work of Mr. Lewis Skinner at the Western Chemical Company's works at Denver has done much to popularize the use of lignite in producers. At the Bureau of Mines testing station at Pittsburg, Mr. Holmes says that California, North Dakota, and Texas lignites have been briquetted by pressure alone. This elimination of an artificial binder marks an important step in advance, and with other improvements under way largely increases the value of lignite deposits.

COLORADO members of the American Mining Congress are to be congratulated on the results of their legislative campaign. Among other things endorsed by them and passed by the legislature were bills providing for a new system of mine taxation, coöperative mine drainage, facilitating punishment of ore-thieves, increasing the appropriation for the State Geological Survey, and an appropriation for completion of the testing-plant at the State School of Mines. Smelting and sampling companies were also made public-utility corporations. There is sharp difference of opinion as to whether this will prove to be a good or a bad move, and probably experience alone will settle the matter. The main fight of the session, so far as mining men were concerned, was over mine taxation. In the bill finally adopted three principles were established: (1) if mines are to be assessed on production the net and not the gross return should be taken as the basis; (2) non-producing property should be assessed much lower than is now the case locally; (3) mine improvements should be assessed in accordance with some simple and easily applied rule that will give the actual value of such improvements. The bill embodying these is now before the Governor for signature. Mine taxation involves many intricate problems, but certainly the surface ground should be taxed only on the basis of its value for the uses to which it is applied, and apparently the most just form of taxation that can be applied to ore is some form of production tax. Ore is comparable rather to a crop of timber or grain than to money stored in banks or cotton in warehouses.

Association of State Geologists

The annual meeting of the Association of State Geologists, and the attendant conferences with officers of the United States Geological Survey, the Bureau of Mines, and the Bureau of Soils, has come to be an event of general importance. Not only do these meetings promote acquaintance and forestall friction, but they are occasions for important exchanges of information as to methods. The officers of geological surveys have many problems of administration such as are not discussed in textbooks or school-room lectures, and the experience of one is appropriately available for all. At the recent meeting in Washington the conference with the Director of the United States Geological Survey was concerned mainly with allotment of funds for coöperative work, but time was found for discussion of the duties of surveys in the matter of educating people to use survey results, and the conditions under which

official prospecting should be undertaken. The session of the Association itself was devoted to discussion of methods of filing and indexing data, of making exhibits, and similar routine matters. Broader questions of policy came up in the effort to determine how far a Survey may wisely depart from the field of geology, and to what extent it should advertise. Engineers who have kept informed as to the work of Geological Surveys as they have developed in the United States, recognize that their scope has broadened until in most States the Survey has become practically a bureau for scientific investigation of mineral resources and for promoting their development. In the latter phase of their work Surveys in the United States have not used the accepted channels of publicity as have similar organizations in Canada, Australia, and elsewhere. If it is a good thing to advertise the resources of a State, it is certainly proper to do it as effectively as possible. While, owing to limitations as to funds, the State Surveys have not always been able to command the highest talent, they are doing a truly enormous amount of good work and their resources are neither sufficiently known nor utilized by mining engineers. We hope the Association will effect a change in this among other particulars.

Peace in Mexico

Peace has been proclaimed in Mexico, with the understanding that President Diaz and Vice-President Corral shall resign, and Señor de la Barra, who becomes president *ad interim,* will proceed at once to restore railroad and telegraphic service and to indemnify the losses incurred by non-combatants during the insurrection. But a phase of the situation that is of the gravest import is forcibly emphasized by the slaughter of 200 inoffensive Chinese at Torreon by the rebel troops. The telegraphic reports indicate clearly that the rebel leaders were unable to hold their men under control, so that they ran amuck like savages. To declare peace is easier than to secure peace, and unless there is a strong and steady hand in control it is likely that conditions in Mexico during the next few months will not be so tranquil as the best interests of all demand. The 'rebel army' is far from being a unit, the obedience which the scattered commands show to any central authority is but shadowy, and their pacification is likely to prove a slow task. Certain high-minded journals have deplored as sordid the argument that the commercial interests of foreigners in Mexico are of too great importance to permit an indefinite prolongation of disturbed conditions. This is wide of the truth; the damage to foreign investments is but an index of the vastly greater damage to the domestic interests of the Mexican republic. General Sherman is reported to have said "War is hell." It is not only that, but it is also foolish. To involve a country in domestic war to settle political questions, except of vital importance, is a proceeding on a par in intelligence with the setting on fire of a house in order to rid it of rats. The United States and Great Britain have agreed by treaty not to war with each other, even on questions involving national honor, and it is likely that the United States will make similar agreements with France and Germany. When questions of national honor can be settled by arbitration, political questions should be settled by less destructive methods than those of warfare. That there has been an insurrection is a blot upon the fair name of Mexico; its persistence will be a national disgrace. A firm hand is needed to grasp the tiller of the Ship of State. Señor Francesco I. Madero has shown that he possesses many high qualities, but he is confronted by a most difficult task, and the future must show whether he is the strong leader needed to meet the demands of the hour.

Chlorination Versus Cyanidation

The announcement that the chlorination plant of the Portland Gold Mining Company at Colorado Springs is to be converted into a cyanide plant, is an interesting and significant event in the protracted controversy as to whether chlorination or cyanidation is better adapted to the treatment of telluride ores; and must be a source of gratification to Mr. Philip Argall, who has so repeatedly urged the superior advantages of the cyanide process in the treatment of these ores. The Colorado City plant of the United States Reduction & Refining Company is now the only one using the chlorination process to treat Cripple Creek ores; and, indeed, the only large and important plant in the United States which is now using this process. It is reasonable to expect that at no distant date this also will be so converted as to employ only the cyanide process, which the same company has long been using in the treatment of tailing. But to infer from these changes that the employment of the chlorination process in the beginning was ill-advised, is not justified by a careful consideration of the conditions existing at the time when the plants were built. The cyanide process of 1911 is better suited to such ores than chlorination; but the cyanide process of that earlier date was not. Since the discovery of Cripple Creek radical and sweeping improvements have been made in cyanidation, while the chlorination process has been but little changed. The former has advanced with rapid strides, the latter has done little more than mark time, and has now dropped to the rear. The manufacture of caustic soda as a by-product did not prove so profitable an adjunct as was once hoped; and, except in the largest plants, the making of a by-product is generally likely to prove more a source of annoyance than profit. A plant where the efforts of all concerned are concentrated on doing one thing as well as possible, will in the end prove most successful, as well as most simple. The use of chlorine as solvent for gold, agitating the ore in horizontal rotating barrels, was first successfully practised at the Haile gold mine in North Carolina, when the southern Appalachian goldfields were still of great importance. It afterward was applied in Colorado, California, and Montana, and its good record permits it to honorably retire.

It is a curious fact that, despite the modern free interchange of information, practice at two such similar districts as Cripple Creek and Kalgoorlie, has developed with so large a degree of independence. The American metallurgists have been ready, however, to utilize the best features that have been developed in Australian practice; the Edwards furnace, for example. The use of bromo-cyanide, which met with approval in Australia at first, but now is falling out of favor, has been frowned on in Cripple Creek, an early attempt to use bromine having failed completely. However, its more recent application at the Goldfield Consolidated mill may in time lead to a successful utilization of the vigorous oxidizing power of bromo-cyanide. That reagent has so far exhibited the faults of its virtues and its vigorous oxidation has led to so high an operating cost that its use was unprofitable. The resulting situation was similar to that of the eminent surgeon, whose operation was completely successful though the patient unfortunately died. The steady decrease in the grade of the ore has brought Cripple Creek metallurgists face to face with a vital problem. The splendid work of the Golden Cycle mill is an excellent example of the way the present situation is being met, but the pressing need of the immediate future is to treat the low-grade ores, without roasting, at the mines. Important work has been and is being done by the Portland and other companies to solve this problem, and we may confidently continue to look to Cripple Creek for marked advance in the art of cyanidation.

Operation of the Goldfield Consolidated Mill

By J. W. Hutchinson

(Continued from page 686.)

Precipitation

The solution from the Butters filter is clarified in three 36 by 36-in. 60-frame Perrin presses, which are fed by one 4-in. Morris centrifugal pump, direct-connected to a motor. They have the capacity to clarify 2000 tons of filtered solution per day, equivalent to 1300 lb. of solution per square foot of filter-surface. To this operation must be accredited part of the success obtained here with zinc-dust precipitation. At times it has been necessary to pass part of the solution to the precipitation-tanks without clarification, and each time it has resulted in a precipitated solution of high metal content. The high-grade solution from the concentrate plant is clarified in a similar press and precipitated in the mill presses. The solution from the clarifying-presses gravitates to three 28 by 8-ft. redwood tanks, two of which are for the mill and one for the concentrate-plant solution. The usual Merrill equipment is used for feeding and emulsifying the zinc-dust, which gravitates through 1-in. rubber hose to the suction pipes of two 7 by 9-in. Aldrich pumps, which deliver the solution and zinc-dust to four 30-frame, 48-in. triangular Merrill precipitation-presses. These presses have 1680 sq. ft. of filter-surface and 140 cu. ft. of storage for precipitate, equivalent here to 1.6 tons solution per square foot of filter per day, and to ¼ cu. ft. of storage per pound of daily precipitate. Each press, when filled at a pressure not exceeding 5 lb. per square inch, will hold approximately 2500 lb. of precipitate containing 30% H_2O.

In figuring precipitating equipment for silver ores, the filter-surface is not the only consideration, as can be seen from the following instance. In evolving a process for treating a high-grade silver-gold ore, it was decided to precipitate 600 tons of solution from 120 tons of ore. The equipment, which a zinc-dust process company agreed to furnish, contained 384 sq. ft. of filter-surface, which would have been satisfactory for filtering. The storage-room in this equipment amounted to 32 cu. ft. The amount of daily precipitate at this plant is estimated at 400 lb. It can readily be seen that had this equipment been put in it would have been necessary to clean the presses every fifth day. It was finally decided to put in 800 sq. ft. of filter-surface and 70 cu. ft. of storage, and clean up three times per month. It seems that it would be advisable for the patentees of precipitating-presses to design a special press for silver ores with a greater proportion of storage room to filter-surface than the standard press in use has. It has been found necessary here not to allow the pressure to exceed 5 lb. per square inch; at a higher pressure the precipitate has a tendency to cake, which prevents the inflowing solution from filtering through the excess zinc-dust and being precipitated. This experience is in direct contradiction to the theory that precipitation is complete in the pipe-line, but it has not been possible here to corroborate this. After cleaning the presses, in order to insure satisfactory precipitation, it is necessary to use $^3/_5$ lb. of zinc dust with the first 250 tons pumped through the presses. After the filter-cloths have been coated with this excess zinc, the amount used varies from ⅛ to $^1/_3$ lb. per ton of solution. During the first 18 months operation the plant was supplied with most inferior zinc dust, which resulted in a high consumption of this chemical, as can be seen by referring to the subjoined table. In the latter part of 1910 it was decided to have this commodity shipped in metal-lined cases, similar to the cyanide package. The beneficial effect was immediate, and although the first cost is ¼c. per pound higher than the quotations for barrel packages, the consumption of zinc dust is reduced enough to offset this expense many times.

At the beginning of operations the strong and weak solutions were precipitated in separate presses. During this time the total zinc in the precipitate averaged over 30%. It was decided later to pump the strong solution, which titrates 4.5 lb. KCN and averages 1½ oz. gold per ton, through the weak-solution presses. By doing this the zinc has been reduced to 15%, and no more zinc dust is required to precipitate the 1½-oz. solution than is used on the mill-solution. This is one reason why it is believed here that the condition of the press is more important for efficient precipitation than length of pipe-line. Since the metal-lined zinc-dust package has been used, three presses are kept in constant operation, and the fourth cut-in only at the beginning of the bi-weekly clean-up. The clean-up car, which is steam-jacketed, runs on rails underneath the presses, as shown in the sketch. This change was made in order to avoid handling or transferring the precipitate, and is very satisfactory. Six hours are required for two men to clean a press and have it ready for operation. The work of cleaning is done by the refinery crew, which consists of three shifts of two men each. All filter-cloths for the clarifying and precipitating-presses are cut by the filter operators who have some little time during each cycle for this work. A double thickness of twill is used for filtering; when the outside cloth becomes worn, it is taken off, burned, and added to the precipitate.

The efficiency of this method of precipitation is shown in the following table:

	1911.	1910.	1909.
Value of Mill Solution—	Oz. Au.	Oz. Au.	Oz. Au.
Before precipitation	0.200	0.200	0.230
After precipitation	0.003	0.004	0.005
Percentage of recovery	98.5	98.0	97.8
Value of Concentrate Plant Solution—			
Before precipitation	1.56	1.22	1.40
After precipitation	0.014	0.016	0.017
Percentage of recovery	99.0	98.7	98.8

In the cost of precipitating is included the power required to elevate the solution to the press-room and the total cost of operating the clarifying-presses. The latter may seem unjust to the zinc-dust precipitation, but since it is a detail absolutely essential to the successful operation of this method, it should be charged against it. The solution from the filters, although apparently clear, contains a minute amount of flocculent slime which would cause the pressure in the precipitating-presses to rise if it were allowed to pass to them. In addition, the unclarified solution would precipitate, from a physical standpoint, on zinc-shaving, and as stated, it is thought here this cost is properly charged against the precipitation. The following table shows the cost, including cleaning-up and items mentioned above:

	1911.	1910.	1909.
Tonnage	850	850	600
	Cents.	Cents.	Cents.
Labor	1.0	0.9	1.3
Supplies	4.9	8.7	9.0
Power	1.4	1.4	1.7
Total	7.3	11.0	12.0

In spite of the fact that the heat was so intense it warped 12-in. I-beams, destroyed part of the steel structure of the press building, and burned the zinc in the presses, they passed through the refinery fire without damage, yielded 11,000 oz. of gold which they contained, without loss, and were in operation four days after the disaster.

Melting

The melting-room, as originally designed, contained a double-muffle drying-furnace and four Faber du Faur tilting furnaces for treating this precipitate. Apparently not enough experimental work was done on this part of the treatment while engaged in making the design for the

plant. The process as outlined consisted of nitre roasting the precipitate, with subsequent melting in the tilting furnaces. The bullion from this method averaged about 250 fine in gold and silver. The analysis given will explain why. Later, acid-treating tanks were put in, which materially reduced the amount of precipitate to be melted, and by the addition of pyritic concentrate to the flux, enough copper and lead were converted to matte to raise the grade of the bullion to 425 fine, gold and silver. The following is a typical analysis of the bullion originally made at the plant:

	Per cent.
Au	34.87
Ag	5.75
Cu	40.50
Pb	12.95
Zn	3.48
Cd	1.31
Fe	0.18
Mn	Trace
As	0.10
Sb	0.15
Bi	0.07
Ni	0.16
Co	0.03
Te	0.39
S	0.10

The process was unsatisfactory from every standpoint, as the comparative tables below will show. The fire, which originated in this melting-room, through the failure of a defective bushing in the fuel-line, made it imperative to go ahead with work which had long been planned but postponed on account of other work which seemed more necessary. Much work was done with a view of finding some wet method which could be economically applied to the precipitate. The large amount of base metals made the cost of reagents prohibitive. Electrolytic parting of the base bullion would have made it necessary to carry a large stock of silver in order to secure the correct proportion of silver to gold for rapid parting. This idea was abandoned on account of the high cost. Cupellation of the briquetted precipitate, as practised at the Homestake, was impossible on account of the high percentage of copper. Laboratory work with a modification of the Tavener process, in which enough sulphur obtained from concentrate was added to matte the copper, yielded a clean lead bullion, and low-grade slag and matte. The cupellation of this base bullion left a gold bullion carrying approximately 850 parts gold and 80 parts silver.

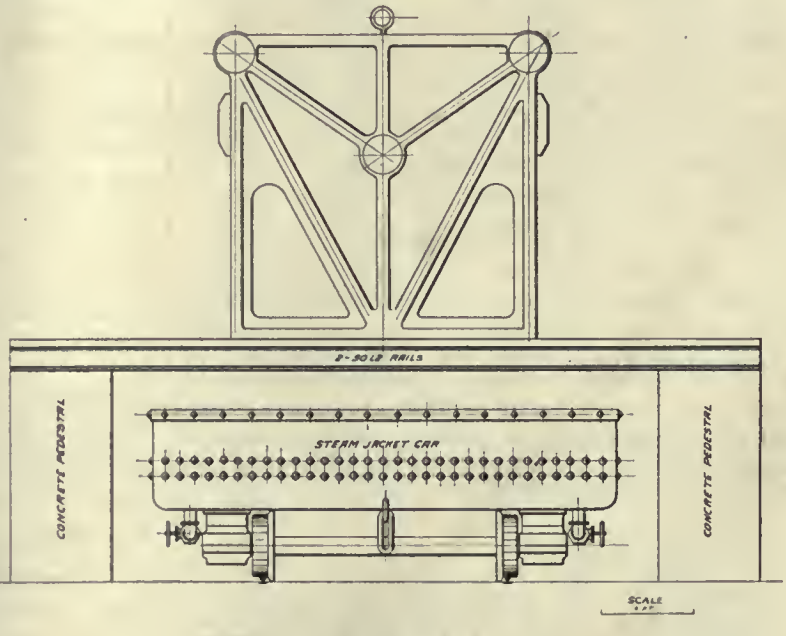
About the time it had been decided to briquette the precipitate with litharge and concentrate and smelt in a small reverberatory with suitable flux, Henry Hansen, the mill superintendent of the Pittsburg Silver Peak Co., at Blair, Nevada, told me of some experiments which he had been making with a small blast-furnace for smelting his briquetted precipitate. The refining process at that mill was at that time similar to Homestake practice. He had found the smelting of the briquetted material in the cupels a tedious operation, and had made some tests in a small blast-furnace which he was using for cleaning his cupel slags and for other clean-up work. The bullion from this furnace was cupelled, and the total time and expense of melting were reduced materially.

Smelting precipitate containing 40% copper on a lead basis did not sound very attractive as blast-furnace work at first, but after experimenting here it was decided it could be done very efficiently and economically. The precipitate is now treated in the following manner: The upper floor of the refinery is connected with the precipitating-room by a 30-in. gauge track with branches to each of the four presses. The steam-jacketed clean-up car is run underneath the press to be cleaned, the precipitate is dropped into it and hoisted to the refinery, where the total weight is determined on platform scales. After deducting the weight of the car and the moisture, fluxes are added in the following proportion:

	Parts.
Dry precipitate	100
Litharge	100 to 125
Blanket concentrate (S 35%, SiO_2 30%)	60 to 70

Flue-dust and floor sweepings in quantities to reduce the moisture to approximately 9 per cent.

The admixture of precipitate and fluxes in the car passes to a hydraulic elevator which delivers it at the feed-hopper of a two-mould Boyd press. This press was purchased from the Selby Smelting & Lead Co. and has a rated capacity of 30 tons in 24 hours. The dies have been changed to make a circular brick 4½ in. diam. and 3 in. thick, since the rectangular one was too large and unwieldy for use. Two men have no difficulty in fluxing and briquetting 2000 lb. of precipitate in 8 hours. One man feeds the press and the other receives the briquettes on rectangular trays, which are stacked in jacketed drying-carts and allowed to dry for 48 hours. Steam was used for drying during the winter when the heating plant was in operation. Having an excess of air, it was decided to heat it in one of the muffles of the drying-furnace, and allow the heated air to circulate through the trays of briquettes. This arrangement is very satisfactory and is more economical than the use of steam jackets.



MERRILL PRESS AND CLEAN-UP CAR.

The coke-bin is situated on this floor of the refinery and the coke can be shoveled to the furnaces with no extra handling. The blast-furnaces are of the cylindrical type, 20 inches in diameter at the tuyere line with riveted steel jackets, and provided with a removable curb, mounted on wheels. The jackets are arranged to be suspended from 15-in. I-beams which pass through the concrete retaining-wall. A Connersville blower direct-connected to a 10-hp. motor supplies a blast of 3 oz. per square inch for both blast-furnaces and the double English cupelling-furnace. This blower has a capacity of 10 cu. ft. of air per revolution and is operated at present at 250 r.p.m. Arrangements are being made to reduce the speed, as the supply is in excess of the amount required. The gases from all furnaces pass to a dust-chamber which contains 2700 cu. ft. There are nine take-out hoppers inside the building through which the flue-dust is drawn after each melt. The product recovered from the flue never exceeds 400 lb., and contains less than $500 in gold from a total value in the melt of

$400,000. In order to prove beyond question that gold was not escaping, an 8-in. Sturtevant exhaust fan was connected to the vertical stack and the gases filtered through muslin bags. The dust and fume collected from two separate tests of an hour's duration amounted in both cases to less than 5 lb., and assayed 1 oz. per ton.

The following analysis will give an idea of the baseness of the precipitate to be smelted:

	1911. Per cent.	1910. Per cent.	1909. Per cent.
Au	21.50	8.75	13.43
Ag	3.00	1.14	2.13
Cu	39.80	21.59	22.85
Pb	4.60	28.58	6.86
Zn	15.50	12.57	32.50
Cd	....	0.94	....
Fe	....	0.18	....
Mn	....	Trace	....
As	....	0.06	....
Sb	....	0.11	....
Bi	....	0.02	....
Ni	....	0.08	....
Co	....	Trace	....
Te	....	2.12	....
S	....	1.38	....
P	....	0.017	....
SiO_2	....	1.54	....
CO_2	....	2.74	....
Soluble alkaline salts	....	0.74	....
Moisture (105°C)	....	1.25	....
Combined water	....	3.19	....

The furnaces are 'blown-in' in the following manner: A wood fire is built in the crucible, the blast turned on, and wood thrown in from the charging floor until the crucible and lead-well are cherry red. A few charges of coke are added and the blast maintained until the whole charge is white-hot. The blast is then cut off and about 500 lb. of pig lead fed in to fill the crucible. The siphon is kept plugged with brasque in order to fill the crucible and float the ashes, charcoal, etc., which are raked out and subsequently returned to the furnace. When these have been removed the siphon is opened and blank charges of coke and slag are fed until the furnace is half full. This operation requires about 2 hours. By filling the furnace with these blank charges a bed is made for the first charge of briquettes, which prevents dusting. When the furnaces are ready, the following charge is fed:

	Lb.
Briquettes	160
Old slag	40
Borax	10
Cupel bottoms	10
Iron (oxidized)	5
Coke	25

With the exception of one run, when the slag contained 15% Zn, and became too pasty to work well, 24 hours is required to smelt 16,000 lb. of briquettes. The lead bullion contains approximately 20% gold and silver and 1% copper, which makes the lead-wells 'mushy.' In order to keep them open it is necessary to pass a hot iron rod through the siphon. The matte-fall is about one-third of the weight of the briquettes and is collected in a portable settler, from which the slag overflows into pots. The matte from the precipitate-run contains approximately 20% Pb, 50 oz. Au, and 200 oz. Ag per ton. This is stored until a sufficient quantity is on hand to make a separate run. The crucible of one furnace is then filled with brasque, and the furnace operated as a copper furnace. The separation of lead and matte is made in the portable settler. This operation reduces the lead in the matte to 10% and the gold to 3 oz. By roasting this product and leaching the copper and silver with H_2SO_4 it has been found possible to avoid shipping it, and a small plant will soon be erected for this purpose. When the slag becomes too 'zincy' for further use, it is either discarded or shipped to the smelter, according to the value.

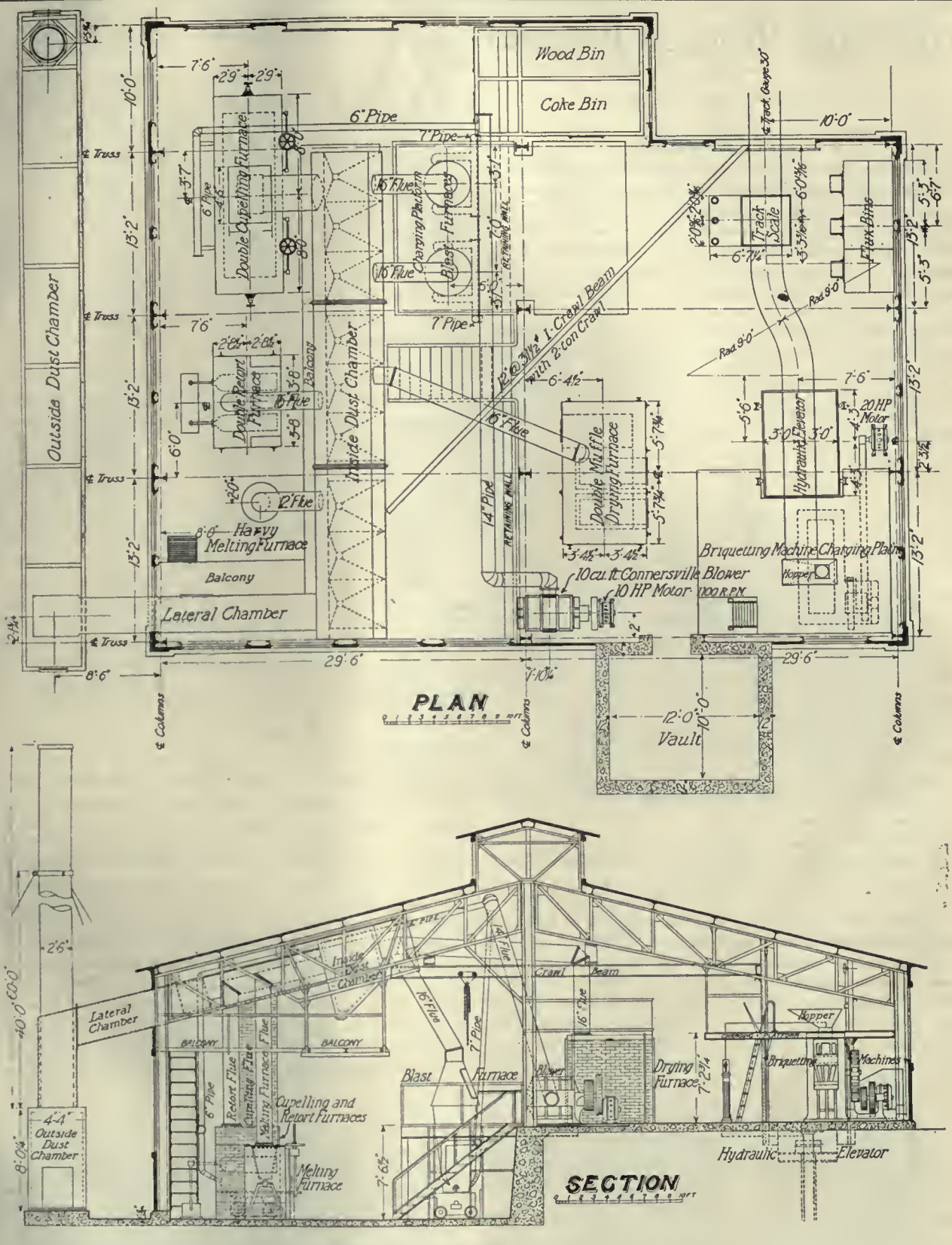
The composition of the slag is as follows:

	Per cent.
Insoluble	24.8
FeO	26.3
CaO	5.5
ZnO	12.3
Pb	6.5
Cu	1.3
Soluble silicates and borates undetermined: gold, 1.2 oz. per ton.	

Cupellation of the lead bullion is accomplished in a double English cupelling-furnace having removable tests, 3½ by 2½ ft. and 7 in. deep. The cupels are made of three parts cement and one part limestone; the latter is crushed to pass 6 mesh and the fine screened through 20 mesh and discarded. They are seasoned for six weeks before using and last for one run, cupelling approximately 4000 lb. lead bullion, after which they are broken up and fed to the blast-furnace with the next precipitate run. Thirty hours is required to cupel 8000 lb. lead bullion, during which time 25 barrels of oil is consumed. The litharge is caught in small ladles and examined for beads of bullion before it is sent to the grinding-room. Should any appear it is returned to the cupels. In finishing the cupellation it is necessary to add about 200 lb. of pig lead to each cupel in order to remove the remaining base. After the last matte and litharge have been floated off, the heat is raised and the blast increased for 20 min. to oxidize the film of base which cannot be removed mechanically. When oxidation is complete, the gold bullion is granulated by pouring into metal tubs filled with water. The material is then dried and melted with nitre and borax in a No. 60 Steele-Harvey tilting furnace. The bars thus produced, averaging 930 gold and silver, are shipped to the Selby Smelting & Lead Co. for further refining. Approximately 5% of the total lead used is lost. The matte and slag account for the greater part of this and the cupellation losses for the rest. The litharge recovered from the cupels is broken in a 4 by 6-in. Dodge crusher and pulverized to 20 mesh in a set of 7 by

CONSUMPTION OF CHEMICALS AND COST OF CONVERTING $KAuCN_2$ INTO FINE GOLD

	—Per Ton Ore Milled—			—Per Base Oz. Bullion—			—Per Fine Oz. Gold—		
	1909	1910	1911	1909	1910	1911	1909	1910	1911
Fine				354 Au / 61 Ag	378 / 39	850 Au / 80 Ag			
Consumption	Lb.	Lb.	Lb.				Lb.	Lb.	Lb.
KCN	1.60	2.61	3.12	0.508	0.77	1.90	1.4	2.0	2.31
Lime	8.72	8.49	8.55	2.70	2.50	5.20	7.61	6.5	6.5
Zinc dust	1.18	1.02	0.50	0.37	0.30	0.30	1.06	0.76	0.38½
Lead acetate	0.65	0.74½	0.58	0.26	0.225	0.37	0.73	0.57	0.44
Litharge			0.165			0.10			0.118
Pig lead			0.07			0.043			0.05
Lb. dry ppt. produced	1.00	0.92	0.52	0.313	0.254	0.32	0.876	0.70	0.38
Cost of	Cts.	Cts.	Cts.	Cts.	Cts.	Cts.	Cts.	Cts.	Cts.
Precipitating	12.0	11.0	7.3	3.8	3.25	4.5	10.7	8.4	5.4
Melting	20.3	18.3	9.5	6.4	5.4	5.8	18.1	14.0	7.0
Shipping bullion	8.4	8.8	8.1	2.6	2.6	5.0	7.5	6.7	6.0
Mint charge for refining base bullion	11.8	11.03	6.7	3.7	3.25	4.1	10.6	8.4	4.9
Total cost ppt. melt. and marketing	52.5	49.13	31.6	16.5	14.50	19.4	46.9	37.5	23.3



PLAN AND CROSS-SECTION OF REFINERY, GOLDFIELD CONSOLIDATED.

14-in. rolls and used for fluxing the precipitate from the next clean-up.

The cut above shows the refinery in plan and cross-section. In order to make it the more easily understood, the names of the more important features have been placed on the drawing, and it will therefore not be necessary to give any further description. The building is a steel frame covered with wire netting and portland cement plaster. Concrete was used liberally in constructing floors and foundations, and it is as nearly fireproof as such a building may be made.

It is not intended to give the impression that the process is perfect, and that the usual amount of 'grief' has not been passed through in getting started; but when the character of the product is taken into consideration, the results are very satisfactory, as can be seen from the accompanying tables:

COST OF MELTING

	Blast-Furnaces and Cupellation.	Acid Treatment and Tilting-Furnaces.	
	1911.	1910.	1909.
Labor	4.2	5.0	6.1
Supplies	5.2	13.2	14.0
Power	0.1	0.1	0.2
	9.5	18.3	20.3

(To be continued.)

Travel and Mining in Honduras

By Rensselaer H. Toll

Situation and Extent

*Honduras has an area of but 50,000 square miles, less than half the size of the State of Colorado. Its population is estimated at 400,000; comprising 185,000 Indians, 205,000 of mixed blood, 5000 negroes, and 5000 whites, most of whom are of Spanish descent, though a great many Americans and Europeans are scattered along the coasts, in the larger cities of the interior, and through the mining regions. The coast-lines of Honduras run nearly east and west. The Caribbean coast is about 400 miles long and has many good harbors, such as Trujillo, Ceiba, Tela, Omoa, and Cortez, the last-named being the usual port of entry for travelers. The Pacific coast is occupied by San Salvador, leaving but sixty miles to Honduras, which, however, contains the beautiful harbor of Amapala. Both coasts are unhealthy, but the miasmic influence does not extend far inland.

As elsewhere in America, the principal rivers flow to the Atlantic. The Segovia, or Coco river, which is the boundary between Honduras and Nicaragua, is about 350 miles in length; but it flows rapidly over a shallow rocky bed and is navigable only by canoes. The largest river entirely within the boundaries of the country is the Ulua, which flows north and is formed by the confluence of the Santiago and the Comayagua, with their tributaries, the Santa Barbara and the Sulaco. Steamers of shallow draft can ascend the Ulua as far as the mouth of the Santiago, about 70 miles by the stream. The Comayagua river rises in the mountains at the southern border of the great plain of Comayagua, more than two-thirds of the distance to the Pacific coast; and the streams of the Ulua system drain about one-third of the entire territory of Honduras.

As a whole, the country is very mountainous, not even the coasts being free from rugged heights, for along the Caribbean many mountains raise their proud heads above the clouds while their feet are bathed by the ocean surf. Nor are their elevations insignificant, for many peaks reach an altitude of 9000 ft., while in the Sulaque mountains are some which approximate 10,000 ft. above the sea. Mountainous as the country is, there are no consecutive ranges of great length, the longest being the Sierra Madre, and this splits into two parts soon after leaving Guatemala. Between the various small ranges of mountains are broad fertile plains like that of Comayagua, which is about 40 miles long from north to south and 10 miles in average width; the plains of Yoro and Olancho, celebrated for the excellence of their cattle; the plains of Omoa, Sensenti, and many others, all extremely picturesque and fertile.

Mineral Resources

Honduras ranks high in mineral resources: among the metals so far discovered being gold, silver, copper, iron, lead, zinc, antimony, and nickel. Kaolin, opal, aluminum, chalk, coal, asphalt, and petroleum also are found in quantities which will doubtless render them all profitable under more advantageous conditions. All kinds of building stones, including marble of a fine quality suitable for statuary, are found. Because of the inadequate transportation facilities and civil strife, only the precious metals can be mined profitably at present. Many of the rivers, especially those flowing into the Atlantic, contain gold in quantities large enough for the Indians to work, and there are several small quartz-mines in operation. Some of the placer gold is said to contain platinum in so appreciable an amount as to be paid for by the United States mints. But despite this showing, the only mine of present importance in Honduras is the San Juancita, owned by the New York & Honduras Rosaria Mining Co., with headquarters in New York. This mine is in the department of Tegucigalpa, about 20 miles north of the capital, on the northern slope of a steep and high mountain formed principally of andesite overlying black shale.

The main veins, the Rosaria and Candelaria, strike generally east and west, dipping steeply to the north, in places being quite vertical. These veins have been worked for over thirty years, and there are about 30 miles of workings, with a vertical extent of 1800 ft.; but the mine is said to be in better condition now than ever before. Within recent years important north and south veins have been developed, which appear to have given the property a new lease of life. The mine is equipped with electric haulage, and a single-rope tramway conveys the ore to the mill, an old affair of fifty stamps and two tube-mills. The metals are extracted in the cyanide plant, which has mechanical agitation-vats and Butters filters. The precipitate is shipped to New Jersey, as the cost is about the same as for that of reduction at the mill.

About 3000 tons per month is milled, and the annual production is close to 1,000,000 oz. of silver and 16,000 to 17,000 oz. gold. About 2000 men are employed, of whom 40 are Americans. The equipment of the Rosario is constantly undergoing renewal and improvement, two very fine hydro-electric plants having been built recently; and a new mill and cyanide-plant, offices, hotel, and club-house are in course of construction on the mountain-side at the level of the lower adit, 1500 ft. above the present townsite. The property is connected with Tegucigalpa by a most outrageous cart-road, which in the higher mountains is very muddy because of the numerous springs; and the grade in many places is over 30%. As an illustration of the difficulties of operation in such a locality, it may be mentioned that the cost for transportation of heavy freight from San Lorenzo, the port near Amapala, to San Juancita is 5c. gold per pound, light freight costing about half as much.

Mining Laws

The mining laws of Honduras are very liberal. Any amount of ground may be denounced, but the usual size of claim is 500 hectares, or 1220 acres. By following a procedure similar to our patent proceedings, a title may be secured which is equivalent to a patent in the United States. The annual tax is 50cv. (about 20c. gold) per hectare, and so long as the taxes are paid the title remains absolute. But should they be unpaid for a period of two years, the ground reverts to the public domain and is open to denouncement again. As in Mexico, there are no extralateral rights, all boundary lines being vertical. For a small consideration one may obtain a concession to prospect and locate claims over a large area, during the term of which no one else is permitted to make denouncements within the specified territory. Upon application to the President, mining machinery and supplies may be brought into the country free of duty.

Ports and Railways

The interior of Honduras may be reached through Puerto Cortez on the north coast, and Amapala on the south coast. From New Orleans the United Fruit Co. operates small steamers which make the trip to Cortez in a little more than five days, stopping at Belize, British Honduras, and Barrios, Guatemala. The steamship fare is $27 one way. From San Francisco to Amapala requires 22 days and costs four times as much; hence, though the trip from Amapala requires but three days over a good road, and that from the railroad at Pimienta to the Capital requires six days over a bad trail, much time and money are saved by going through Cortez. If the traveler has time and inclination he may take one of the large new steamers of the United Fruit Co. and catch one of the smaller ones at Barrios. These larger vessels are of 5000 tons burden and very comfortable—almost luxurious—and a trip on one of them is quite a delight. During the wait at Barrios he may run up to Guatemala City, the metropolis of Central America, and spend a day or two viewing this interesting old city and laying in a supply of silver jewelry and silk shawls for souvenirs.

Cortez harbor is one of the best on the Gulf. It is ellip-

*Address delivered before the Colorado Scientific Society, April 1, 1911.

tical in shape, about nine miles in circumference, and deep enough for the largest vessels to anchor. Puerto Cortez is a straggling, crudely-built town stretching along the shore for two miles. Its single street is occupied principally by the Honduras railroad, whose terminus is the wharf at the lower end of town. At the upper end this road enters the jungle, bound for La Pimienta, on the Ulua river, 56 miles away, a distance usually covered by the train in about eight hours. This little narrow-gauge road is the first section of a transcontinental line which was projected to San Lorenzo, through the valleys of the Comayagua and the Goascoran, which practically bisect Honduras, a total distance of 232 miles. From 1867 to 1870 bonds to the value of about $30,000,000 were floated in London and Paris for the purpose of building this railroad. An English company took the construction contract on a percentage basis, and it was profitable, therefore, to make the construction as costly as possible. So, between the commission for the sale of the bonds and the padded accounts for material and labor, by the time the road had reached San Pedro the proceeds from $25,000,000 worth of bonds had been consumed; a cost of nearly $700,000 per mile. The road was finally completed to the Ulua river and graded several miles beyond, but the Government was bankrupt. Notwithstanding the enormous cost, the construction of this railroad was wretched. For miles the rails were laid upon the bare ground, without ties of any kind, being held in place by stakes driven in the earth. They soon became imbedded to such a depth that lateral movement was impossible, so the trains probably kept the track as well as they do now. But, bad as the track and cars are, this little railroad presents many interesting features. For many miles it runs through a dense jungle of palms and other tropical foliage whose sweeping branches cast grateful shade over passing trains, while the trailing vines, covered with morning-glories and flowers of strange shape and gorgeous colors, lend fragrance and magnificence to the scenery, which the most carefully cultivated lawns and flower-beds of our great Eastern roads cannot equal. A dozen miles from the coast the jungle frequently gives way to large cleared pastures, and *fincas* where the luscious banana hangs from the broad-leafed stalk; and at each station cars are being loaded with this nutritious fruit.

The day before our arrival at Cortez the American and upon the town and railroad, and the camp was in general readiness, if not eagerness, to cut down ruthlessly any revolutionists that might get off our train. Fortunately for us, we carried no such passengers.

Travel in the Interior

At La Pimienta one is obliged to take passage on a mule, and here the really tiresome portion of the journey begins, for five or six days on a Honduras mule is not the most delightful experience in the world, even to a stranger, to whom the wonderful foliage, picturesque dwellings, the brilliant flora, and myriads of gorgeously plumed birds present an ever-changing panorama of loveliness. Soon the diet of *tortillas, frijoles,* and rice, and steady grind of the saddle, and the stings of numberless insects by day and by night, spoil the effect of the landscape, and before the end of the second day the screams of the vari-colored macaws flying in pairs across the sky, the chatter of monkeys in the trees, the bright plumage of the big-billed toucan, and the golden-tailed *Oro pendulum,* singing in melodious con-

TRAIL THROUGH LOWLANDS. TREES COVERED WITH ORCHIDS AND VINES.

RAILWAY AT CHOLOMA WITH U. S. SOLDIERS GUARDING AGAINST INTERRUPTION OF TRAFFIC.

ULUA RIVER AND POTRERILLOS CAMP OF GENERAL CARIAS.

CEIBA, HONDURAS. BATTLE WAS FOUGHT AROUND TRENCHES IN WOODS AT THE LEFT.

English officials had taken charge of that port and had shipped the Honduran army out of Cortez and San Pedro and dumped it off at the end of the railroad. When we reached that point a most interesting sight met our eyes. On the opposite bank of the river was the camp of the Government forces, with a line of entrenchments stretching along the bank for a half mile. All the boats were moored on the farther side of the river; more than a thousand riflemen were in their pits and trenches, ready for battle; nine machine-guns and two 2-lb. cannon were loaded and trained

tralto from above its wonderful swinging nest at the end of the highest branches, have become commonplace.

By the end of the second day the traveler finds his chief interest in the application of witch-hazel to his sore muscles and iodine to his insect-bites, for the bane of existence in Honduras is the ravenous nature and overwhelming numbers of the insects. The timber-tick is always present in full force, the nimble flea fills every habitation; and along the coast the mosquito and the tiny sand-fly add their due portion to the sum total of human misery. But for objection-

ableness no other insect can compare with the *garrapata,* minute representatives of the tick family, which wait in hordes at the end of every branch along the trail to drop upon the passer-by, scatter over his person, and bury their screw-like heads in the flesh. Against them man has no protection but tobacco-juice, though by keeping one's clothing saturated with this drug one may pass through the interior with a small degree of freedom from these pests. Another very interesting insect is the *nigua,* which is almost microscopic and hence difficult to detect. Its principal business is to bore into the flesh at the side of the nail, usually on the toes, and deposit its eggs, which hatch there and produce sores similar to boils; the only remedy is to cut out the larvae, often a quite painful operation.

Outfit and Medicines

For the benefit of those contemplating a trip into the interior it may be well to state that the outfit for the journey is best obtained at San Pedro—mules, *mozos,* and all. With proper credentials it is often possible to rent animals at about one peso per day. *Mozos,* or native attendants, may be engaged at the same rate. Often, however, one must purchase animals, and a good mule costs about ₱200; horses, ₱25 to ₱100. A saddle-animal, a pack-animal, and a *mozo* are required for each person, unless the party consists of more than three, in which case the proportion of pack-animals and *mozos* may be decreased.

The essential articles of clothing are: light underwear, khaki suit, good waterproof hat with broad brim, high boots; and a good raincoat kept strapped to the saddle—preferably a black rubber coat, as 'oil-skins' and cravenettes are but slight protection against a prolonged tropical down-pour. It is not advisable to carry any luggage which can be damaged by rubbing on the outlandish native pack-saddles or crushed by tight binding-ropes. Use heavy canvas bags or wrap in a bundle and cover with oil-cloth. It is well to lay in a small supply of canned goods and bread; for, though there are places along the trail where travelers regularly spend the night, noonday finds one far from habitations and the fare at the lodging-places is not sumptuous.

Do not forget a small assortment of bandages, cotton, court-plaster, surgeon's plaster, vaseline, carbolic acid, and witch-hazel; quinine, to allay fever; iodine, potassium permanganate, and potassium bisulphate for stings and bites of insects or reptiles. I always carry an ounce or two of aconite to ward off colds. Five or six drops of this every couple of hours when one feels a cold coming on will do no injury and is a sure preventive. For sleeping purposes a pair of heavy blankets and a hammock or folding cot make up the equipment. It is not a bad idea to carry a 0.38-calibre revolver for protection against unkindly disposed natives, and as a means of killing game. Deer are plentiful through the country; peccaries, tapirs, coyotes, jaguars, and other animals are found in some parts of the interior; the iguana, a species of lizard which attains a length of three to four feet, is quite common, and the natives esteem its flesh a delicacy; squirrels abound through the forests; and there are ducks, geese, and numerous game-birds, of which one of the most common is the *chachalaka,* which resembles the wild turkey.

The Honduran native is not so good a prospector as the natives in many parts of Mexico. He does not use his eyes and head to so much advantage in his work as the average Mexican, and does not recognize the different formations so readily; hence the country has not been nearly so well prospected as Mexico, and there is probably more chance of reward for intelligent prospecting.

A cement for making tight joints in pumps, pipes, etc., is made of a mixture of 15 parts slaked lime, 20 parts graphite, and 30 parts barium sulphate. The ingredients are powdered, well mixed together, and stirred up with 15 parts of boiled oil. A stiffer preparation can be made by increasing the proportions of graphite and barium sulphate to 30 and 40 parts respectively, and omitting the lime.

Oilfields South of Coalinga

By Wm. Forstner

In the middle of October 1910, the drill at the well of the Coalinga Oil Co., in the N.E. ¼ of section 22, T. 21 S., R. 15 E., cut through a peculiar black greasy material at a depth of 3750 ft., 2850 ft. below sea-level. This material came up, some on the bit, but mostly on the line, while drilling at 3750 to 3790 ft. During the latter part of the drilling it was nearly exclusively on the line, about 20 ft. above the tool, at a point where the swaying of the line was liable to throw it against the walls of the bore-hole. Past the depth of 3790 ft. no further black sticky material was brought up in drilling. From 3720 to 4154 ft. the well went through shale, with only one stringer of sand 2 ft. thick at 4002 to 4004 ft. It is probable that the black greasy material came from a bed at or near 3750 ft. depth. The thickness of the bed can not be estimated from the data at hand, but it is probably not over 20 ft. Some of this material was forwarded to me for investigation. It has been so thoroughly mashed that there is no possibility of judging of its structure, and resembles axle grease removed from an axle; its color is black, it has no smell, and it is greasy to the touch, staining the fingers black. Adding chloroform to it in the test tube, the color of the solution is black instead of brown, as is the case with oil. No grease appears on shaking in the upper part of the tube, but a dark-brown film, insoluble in chloroform is leached out of the mass by the chloroform and is deposited on the tube. I took the sample to Abbot A. Hanks, in whose laboratory the further investigation was made. Of the entire mass 70% was found to be of inorganic origin, crushed shale and considerable iron. With a strong glass a number of particles of steel from the bit could be distinguished. Dissolving the organic matter and evaporating the solvent, it was found that 24% was a light yellow, viscous, unctuous material, with a taste resembling vaseline, soluble in CS_2, in boiling ether, but insoluble in cold alcohol; and 3% a darker material, soluble in CS_2, in chloroform, ether, and boiling alcohol, but insoluble in cold alcohol. All the native bitumens are soluble or practically so in CS_2, except the 'pyro-bitumen albertite,' but differ in their behavior toward other reagents. Paraffine and ozokerite, its solid native hydrocarbon, are soluble in ether, but only sparingly in boiling alcohol, not over 3%, and insoluble in cold alcohol.[2] Petrolene, the liquid part of the asphaltic solid hydrocarbons, is soluble in ether and chloroform, and dissolves in strong alcohol. It stains paper like oils, and burns with a strong smoke.[3] Both these latter characteristics were absent in the material tested. Asphaltene, the solid part of the asphaltic hydrocarbons, is soluble in chloroform and insoluble in strong alcohol. The results of these tests appear to me to justify the suggestion that the greatest portion of this material has a paraffine base, and that the 3% of darker material represents the portion with an asphaltic base.

On November 20, 1910, the well of the Bohemian Oil Co., in the S.E. ¼ of the same section, reached the oil sand at a depth of 3700 ft., 2900 ft. below sea-level. It showed 35 ft. of oil sand. The oil is of very high grade, between 35 and 36°B. A sample of this oil was submitted by me for a test to Abbot A. Hanks, in order to determine its character, and he reports that this oil is of an asphaltic base. Judging from the topographic map issued by the U. S. Geological Survey, the collar of this well cannot be over 100 ft. below that of the Hub well. The Bohemian lies on the eastern flank close to the axis of the Jacalitos anticline, as outlined on the map of the U. S. Geological Survey Bulletin No. 396, while the Hub well lies one-half mile northeast of that axis. It must be further noted that the latter well lies close to and north of an east and west

[1]Richardson, Clifford. *Jour.* of the Amer. Chem. Soc., Vol. XXXII, p. 1037.
[2]Redwood, Boverton. 'Petroleum,' Vol. I, p. 241.
[3]Musprat. 'Chemle,' Vol. I, p. 1225.

line of disturbance in the formation, which has a steep dip to the north. This disturbance may account for the occurrence of the bed of solid hydrocarbons in that well.

All native bitumens originate in petroleum, and are products of its metamorphosis, depending for their character on that of the petroleum from which they are derived, and the environment to which it was exposed during the last periods of the time when the changes were going on. Solid bitumens are, apparently, formed from all types of petroleum. Ozokerite consists of solid paraffine, and is plainly derived from paraffine petroleum. From the non-paraffine oils are formed the asphalts of various names and characteristics.[4] All are formed by oxidation and evaporation of liquid petroleum which continually oozes from deeply seated or better covered deposits into other strata or into fissures where atmospheric influence or evaporation are free to act. When evaporation alone takes place, the solid constituents are merely concentrated with the production of the solid hydrocarbons, ozokerite, gilsonite, grahamite, albertite, and similar compounds.[5] It must be further noted that the solid hydrocarbons obtained as residue in the distillation of crude oils are actually contained in the petroleum, and are not the product of decomposition during distillation. They have actually been separated without distillation.[6] The nature of the crude petroleum can be changed by its diffusion through media sufficiently fine-grained and porous to afford capillary spaces, which can cause a separation of the constituents of any mixture, provided these possess different surface tensions. The members composing the natural oil may be grouped as paraffine or saturated hydrocarbons, unsaturated hydrocarbons, sulphur, nitrogen, and oxygen hydrocarbon compounds. D. T. Day early observed that the unsaturated hydrocarbons are less diffusible than the paraffine hydrocarbons.[7] In the Hub well the bed of solid hydrocarbons was found, as above stated, near the top of a thick belt of shale, which would afford the conditions required for the accumulation of the paraffine hydrocarbons in the oils, provided such were present in the oil. In this respect it must be noted that the examination of the California oils, in general, does not show the presence of hydrocarbons of the paraffine series, and if any are present they are contained in the lighter gasolines from this petroleum.[8] Therefore the only explanation available is, that during the diffusion through the shale underlying the bed of solid hydrocarbons of the lighter constituents of the petroleum, the saturated hydrocarbons (paraffines), diffusing more readily than the unsaturated hydrocarbons, accumulated in the overlying sand; and that this diffusion occurred here locally, because, for some reason or other, the shales were dry, and therefore allowed the diffusion.

The oils containing hydrocarbons of the paraffine series as yet found in the Coalinga field, come from the lowest Eocene or upper Cretaceous. The oil at Oil City, in section 20, T. 19, R. 15, north of Coalinga, which contains such hydrocarbons, is derived from the upper Cretaceous.[9] That of the upper Kreyenhagen wells in Canoas canyon, section 33, T. 22, R. 16, which is of a paraffine base, is in wells that start in the lower Eocene shales and therefore derive their oil from the lowest Eocene or upper Cretaceous. As the Hub found the oil sand of the Bohemian over 600 ft. below the bed of paraffine bitumen, it is hardly conceivable that these bitumens are derived from lowest Eocene or upper Cretaceous oils. Besides, the surface indications tend to the suggestion that these formations have been eroded or are absent in this territory.

The determination of the geological conditions governing the oil occurrence in this vicinity is rather difficult. Most probably the Waltham and Jacalitos creeks are the eastern parts of one of the depressions in the Mount Diablo range through which the sea in former geological periods had access to the Great Valley of California, and it appears to me most probable that at one time the main depression was to the south of Currie mountain along the present line of Carey and Salt Lake creeks, tributaries of the Jacalitos creek, and that subsequently Waltham creek, the outlet of Waltham valley, cut its way through the northern portion of Currie mountain. At Devils gorge (Jasper gorge on the map in U. S. Bulletin No. 396) the Vaqueros lies directly over a narrow exposure of the Knoxville (lower Cretaceous) dipping very steeply northeast, which is in turn underlain by the Franciscan which forms the east slope of the main range. Between the Devils gorge and Castro creek, in the southwest corner of section 3, T. 22, R. 15, the Franciscan is overlain by alternating beds of clay shale and sandstone, probably belonging to the Jacalitos formation, and the latter either overlaps the intervening Mesozoic Eocene, and lower and middle Miocene formations, or these were eroded. West of Castro creek, heavy beds of shale overlie the Franciscan. They are found on both sides of Carey creek and the overlying sand gives a strong reaction for bitumen. This shale belongs apparently to the same formation that covers the top of the range, and is found on the west slope overlying the Vaqueros near the Stone Canyon coal mine, which would place the age as Miocene. It is reasonable to suggest that in lower and middle Miocene times the entire range was under the sea, and that subsequent to the middle Miocene uplift all the younger formations were eroded from the east flank of the Mount Diablo range.

A summary of the diastrophic movements in this region may help to a better understanding of the conditions. From the distribution of the Cretaceous in the Coast ranges it is evident that a part of that range did not subside below sea-level during that period, especially in the southern portion, the lower Miocene in many places being found resting on the Franciscan. During the Eocene the Great Valley formed an arm of the ocean, with an outlet to the south. The relation of the Miocene and Eocene suggests that, although no profound disturbances occurred at or near the close of the Eocene, differential oscillations and intervening periods of quiescence occurred. Since in many places the Eocene was greatly eroded before the deposition of the Miocene, subsequent to the middle Miocene, an uplift must have taken place, raising all of western California above the deep-sea, and partly above sea-level into the zone of erosion. Later subsidence never brought the east flank of the San Joaquin valley down to deep-sea level, the upper Miocene and later formations being characteristic littoral deposits. Then followed the post-Miocene uplift of the Coast range, and the post-Miocene interval of high altitudes and erosion. This period of erosion must have lasted a long time, for in places the upper and middle Miocene was entirely removed. After the post-Miocene interval of high altitude, the Pliocene period of depression occurred. Most probably an orogenic movement took place at the close of this Pliocene period of sedimentation, along a large part of the West Coast, which caused the upthrust of the Mount Diablo range. These mountain-making movements were, however, not adequate to efface the peneplain formed in the post-Miocene period of erosion, and it was extended between the bolder masses of the disturbed districts. At the close of the Pliocene the topography was that of an approximate peneplain with numerous peaks and ridges above the general level, while the coast had the aspect of an archipelago.[10] During the long period from the end of the Eocene to the present time, this region then has been submitted to a series of elevations and subsidences. During the former a greater or less part of the older formations was eroded, while all these movements of the earth crust were accompanied by folding, and in many cases faulting, of the strata.

[4]Richardson, Clifford. Op. cit., p. 1036.
[5]Redwood, Boverton. Op. cit., p. 119.
[6]Mabery, Ch. F. *Amer. Chem. Jour.*, Vol. 33, p. 276.
[7]Gilpin, J. E., and Bransky, O. E. *Amer. Chem. Jour.*, Vol. 44, p. 257; Bull. U. S. Geol. Surv. No. 365; *Oil Age*, December 30, 1910, p. 4.
[8]Mabery, Ch. F. *Jour. Amer. Chem. Soc.*, Vol. 28, p. 424; *Amer. Chem. Jour.*, Vol. 33, p. 270; Ch. F. Mabery and E. J. Hudson, *Proc.* Am. Acad., XXXVI, p. 255.
[9]Bull. U. S. Geol. Surv., No. 396, p. 183.
[10]For more detailed description, see 'Historical Geology of California,' by Wm. Forstner, published by the *Mining and Scientific Press*.

When discussing the conditions of oil occurrence, especially in a new field, it must be remembered that the underground conditions are far from regular, and this the more so where, as in this case, all indications point to local disturbances. The developments in the well of the Pulvadore Oil Co., in section 2, T. 21, R. 16, indicate that possibly here the oil measures lie nearer the surface than to the north or south. This well lies about three-fourths of a mile east of the axis of the Coalinga anticline, and in it at a depth of less than 1500 ft. oil measures were found. To the north the Mohawk No. 1, in section 12, T. 20, R. 15, one-quarter mile east of same axis, showed the first oil sand at 3700 ft., and was finished at 3955 ft. The Southeastern No. 1, in section 18, T. 20, R. 16, about the same distance east of the axis, reached the first oil sand at 3600 ft., and was cemented off at 4272 ft. To the south well No. 1 of the Coalinga Kettleman Hills, in section 2, T. 22, R. 17, about one-half mile east of same axis was at 2965 ft. deep in blue shale, with gas but no oil. To the north the axis of the Coalinga anticline is dipping southward, to the south it is dipping northward, and the surface indications therefore suggested that in the vicinity of the location of the Pulvadore well the oil measures would lie deeper below the surface.

There are many unexplained occurrences in this field, and the data at hand are not sufficient to attempt an explanation. The oil operators are unwilling to give access to their logs, notwithstanding repeated requests, and friendly intervention. I have been only able to obtain the log of one well, and one log is entirely insufficient to draw any conclusions from on this subject.

The Hercules Mill

By W. A. Scott

The new mill of the Hercules Mining Co. was built last winter, and began operation in April. The plant is on a steep hillside at Wallace, Idaho. The mine is in the vicinity of Burke, and the ore is taken out through No. 4 adit-level. At the portal of this level is a sorting plant, where the waste is taken out, and the high-grade ore and mill stuff are separated. The mill ore is passed through a crusher and reduced to 2½-in. size. In this form it is transported to the shipping bins at Burke over a 3500-ft. aerial tramway. It is hauled in bottom-dump railroad cars from Burke to the ore-bins at the head of the mill. These bins have a capacity of 1500 tons of ore. The mill is built in two sections, each being housed in a separate structure, the two being 80 ft. apart. The section immediately below and connected with the ore-bins contains the crusher, rolls, trommels, jigs, classifying screens, and Huntington mills; the second section is designated as the slime-plant, and contains settlers and classifiers, traveling screens, tables, and vanners. The ore is discharged from the bins through plunger-feeders upon a 70-ft. belt-conveyor that extends lengthwise of the bins; this conveyor discharges upon another conveyor that travels at right angles to the first, and delivers the ore to a 4-section system of trommels—two 12-mm., one 20-mm., and one 36-mm. The oversize from these goes to a fine crusher; the undersize from the 20 and 36-mm. trommels goes to the jigs, while that of the 12-mm. passes to three Franz traveling screens of 4, 8, and 20 mesh, respectively. The oversize from the Franz screen goes to the jigs, while the undersize is conveyed in launders to the slime-plant. The tailing from the coarse jigs is returned to middling trommels; the jig middling is dewatered by a shaking-screen, and goes thence to a set of rolls, following which it is passed over traveling screens, the oversize from which is reground in Huntington mills; the undersize, together with the 20-mesh Huntington product, passes to the slime-house. The most important product of the mill is made in the 16 two-compartment jigs, and consists of the oversizes of 4, 8, and 20-mesh screens. The ore constituents comprise lead, silver, iron, and a small percentage of zinc, in a silicious gangue.

The slime-house material, consisting of the undersize from all 20-mesh screens, and the 20-mesh product of the three 6-ft. Huntington mills, is classified by traveling-screens, 4-spigot settlers, and Callow tanks, the different classes thus obtained being concentrated on tables and vanners. For this work there are 8 Wilfleys, 8 Franz tables, and 6 vanners. A novel feature of this part of the mill is the work of the Franz tables, designed by Frank Franz, superintendent of the plant. This table has on its deck a system of parallel riffles, or grooves, directed toward outlet slots through which the coarser product is discharged; also a pair of pans, and deflector ribs for directing the stream of finer mineral to the pans where the finer concentrate and gangue are separated. The tail-end of the deck may be adjusted with respect to the other part of the deck, to regulate the speed of concentration of the material. These tables appeared to be effecting a clean separation, and were operating on the second, third, and fourth-spigot product from the settling tank. The other tables and vanners were performing in the usually effective manner.

HERCULES MILL AND SLIME-PLANT, WALLACE, IDAHO.

The mill machinery is operated by electric motors, distributed advantageously throughout both sections. The present capacity of the plant is 400 tons per day, though this is soon to be increased to 600 tons. The mill-work effects a concentration of 8 tons into 1 ton. In the accompanying illustration may be seen the shipping-bin with two lines of conveyors extending at an incline from the ground to the top of the building. This structure is 20 by 40 ft., and 40 ft. high, divided into three compartments—one each for jig concentrate, slime product, and tailing. Each conveyor has a length of 110 ft., one carrying the two classes of concentrate to the bin, and the other the mill tailing, the latter to be hauled or laundered away, and not deposited in the stream. A 60-hp. steam-boiler is in position in a room for that purpose, to serve in heating the building during the cold weather.

Vertical shafts frequently must connect with inclines after the vein has been reached. In many mines an underground hoist and loading pockets are used and the ore is transferred from one skip through pockets to another. At the Harvard mine in Tuolumne county, California, the skip makes a continuous journey from the bottom of the incline up the vertical shaft to the surface. This is made possible by continuing the guides of the vertical shaft down the incline and using no track in the latter. Instead of shoes, wheels are placed on the side of the skip and in the incline the rails, forming the continuation of the guides, are hung on posts rather than set on ties. The whole arrangement works out simply and is an effective means of meeting a common problem.

Concrete in Mining

By George S. Rice

*Concrete is not unknown to miners; apart from its uses in foundations for machinery, it has been employed for many years to plaster mine stoppings and dams built of brick or stone, to render them comparatively water or gas-tight. Within the last few years, contemporaneously with the advance of the science of reinforcing concrete, the general use of concrete in mining operations has been enormously extended. Today practically all foundations for mine buildings and machinery are built of concrete, and many buildings, coal-bins, lofty chimneys, and even a large anthracite breaker have been built of reinforced concrete. In many of the large new mining plants, concrete has entered extensively into construction underground, replacing wood, iron, brick, and stone. Its use for various purposes in and about the mines is rapidly extending, as its merits are better understood. The possibilities of underground application appear to widen constantly, suggesting more than mere economies and even affecting fundamentals of mining.

In the short compass of this paper, the present numerous applications and future probabilities of mine uses can only be enumerated and briefly touched upon in a suggestive way.

Shaft-Sinking

In Europe, mining operations have been regarded as of more or less permanent character, particularly in coal mining, owing to the great number of seams in the coal measures. Hence for many years shafts have been sunk using brick or stone for lining, such shafts being circular or elliptical in cross-section. Where it has been necessary to employ iron or steel casings to pass through water-bearing strata, permanent inner linings of stone or brick have been used. In some recent shafts concrete has been substituted.

In this country, until the past few years, it has been, without exception, the practice to employ wood linings, the shafts being rectangular in cross-section. Water-bearing silt or quicksand were generally avoided, if possible, and where water was met in shaft-sinking, no attempt was made to keep it out, as in the European shafts.

In some instances where the surface quicksand proved shallow, concrete dams were constructed inside of timber lining or coffer-dams. Generally these inner linings or dams were circular or elliptical in section and massive, so that reinforcement was incidental.

Example of a Reinforced-Concrete Lining.—In sinking the air-shaft of a coal mine in Illinois, in 1906, through the surface silt, I used a reinforced-concrete lining, Fig. 1, of rectangular section and sufficient strength to resist the water-pressure, so as to keep the air-shaft dry. This is an important matter if the shaft is to be used for 'intaking' air, since in a wet shaft, masses of ice accumulate in cold weather, thus restricting the ventilating current or stopping it, with serious results. The inner lining was put in after the shaft had been forced through the soft silt, and the outer wood curbing rested on the rock. The latter was a fissured limestone, so the shaft was sunk about 8 ft. farther into the shales below, where a good foundation was prepared for the concrete lining.

As the water rained down the shaft in streams, while putting in the massive concrete foundation, the sinking pump was temporarily checked in laying the successive courses, and the water allowed to rise above the level of the course to be laid, so that the concreting materials could be placed behind the form in water without currents. The concrete was then carefully rammed against the shale and rock to make tight joints.

When this foundation had been brought up to the level of the wood curbing, preparations were made for building up the thinner reinforced-concrete walls, which were but 15 in. thick at the bottom, and 9 in. thick at the top, 40 ft. above. Diagonal wood strips were nailed on the inner face of the wood curbing and to these a tight lining of tongued and grooved flooring was nailed. This deflected the water-streams to the bottom of the lining, and short pipes were placed through the concrete forms at a number of points around the shaft, so as to discharge the water from behind the wood lining into the open shaft. By this method the reinforced walls were erected with freedom from running water.

The reinforcement consisted of deformed bars placed horizontally and vertically near the inner face (that is, toward the centre of shaft). The vertical bars (½ in. square) served only to bond the courses; the horizontal bars (⅞ in. square) were spaced close together at the bottom, and farther apart at the top, according to calculated water and earth pressure, assuming no help from the outer wood curbing. The horizontal reinforcement bars were bent around

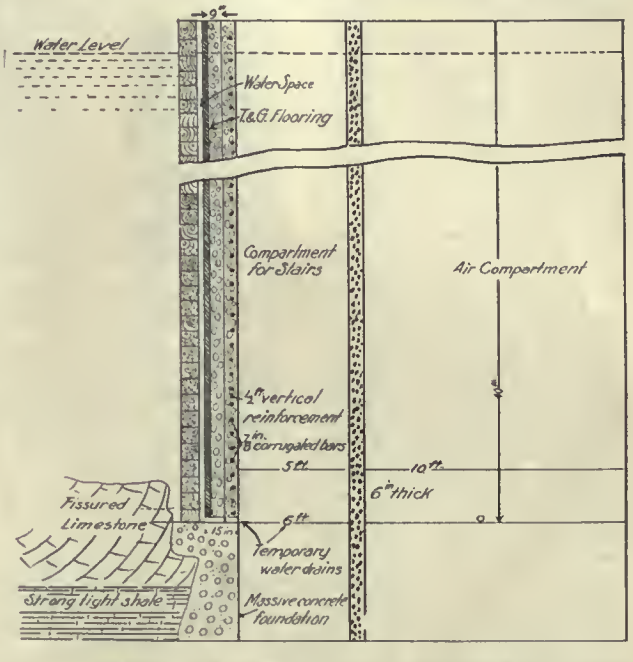


FIG. 1.—SKETCH OF RECTANGULAR REINFORCED-CONCRETE SHAFT-DAM TO WITHSTAND WATER AND GROUND-PRESSURE.

at the corners of the shaft, which were beveled. The shaft had two compartments about 9 by 10 ft., and 9 by 5 ft. in the clear, with a 6-in. concrete partition between.

When the concrete had sufficiently hardened, the drainage pipes were plugged, and the walls then served their purpose as a dam. There was a slight seepage at several points, but this gradually stopped.

Drop-Shaft Sinking

Where the glacial drift or water-bearing silt is very deep, special methods of shaft-sinking have to be employed. The freezing system and the drop-shaft system have been highly developed in Germany and France, and to a point where both are very successful. Reinforced concrete is adaptable for linings in connection with either system, but it has not as yet been employed to any considerable extent.

In this country, little has been done with either of these systems, chiefly because there has been no general need, as shaft-sinking conditions are ordinarily easy. More recently there has been occasion for penetration of water-bearing silts in the Lake Superior iron mines, and one reinforced-concrete casing has been successfully sunk. The plan of the casing was similar to the ordinary drop-shaft casing of brick so extensively employed in England, namely, to build on top of a steel shoe which drops as the excavation proceeds. Skin resistance to descent of the 'drop-shaft' is the chief obstacle usually encountered so far as the casing is concerned, and this has to be overcome by weighting.

The concrete bridge pier caissons sunk in Western river silts, and the caissons used in the vicinity of New York

*Address delivered by permission of the Director, U. S. Bureau of Mines, before the National Association of Cement Users.

for shafts preliminary to tunneling, are of the same nature as drop-shaft casings, except that their greater size and weight, relative to depth, makes the problem of sinking them simpler. The small caissons sunk for foundations of high buildings are more akin to mine shaft-sinking, except the depth is usually less, so air-pressure can be used to hold back the water.

Drop-shaft casings can be sunk by dredging with clam-shell or orange-peel buckets under water when the material is silty or sandy. If complicated by glacial boulders bedded in hard clay or natural cemented material, it is necessary, when the work is too deep for air-pressure, to pump out the water and excavate by hand with the assistance of explosives.

The method of using reinforced-concrete casings seems applicable to many situations where it is necessary to sink through bad ground, modifications being made to suit the condition of the sand or glacial drift that may be encountered.

Cementation of Wet Ground

A most interesting method used in connection with shaft-sinking or tunneling through water-bearing ground has been developed in the Pas-de-Calais coal district of France, which is termed 'cementation.' The coal measures of the district are overlain with bedded marls and chalks, more or less fissured, and the fissures in some places are so filled with water that ordinary methods of shaft-sinking would fail. Heretofore, the freezing system has been successfully used, but the new cementation method, I have been informed by French officials who had used both methods, could be employed at less cost.

In one instance, the cost of cementation through 343 ft. of water-bearing ground was $13,200. Interesting particulars of this work are given in a paper† by J. Lombois, principal engineer of the Mines de Bethune.

Briefly, the process used by this company is to drill a set of holes, six in number, in the water-bearing ground, arranged in a circle, surrounding the site of the proposed shaft, and then to pump a cement grouting through the holes until the fissures and interstices are filled. Shaft-sinking is then carried on as it would be through ordinary rock strata. The system seems applicable to many situations where water is encountered in either shaft-sinking or tunnel-driving in broken rock.

Overcasts, Stoppings, and Dams

Concrete has already been adopted by many mine operators in the building of overcasts (air-current crossings). These have usually been of massive construction. If reinforcements were employed, the cost of overcasts, also of stoppings and dams, might be considerably reduced. Some operators use small coal for stoppings in place of crushed stone. If the coal is sufficiently tough and properly screened, in massive stoppings this is economical, but often too much coal-dust is used, so that an excess of cement is required and the concrete is very weak. Such concrete is not suited for stoping or water dams where there is likely to be much pressure thrown upon them.

Concrete Timber-Sets

There appears to be an even better opportunity for the development of a system of outside-constructed reinforced timbers for passageways than there is for room-props, since timber-sets are intended for permanent use and greater strength is required. In collieries, each timber-set consists of a collar and two posts or legs. The collar is perfectly square in cross-section; the legs may be either round or square. It would be necessary to have legs of different lengths, but this entails no particular difficulty; small differences are easily taken care of by picking the footing deeper, or wedging over the top of the collar. That there is a field for the use of concrete timbers is shown by the increasing use of I-beams for collars, and for legs. Concrete timbers for equal strength would be more durable and should be cheaper.

The opportunity for use of concrete posts and timber-sets in certain kinds of metalliferous mining appears to be as great as in collieries. Often great strength is needed, and in some parts of the country, as in the Southwest mining districts, big timbers are difficult to obtain and very expensive. Crushed rock for concrete is nearly always at hand in metal-mining operations, and portland cement can now be obtained at moderate price in any part of the United States. Reinforcing material is often found in the scrap-iron pile. In some cases, large concrete timbers could be built in place, but in many instances, owing to the condition of the roof, it would be necessary to have the full strength of a concrete timber or beam at the time of erection; hence the necessity of having concrete timbers constructed and seasoned in advance of setting.

Concrete Ties

Among other mine supplies subject to rapid deterioration, there is the considerable item of track ties. Frequently there are miles of track in a mine, especially in a large colliery, for which an immense number of ties is required, running into the tens of thousands in a single mine.

Ties have a shorter life than props or timbers, as they are subject to both wear and rot. In most mines the floor of the roadway is generally damp, and in the case of bituminous mines it is purposely wetted in order to lay the dust. This damp condition favors the rotting of ties. Ties, as a rule, are made of oak, preferably white oak, and are either split or hewn like railway ties. They have to be renewed at intervals of 2 to 4 years. Here then is an opportunity for concrete ties if they can be adapted to the conditions. Possibly, if made light and durable enough, they could be used for temporary ties and be taken up and relaid like the rails in other parts of the mine when the room was finished.

In the development and testing of concrete props, ties, timbers, as well as the concrete linings previously mentioned, there would appear to be need of work on the part of the United States Bureau of Mines to undertake tests under practical conditions in order to benefit the mining industry.

The aggregate of new construction for mining plants annually reaches large sums. In the case of large modern collieries, a single plant may involve, exclusive of machinery, for outside buildings and miners' houses, from $100,000 to $200,000. Generally the construction of the mining plant is under the direction of a mining man, and the buildings are treated as incidental to the machinery and mine development. Under such circumstances, the construction of the general buildings is not given the thought and attention that they warrant, and buildings are often makeshifts. If concrete builders would give the subject the same study that they give to bridges and buildings for manufacturing, and be prepared to take up the construction of mine buildings of various kinds with promptness, there appears to be a large field of usefulness, productive of improved construction and adequate fire protection.

The use of lignite in gas-producers, with subsequent employment of the gas in gas-engines, continues. Satisfactory progress in this direction has been made at several large establishments. It is likely that the use of a tar-less gas-producer, such as has been in successful operation on Colorado lignite, would be advantageous in Texas. It is also suggested that an effort be made to save the ammoniacal liquor from the gas-producers and use it in the manufacture of ammonia compounds, such as anhydrous ammonia, sulphate of ammonia, etc. The briquetting of lignite does not seem to appeal to the trade, and there is no plant in operation in the State.

Accidents in mines are more common on night than day shifts, and at one large mine where careful records have been kept, 60% of the accidents have happened in the first few days following a change of shift. It takes a short time for the men to accustom themselves to sleeping by day, and there are always some who work 'long shift' following change-day.

†*Bulletin de la Societe de L'Industrie Minerale*, Vol. IX, 1908.

The Copper Situation

The drastic measures employed last month to bring consumers into the copper market, the price being broken to less than 12c., evidently failed to even temporarily bolster the situation. Copper is working to another crisis, to the point where a group of high cost producers must suspend operations for the time being. During 1910, the accumulated visible supply reached a high figure in July of 170,640,678 lb. It was during the latter part of 1910 that the co-called curtailment policy was inaugurated and the hope generally expressed that the output would be regulated and the metal market materially strengthened.

Now the copper surplus is again reaching a danger point. Instead of the hoped-for decrease, the Producers' Association figures for March showed an increase of 3,547,974 lb., making accumulated stocks total 165,555,908 lb. The surplus abroad as of the same date is 173,687,360 lb., making a world surplus of 339,243,268 lb. While the dead weight of the accumulated copper is a burden, it is the continued high-pressure production that renders the situation acute. At most, accumulated copper means a world's supply for not more than sixty or ninety days, but it seems now to be impossible to regulate production, especially so long as the porphyry properties dominate the market. These mines can show profits only when operated on a gigantic scale, and the loss entailed by partial or complete shut-down must be estimated in proportion. The Nevada Consolidated's quarterly report, just issued, shows a production for the first quarter of 1910 of 15,893,743 lb., produced from ore averaging 1.84% at a cost of 6.99c. per pound. It is evident from the company's statement that the property is capable of still greater things. On the Liberty Pit 8½ acres has been stripped of overburden, and this part of the ground is expected to furnish 2000 tons of ore per day when called upon. The entire plant will be using fuel oil instead of coke by July. Utah Copper shows a production during the same period of 21,296,709 lb., costs being 8.434c. per pound.

The figures are not particularly important for comparison and analysis, save to officials and stockholders. The general public and the holders of shares in other concerns need study results only to estimate the possibility, or rather the impossibility, of regulating output. It is so patent that mines and plants, such as the two leading Guggenheim properties mentioned and others now in the making, and upon which millions of money have been expended, must operate at a profit, if possible, at some loss if absolutely necessary, but in any event, must keep going to avoid the terrific loss entailed by anything approaching a shut-down. Copper metal and copper shares can improve and advance from the present position only by a working out of the law of the survival of the fittest. The high-cost producers will have to do all of the curtailing.

Gold Mining in Korea

The most important gold mines in Korea are operated by American companies. The important Oriental Con. mines at Taracol and Tabowie have often been described and the Chicksan mines south of Seoul were described in the *Mining and Scientific Press* of April 1. Another important mine is the Suan copper and gold mine. This was formerly operated by the Korea Syndicate, an English company which did not meet with the expected success, and in 1908 sold the concession to Collbran & Bostwick, a well known American firm which has done extensive engineering work in Korea, who in 1909 erected a 20-stamp mill on the property and in 1910 added 20 more stamps. The ore offers a good deal of trouble in milling, as it is difficult to save the copper, and bismuth, present in the ore, interferes with the catching of the gold. The mill treated 32,793 tons of ore during 1910, 389 tons of concentrate was shipped to Tacoma, together with 707 tons of high-grade ore. The bullion produced in the mill was worth $263,482, or $8.03 per ton, and the ore and concentrate realized $104,468. The profit was $215,151, out of which $64,597 was used for capital expenditure, chiefly for the purchase of the additional plant, and $100,000 has been distributed as dividend. As regards the extraction, 67% of the gold content is recovered on the plates, and 11% in the concentrate, making a total of 78%. The recovery of copper is only 18%, which shows that the concentration plant is unsuited to its work, losing not only copper, but also gold. The ore reserve on December 31 was 190,000 tons assaying $13.42 gold and 1.76% copper. Since then rich ore has been found on the 400-ft. level.

Manufacture of Coalite a Failure

About two years ago information was published about 'Coalite', a patent fuel, that was being boomed by company promoters in London. It now develops that, so far, it has been a ghastly failure. The promoters started with too much mystery and with too many claims. As was previously mentioned, coalite is a semi-coked bituminous coal, the coking process being conducted at a lower temperature than when gas coke or metallurgical coke is to be produced. Only one-half of the volatile matter is expelled, so that the product gives a cheerful flame in the open grate; while the coal is made sufficiently porous to allow the requisite amount of air to come in contact with it, in order to prevent the formation of smoke and soot. Theoretically it was an ideal fuel for the Englishman, who loves an open fire, and who hates closed stoves, hot air, and steam-heat. Enormous amounts of capital were raised and spent on plants in various parts of the country, and quite a number of eminent scientists and manufacturing engineers lent their names to the scheme. The true facts have now come out, and Herman Clarke, who was recently appointed manager, has given a plain, unvarnished tale to the unfortunate shareholders. He reports that 100 tons of bituminous coal will give 72 tons of coalite, 65 tons of gas coke, and 70 tons of metallurgical coke, according to the method of treatment. The corresponding amounts of by-products are 5000, 11,500, and 10,500 cu. ft. of gas; 22, 9, and 8 gal. of liquid hydrocarbons, and 16, 26, and 27 lb. of sulphate of ammonia. The candle-power and thermal efficiency of the coalite gas is higher by 30% than that of the other gases. It has been found that coalite is of no commercial value as an adjunct of gas manufacture, and all of the plants erected at gas works have been making a dead loss. As far as the coalite itself is concerned, it is found, under present methods, to be much too brittle, and quite one-half is lost as dust, fine, or slack, that brings no price in the market. Mr. Clarke is of opinion that the only hope is to centre operations on the improvement of mechanical handling, in order to produce a strong enough material, for, as a household fuel, coalite certainly has a promise. Two years ago there was a controversy as regards the value of the patents, and it was generally argued that they were not valid, for the process is simply a reversion to the old methods involved in gas manufacture and in the production of metallurgical coke. Modern methods adopted in these two industries naturally aim at a hard coke produced at a high temperature, and they have been successors to the older and less complete reactions, now represented by coalite. No lawsuit was ever started with regard to the validity of these patents, because it was to nobody's interest to do so. Therefore, the question of the validity never came before the courts.

Transvaal Gold Production

The Transvaal gold production for the month of March is given as 676,065 oz. of fine gold, valued at £2,871,740, being £277,106 more than the output for February. This output constitutes a record, being £65,505 more than for December 1908. Negotiations are in progress between the Union Government and the Government of German Southwest Africa on the subject of the recruitment of natives. The Transvaal Chamber of Mines has requested that the

question of reciprocity also be discussed. The new post-office bill provides that the Governor general may make regulations providing that gold and diamonds shall be carried exclusively through the medium of the post-office.

The Motter Method

By Paul W. Gaebelein

A lot of 2000 lb. of ore from the Gubucia mine, at Ocotlan, Oaxaca, Mexico, was recently treated by the Colorado Metals Extraction Co. of Denver, at its 20-ton plant, in which the Motter process is used. The ore was a complex sulphide, an assay of which showed the following: Gold, 0.11 oz.; silver, 5.4 oz.; lead, 3%; copper, 5.9%; zinc, 10.5%; iron, 13.2%; sulphur, 14%; silica, 52%. The treatment consisted of dry-crushing to 20 mesh, roasting in the Motter furnace, forming sulphates of copper and iron; leaching to recover copper, and concentration to separate lead and zinc, as these were the metals which had proved difficult to recover. After concentration, the following results were obtained: Lead concentrate: silver, 36.3 oz.; gold, 1 oz.; lead, 76%. Zinc concentrate: silver, 7.4 oz.; zinc, 46.6%; iron, 2.9%; silica, 14 per cent.

No attempt was made to recover gold by amalgamation, as practically all the gold and silver went into the lead concentrate. The copper, of which 95% was recovered, was obtained as high-grade cement copper. The zinc concentrate was cleaned of magnetic iron by magnetic separation, and the product, 46.60% zinc, is a high-grade product. By a more careful concentration, this percentage could undoubtedly be raised to 53%, but the lower product is marketable at a good profit. The treatment effected an extraction of 90% of all the metal of value, a most gratifying result.

Australasian Gold Production

The gold yield of Australia and New Zealand for January, as given by the *Australasian*, shows a falling off as compared with the corresponding month in 1910 and 1909. Each State in the Commonwealth has to report a decreased output, but New Zealand shows an improvement. The following is a comparison of the figures for January, including approximates for South Australia and Tasmania, with the totals for the corresponding month in 1909 and 1910:

	Jan., 1909. Fine oz.	Jan., 1910. Fine oz.	Jan., 1911. Fine oz.
Victoria	40,756	52,057	42,611
New South Wales	16,739	18,319	13,397
Queensland	24,486	29,812	24,183
Western Australia	132,286	127,350	119,497
*South Australia	780	620	1,000
*Tasmania	5,000	3,700	3,000
Total Commonwealth	220,047	231,858	203,688
New Zealand	34,318	37,868	46,067
Total	254,365	269,726	249,755

*Estimated.

Russian Copper in 1910

The quantity of copper smelted in Russia during 1910 amounted to 1,383,456 poods.* This quantity may be compared with 1,128,939 poods in the year 1909. It is an increase in production of 22%, an important one, particularly when we take into account that the production of copper in 1909 showed a considerable excess over 1908, when the production amounted to 1,031,201 poods, and still more is the contrast striking when compared with the production for 1907, which amounted to only 900,935 poods. Thus the production of copper in Russia in 1909 exceeded that of 1908 by 97,738 poods or 9.4%. That of 1908 exceeded that of 1907 by 130,266 poods or 14.4%; in the total production for 1910 as compared with 1907 we have an increase of 13 per cent.

It is useful now at the end of the year's work to give in detail the production of the various copper producing districts of Russia for the past four years.

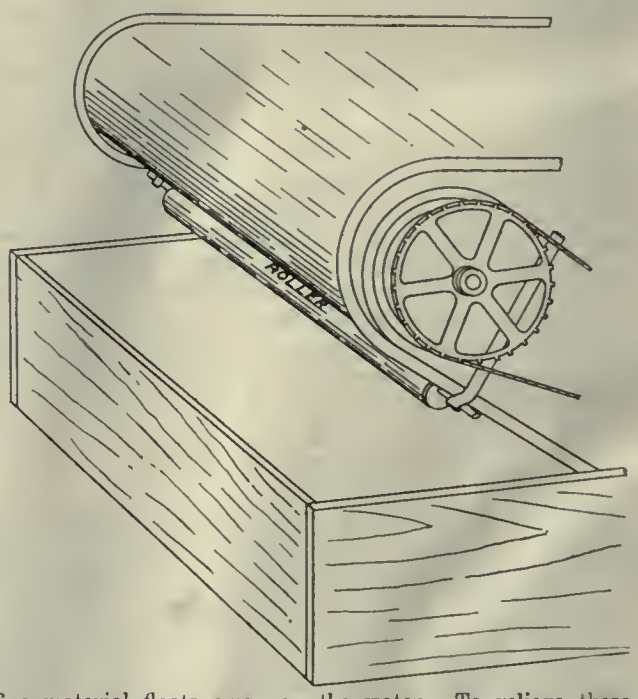
	1907. Poods.	1908. Poods.	1909. Poods.	1910. Poods.
Ural district	457,906	522,583	530,773	656,770
Caucasus	310,238	298,893	391,290	470,745
Altai	2,800	5,280	5,211	3,540
Siberia	66,157	149,829	150,582	195,900
Total	900,935	1,031,201	1,128,939	1,383,456

Lastly, we have to take account of the chemical works and refineries which can hardly be itemized, but which are probably responsible for re-smelting a large quantity of waste. These produced 63,834 poods in 1907, 54,618 in 1908, 51,084 in 1909, and 56,500 in 1910. It will be observed that the chemical works do not make much progress; this indicates that as the country progresses as a copper producer more smelters are being erected at the mines, and the chemical factories are less depended on except for handling waste and scrap. A description of some of the districts is given in the St. Petersburg letter in this issue.

*1 pood equals 36.11 pounds.

Concentrate Collecting Device

The concentrate collected by vanners is always fine-grained and usually high grade. As the belt comes to the head of the machine wash-water is run on it and the concentrate is expected to fall into the box set below. Actually much of the fine material is held on the belt by adhesion and the surface tension of the water until the first box is passed. To recover this material other boxes are placed in order and the belt dips down into water in one of them. It is necessary to scrape the material out of these boxes from time to time, and with the best care some



fine material floats away on the water. To relieve these conditions a wooden roller is sometimes placed as shown in the sketch above. By proper adjustment this can be brought up against the belt with any desired degree of tension. It operates to dry the concentrate and cause it to fall more readily into the box below. This device is in satisfactory use at a number of mines along the Mother Lode of California and elsewhere. It was invented by W. G. Dodd and first manufactured by the Union Iron Works of San Francisco, being placed on the Union concentrator. Similar devices have since been manufactured by others and may, indeed, be easily made at any mine.

Concentrates

Most of these are in reply to questions received by mail. Our readers are invited to ask questions and give information dealing with the practice of mining, milling, and smelting.

A PUMP designed to raise approximately 400 gal. per minute should have a suction-pipe about 9 in. diameter, delivery 12 in. diameter, and the piston 12 in. diameter.

ASSESSMENT WORK must be done on all unpatented mineral land in the United States; none is exempt. The assessment for next year can not be done the present year. If several thousand dollars worth of work be done this year it can not be applied on next year's assessment.

THORIUM MINERALS are in constant demand for use in making incandescent mantles for gas-lamps, but only one mineral that carries much thorium—monazite—has thus far been found in quantities large enough to make it commercially valuable. Some specimens of monazite contain as much as 20% of thorium, but it is generally less than 10 per cent.

MONAZITE is principally obtained from Brazil and the United States, which supply the world's demand, although the greater part of the output of the United States is used in this country. For many years North Carolina and South Carolina have furnished this supply, but important deposits have been lately discovered at several places in Idaho.

ELECTRIC SQUIBS may be used instead of electric fuses when blasting powder is the explosive used. They are made on the same principle as the electric fuse, but cost less, as a heavy paper shell replaces the copper cap of the fuse. As the charge in an electric squib does not detonate, but burns or flashes, it will not detonate dynamite or other high explosives, and can be used only with blasting powder or other low explosives.

DEGREES BEAUME, a term which is in common use among petroleum operators and refiners, is apt to be confusing to those who are not acquainted with the method by which the system of units was established. For liquids lighter than water, among which is mineral oil, the Beaumé measurements are opposite to those of specific gravity. That is to say, the greater the specific gravity of the oil, the lower the Beaumé measurement, and vice versa.

RECORDING GAUGES are used for many purposes about mines. In the dredging fields of California they are used by the Yuba company to give a continuous record of the depth at which the bucket ladder is operating. Incidentally they give a record of stoppages and delays, and allow the general superintendent to keep in close touch with the work of each dredge. Where electricity is used for power, the current-meter readings are also available and serve much the same purpose.

DUMPING rock and waste alternately from the same skip requires special arrangements at the top. At the Kennedy mine, in California, the manager, Webb Smith, has met the problem by building the rock-chutes below the ore-chutes. When rock is hoisted extra steel flanges carrying the usual curved track for engaging the skip-wheels and dumping the load, are run out over the shaft by means of a rack and screw. The skip-wheels follow the rails on these sheets and the rock is dumped in the appropriate pocket. When ore is to be hoisted these sheets are run back out of the way so that the skip travels to the higher platform before dumping.

MINING CLAIMS, in common with all patents for lands entered after August 31, 1890, or entries or claims validated by the Act of that date, are subjected to a reservation for "a right of way thereon for ditches or canals constructed by the authority of the United States." Since, however, the United States has not delegated this authority to the individual States and the right of eminent domain does not obtain against the Government, a claim held by possessory title is not subject to claims for right of way under rights granted by a State. The recent decisions of the United States Supreme Court make it clear that in all these matters the rights of the United States are supreme. After patent is passed the land becomes private property and is subject to State laws in all particulars.

ALUMINUM is used in iron and steel works for removing oxygen from the molten bath, the heat generated being so great as to raise the temperature of large bodies of iron. It also has the power of combining chemically with the gases imprisoned during the cooling of the metal, thus preventing porosity. For these purposes the metal is either used in the form of an alloy known as 'ferro-aluminum,' or as the pure metal, either in the granulated or bar form, or in small pieces weighing uniformly one-eighth or one-fourth of an ounce each. In the thermit welding process, invented by Goldschmidt, aluminum and iron oxide are intimately mixed in a finely divided state and ignited by means of a fuse. The heat of combustion of the ensuing reaction raises the temperature to the melting point. The reaction takes place in a funnel-shaped crucible, from which the fluid metal resulting from the reaction is run into a suitably shaped mold formed around the joint to be made, which is preheated by means of a blow-lamp to avoid chilling the first lot of metal coming through.

SAND-FILTERS are not properly appreciated among mill-men. They are widely used in connection with purification of water for city supplies and in certain situations may be applied advantageously in metallurgy. At the Kennedy mine sand-filters are used in the chlorination plant. The filter rests on boards raised from the bottom of the vat by one-inch wooden cubes. Above the boards is a first layer of quartz pebbles of 1 to 1½ in. diam., carefully set in place by hand. Above this and between the pebbles, is placed quartz of about ½-in. diam., and over that a layer of screened quartz of ⅛-in. size. The whole filter is about 5 in. thick. On top of the last layer of quartz, shoveling-boards are placed, being spaced about 2 in. apart. The roasted concentrate is dumped loosely on these boards. Contrary to general belief, such a filter does not become quickly clogged with slime, serving, indeed, without renewal for three months or more. The principle of the sand-filter has been applied by Bertram Hunt, W. A. Caldecott, and others, in mechanical plants, but in out-of-the-way places the simple form used at the Kennedy will often give good service.

A THREE-SHIFT system of work in a mine is rarely adopted except where time is a great consideration, as, for example, where a leasing company has only a limited period in which to operate, or where overhead expenses are unusually high. When three shifts are employed the men, at best, work only seven hours and a half to seven and three-quarters, while they always draw pay for eight hours. Three shifts also usually require one crew to follow another so quickly that the ventilation is poor and the men work at once ineffectively and under unhealthy conditions. It requires skillful management to handle three shifts effectively, though the overhead expense is thereby spread to cover more units of work. Where two shifts are employed it is customary to allow two or even four hours to intervene between one shift coming off duty and the other going on. In certain situations this is not economical. In hot countries it is bad for the men and destructive to their energy to make them dependent upon daylight hours for sleep. It is often better therefore to have the second shift follow the first promptly, so that, at worst, the men leave the mine soon after midnight and get the bulk of their sleep before day. They rest more, are better contented, and work more effectively. Such a plan necessarily involves as careful planning and as much attention to ventilation as though three shifts were employed.

Discussion

Readers of the MINING AND SCIENTIFIC PRESS are invited to use this department for the discussion of technical and other matters pertaining to mining and metallurgy. The Editor welcomes the expression of views contrary to his own, believing that careful criticism is more valuable than casual compliment. Insertion of any contribution is determined by its probable interest to the readers of this journal.

Western Australian Goldfields

The Editor:

Sir—As I am frequently asked about the new Western Australian goldfields by the roving and adventurous mining element—and, no doubt, there are many among your readers who would like the same information—I would suggest that a short article in your columns, stating briefly the nature and extent of the discoveries, routes, and cost of transportation from San Francisco and such other information as would be of use to one contemplating such a trip, would be appreciated. It is always quite an effort for those living remote from such news centres as San Francisco to assemble information of this kind.

PROSPECTOR.

Goldfield, Nevada, May 1.

[Australia is such a large country and conditions differ so in various parts that it is difficult to condense the information requested. However, as to steamship routes, there are three. The Union Steamship Co. of New Zealand runs an excellent line of clean comfortable boats direct from San Francisco to Wellington, with connections for Australian ports. Boats sail about every twenty days, and the time to Wellington is 22 days. From Wellington to Sydney, boats sail on Friday, arriving Tuesday. At Sydney connection is made with railways and steamships to all parts of Australia. By this route first-class fares to Sydney, Melbourne, and Fremantle are, respectively, $192, $205, and $242 one way. Second-class fares are $120, $133, and $170. Alternative routes are by way of Victoria and Canadian Pacific boats direct to Sydney or by any of the several lines from San Francisco to Honolulu, where connection may be made with boats direct to Sydney. Sailings of all these boats are announced regularly in the San Francisco papers. Details as to discovery of new districts and new mines are given regularly in our news columns, particularly in our monthly letter from Kalgoorlie. It should be remembered that Western Australia alone corresponds in size with the Great Basin and Pacific Coast portions of the United States. Much of it is unexplored. The rocks are mainly old and metamorphosed, and while men used to desert conditions in Arizona and Nevada would be at home there, they would have to unlearn and learn a great deal to prospect successfully. Extralateral rights are not recognized and titles carry leases rather than freehold. Aside from that, the mineral laws are not greatly dissimilar from our own, and they are extremely liberal throughout Australia, being designed to encourage prospecting and the influx of settlers. Fees are moderate and the States maintain helpful bureaus of information as well as geological surveys, and State stamp-mills where the prospector can have his ore tested at moderate cost. In our issue of November 24, 1910, we printed an abstract of an excellent article on the mining outlook in Western Australia, by A. Montgomery, the State Engineer. Any prospector going down there should inform himself thoroughly as to the habits and nature of camels, which in Australia are used as burros are in America. A story is told of one American prospector who neglected this precaution. However, after buying his camel and outfit he had $50 left and started bravely into the interior. The first night, in response to a question of the inn-keeper he said, "Yes, give the camel all he wants to drink." The next morning his bill was $41.50; $1.50 for his own bed and lodging and the remainder for eight buckets of water at $5 each. The expedition broke up right there, and that particular prospector came home as soon as he could earn money to pay his fare. This, however, need not discourage anyone else who is prepared to study the situation in advance and take a chance. Australia is a 'white man's country' with a low death rate, generally healthful conditions, and offers many inducements to those who have the pioneer spirit and are willing to make it their home.—EDITOR.]

Surface Indications of Ore-Shoots

The Editor:

Sir—The valuable and instructing contributions of W. H. Storms in the *Mining and Scientific Press* of October 22 are to the point. I have applied them in almost all cases of recommending or commencing of exploration and development during my mining and prospecting experience for the past 22 years. Mr. Storms' observation as to gulches, depressions, etc., crossing the strike of the vein is a rule, and the observations of others to the contrary are exceptions and only rarely occur. There is much to be learned from all of them nevertheless. But different localities present different conditions. I find in this district that wherever the percolating surface waters have access to the ore deposits for long periods, the metals disappear and are evidently carried away in solution. We miners call these cracks or fissures 'robbers,' as the occurrence of them is immediately followed by the impoverishment of the vein. Sometimes the veins or lodes are enormously rich and present all the appearance of a permanent orebody, yet upon following up the vein and never encountering a single fissure, fault, or break, the metals disappear from the gangue, neither hanging nor foot-wall carrying any ore, nor are any cross-leads to be found, but in the place of a former rich vein the same gangue still continues at its natural dip and strike, but absolutely barren. The explanation of this phase of distribution I had hoped might be brought up in the discussion. The others so far enumerated have been recognized by all miners and chloriders of any intelligence and experience. Some of the former disturbances disappear with the gaining of depth, but the latter that I have mentioned seems to me most disastrous to the miner, as it is unforseen, and in this district has never been followed out as to the final results.

So I will put the question before the mining profession as 'The Barren Zone Question and its Final Outcome in Arid Regions of the Southwest.' Kindly enlighten us chloriders and prospectors, as we are also members of the great mining fraternity and have to go first in cases of new discoveries.

LORENZ VON SCHOEN.

Fenner, California, April 14.

Re-Location v. Resumption

The Editor:

Sir—I fully agree with the statements and sentiments set forth in your editorial of April 22, under the title 'Relocation of Mining Claims,' and I am not at all in sympathy with the ideas of Messrs. J. W. Bush and E. L. Ballou, as expressed on page 565 of the same issue. The intent of the law is so clear that it seems strange than anyone should fail to understand its import. Moreover, the courts have so repeatedly passed upon this question, that there should be no further misunderstanding. To permit an original locator to hold a claim year after year without performing any work for its development or benefit in any manner is so clearly contrary to the spirit and intent of the law as to be absurd. I also think that the attempt of the California legislature to place a three-year limit to the holding of title without doing annual labor, was a mistake. It is not an improvement of the existing Federal law. Under the Federal law, should a man locate a claim on the first of June, of the present year, then, except in those States that require a specified amount of work to be performed within a given time, usually 60 or 90 days, as a part of the act of location, the locator has all of the remainder of the year 1911, and all of the year 1912, up to midnight of December 31, 1912, within which to begin the performance of the so-called annual labor. Failing to initiate this work within this time, and to continue it until not less than $100 worth has been

performed, his title, by right of location and possession, ceases upon the opening of the new year 1913, should a stranger appear at that hour to re-locate the claim, as provided by the Federal law, and the original locator has no recourse whatever.

There is a strong sentiment in some districts against this interpretation of the law. In 1905 I was in a mining camp where I had not been for many years. I noticed a cut up on the hillside 200 ft. above the village street. "Who owns that claim?" I inquired of a resident. "Jim Smith," was the reply. "How long has he owned it?" I asked. "Oh, ten or twelve years, maybe longer," was the response. "Where is his development work?" I then inquired. "There it is," he answered; "that cut up there." I laughed at him and said, "Why, that hole was made there in 1879 by Kelley; I was here myself at the time. That claim has been open to re-location for at least 25 years." He looked at me in a peculiar sort of way, and quietly remarked, with significant expression, "There's lots of claims like that in this district, and anyone coming in and attempting to re-locate any of them would find himself most unpopular—it might be more healthy somewhere else." Of course this was largely bluff, still it was an expression of the almost universal sentiment of that camp and also of many others. If the veins should be found to be rich, or for any other reason a mining excitement should begin in the district such sentiment would be quickly set aside by men as courageous and determined as these old hangers-on, and moreover the newcomers would have the right on their side, and these long idle claims would all be re-located and held by the strangers, notwithstanding the protests of the old timers. I think the Federal statutes might be amended so as to state clearly what the law contemplates in this regard. No mining district ever came into prominence through the wholesale location of claims by a few individuals who did no work on their locations.

W. H. Storms.

Berkeley, California, April 24.

The Editor:

Sir—Have read with considerable interest the articles and editorials appearing in the *Mining and Scientific Press* from time to time, and particularly those appearing in the issue of April 22 anent the right of an original locator to relocate after failure to perform the required annual labor. As the Federal Supreme Court has not as yet passed directly upon this question, and until it does, no authoritative determination of the issue, applicable equally to all of the public domain, exists, I presume the matter is still open to discussion.

As stated in your editorial, the weight of authority undoubtedly is to the effect that the location as to the original locator is not vitiated nor his title extinguished by his failure to perform the annual labor, but that the same endures until extinguished by the initiation of a hostile claim by others; and that in the absence of such hostile claim, the original locator may resume work at any time with the same effect as though no failure had occurred. From this, it would logically follow, that in the absence of such hostile claim the location, so far as the original locator is concerned, is still a valid and subsisting claim, and one upon which he could not make a valid re-location. It could hardly be contended that the attempted re-location, *ipso facto*, constituted an abandonment of the original location, and if it did not, the attempted re-location, as stated in your editorial, is the best evidence that there never was a real abandonment or intent to abandon, and consequent extinguishment of the original location irrespective of the performance of the annual labor, and it is a well settled rule of law that no person will be permitted to take advantage of his own fraud.

But aside from these technical considerations of the case, the manifest intent of Congress in prescribing the annual labor requirement was to prevent speculators from perpetually monopolizing the public domain to the exclusion of bona fide locators, and the retardation of the development of our natural resources. To permit a speculator to hold his ground and exclude genuine locators merely by relocating year after year, would be so palpable an evasion of the reason and spirit of the law as to be unworthy of serious consideration. In the construction of statutes it is a well established rule of law that "Of every legislative act intelligent purpose can be predicated, and the end contemplated by that act and toward which it was directed by the legislative power, must always be considered in determining the character of the act itself; and when, under one interpretation the effects and consequences are absurd, unjust, or contrary to the public good, and under another interpretation such effects and consequences are reasonable and just, it is evident that the latter interpretation is alone correct."

I am sorry that the company by whom I am employed does not consider a good law library a necessary adjunct to the operation of a mine, or I might be able to cite some recent decisions bearing upon this important question.

C. W. L. Stevens.

Goldfield, Nevada, May 5.

The Editor:

Sir—Just what the makers of the law of 1872 intended in relation to allowing a claimant to re-locate as well as resume work to continue lawful possession of mining ground, might be made clearer by referring to the *Congressional Record* of that time. In the absence of this, the apparent absence of any court decision in the matter, and the custom of many years, makes it look, on the face of it, as though re-location is not prohibited, or that it opens a claim contest. That claim-holders are any more prone to strive for 'something for nothing' than men in other walks of life will hardly be asserted. The claim-holder looks at re-location as a question of choice on his part. When the last minute arrives he may maintain the title he already has by resuming work, or he may abandon what work he has done and acquire a new title by re-location. That abandonment preceding re-location is genuine appears when patent is applied for, the $500 worth of work having to show for the final location. A careful reading of the excellent special act for Alaska shows it can be readily interpreted to mean that in all other sections the claim-holder can himself re-locate his former ground. It would be no less fair to claim its sanction by Congress in the special Act of 1891 in relation to the Uncompahgre Indian lands, wherein the perfection of certain titles is contingent on re-location.

As far as getting the country prospected goes, it really is immaterial whether one man holds the ground without work, or whether a succession of locators hold it in like manner. Until $500 is expended a patent is not possible, and there are many chances of trouble for the claim-holder who fails to do his annual work.

E. L. Ballou.

Igo, California, May 6.

Uses of Manganese

The principal use of manganese ores, according to E. C. Harder of the U. S. Geological Survey, is in the manufacture of iron-manganese alloys such as spiegeleisen, ferromanganese, silverspiegel, and silicomanganese. The first two of these contain principally iron and manganese; the last two contain considerable silicon in addition. Ferromanganese and spiegeleisen are used in steel manufacture as reducers of iron oxide during the final melting, as recarburizers, and in the manufacture of special steels alone or in combination with chromium, nickel, tungsten, and other steel-hardening metals. Manganese is also used in the formation of alloys with copper, aluminum, zinc, tin, and other metals. Manganese ores or manganiferous iron ores are used to a slight extent as fluxes in the reduction of silver, lead, and copper ores. Manganese peroxide is used as an oxidizer in the manufacture of chlorine, bromine, and oxygen, and of potassium ferromanganate; as a drier in paints and varnishes; as a decolorizer of glass; and in the manufacture of the dry and the Leclanche cells.

Special Correspondence

ST. PETERSBURG, RUSSIA

ALTAI COPPER PRODUCTION.—FUTURE OF ALTAI INDUSTRY.—URAL PRODUCTION.—BOGOSLOFF AND KYSHTIM.—INCREASE OF PRODUCTION AND CONSUMPTION.

The smelting of copper at Altai (in the Suzunsky factory) is effected under the disadvantageous circumstances of absence of means of communication, resulting, of course, in a restricted development of the industries of the district, and it is further to be observed that the exploitation of the copper deposits up till now in that neighborhood can not be called active. The complexity of the Altai ore and the resistance it offers to treatment are hardly equaled the world over; and therefore at the present moment the smelting of copper at Altai may be considered only a survival of the past importance of the country as a mining centre.

Its future is by no means in doubt, though for the moment the Altai copper industry is quite insignificant, the production not only is not increasing, but the tendency is rather to decrease. The reasons for this are on the one hand the poorly developed condition of Russian chemistry, particularly in the handling of pyrite and also the rapid development of the metallurgical production of the red metal on the copper ore producing fields. If on the basis of the figures given on page 728, we consider the proportion of the increase in the production of copper-bearing districts in 1910, compared with 1907, we find that the Ural production has increased by 43.4%; that of the Caucasus 51.1, and that of Siberia by 206.8. Consequently, above all, the increase in the production of copper is most observable in the Siberian factories (Spassky, Yenissei, and the Dzhiltaffsky). This, of course, is quite comprehensible, because all these factories began production only at the beginning of the present century. In their case it is rather the birth of the production of copper and not the development of the industry that is to be considered. After the Siberian factories follow the Caucasus, where for the last few years the development of the copper industry has been rapid and extensive, particularly in the case of the Alaverdesky factory and the Caucasian Copper Co. and the Dzansulsky factory.

In the Urals the largest producing works is the factory of the Bogosloff, following which is the factory of the Demidoff's Successors. Independent of the activity of these producers of copper there is the Kyshtim company, which has had a considerable share in the Urals' output. This company produced 93,747 poods in the year 1910, against 17,502 poods only obtained at its works in the year 1907.

The foregoing confirms the estimates that have been made from time to time in the course of the year 1910 respecting the probable results of the copper companies' operations. It need only be briefly stated, in order to avoid repetition, that the copper situation in Russia is one calculated to give pause to other copper producing countries that have acquired the habit of looking to that land as a good and lasting market. The development last year indicates that within a brief period the country will be self-supporting in copper, and the only advantage that outsiders will have will be the cost of carriage from the great copper-producing centres of the Urals and Siberia to industrial districts near the ports, where water-carried copper has an advantage. But against this has to be set the enormous progress that has been made by the Caucasus, and there is no indication either here or in the other areas named—the Urals and Siberia—that either the source of supply will fail to respond to increased calls or that the production of the finished article is likely to be carried on with diminished intensity. Consequently the Caucasus must in self-defence, so to speak, become an exporter of metallic copper, and it will be a simple matter for the Russian Government to consider Caucasian copper shipped, say at Poti, Novorossiisk, or Taupse, to the South Russian ports in the Black Sea, or to the Baltic ports, in Russian bottoms, as not having left the country and consequently as standing free of import duty; so that Russian produced copper can be delivered by water carriage on the same terms, as far as freight is concerned, as other countries' copper; and enjoy the while the tariff protection. The industries of Russia are developing with great rapidity, and machinery requiring copper, including sugar-mills, cables, electric works at mines, and others, is being called for in ever-increasing quantities, so that after all the rising tide of home production may not fill the widening gulf of home consumption.

BLACK HILLS, SOUTH DAKOTA

DEVELOPMENT OF DUNN PROPERTIES.—CONSOLIDATION OF PORTLAND PROPERTIES.—SALE OF HIDDEN FORTUNE IS POSTPONED.—SALE OF THE ALDER CREEK.—DIVIDENDS FROM WASP NO. 2.—DREDGING NEAR MYSTIC.

The Deadwood Lead & Zinc Co. is the name of a new corporation, organized locally, to develop the Dunn properties on Spruce gulch, near Deadwood. Aaron Dunn is president and O. N. Brown general manager. A large body of ore carrying pyrite, zincblende, and galena is exposed in the workings. A carload has been shipped to the Safe Investment mill. The middling, containing the iron and zinc, will be shipped to Plattesville, Wis., where it will be treated by the Huff electrostatic process. The ore carries gold and silver, averaging $3 per ton, 5% galena, and 4% zinc.

The Trojan Mining Co. has been incorporated to consolidate the interests of the Portland, Clinton, and American Eagle companies, in the Portland section of the Bald mountain district. This gives the company 700 acres of mineral land, with a large amount of known ore. The American Eagle mill is being remodeled by moving the crusher from the top of the building to a convenient location beneath new ore-bins on the hill at the rear of the plant. A belt-conveyor will take the crushed ore to the mill-bins. Additional Dorr classifiers are being installed, a Dorr pulp-thickener and a stationary-leaf slime-filter. The plant will have a capacity of 300 tons per day. Electric haulage will bring all ore to the mill through tunnels and sheds. H. S. Vincent, of Deadwood, is general manager.

Sheriff's sale of the Hidden Fortune property has been postponed to July 8, upon representation of stockholders that a deal was on foot which would result in work being undertaken and all obligations met. The mines of the Black Hills Development & Financial Corporation, at Carbonate, are being developed to produce a weekly tonnage of 200 tons of gold ore from the Seabury-Calkins, and 100 tons per week of silver ore from the Iron Hill. Shipment is to commence soon. The Alder Creek property has been taken over by Illinois interests, and the cyanide-plant will be overhauled and electric equipment added.

Development work has been suspended by the Imperial company in the shaft at the head of Annie creek. The burning out of a motor in the station at the bottom of the shaft damaged the station and stopped the ventilating apparatus. Repairs will be made and work resumed shortly. P. H. Bertschy, who is leasing at another point on the Imperial territory, is making regular shipments to the Lundberg, Dorr & Wilson mill at Terry. Delay has been experienced at the Reliance in getting things in shape for starting the mill. One of the slowest tasks to finish is that of soaking up the tanks and making them water-tight. Twenty stamps furnished by the Stearns-Roger company, of Denver, have been erected in place of Chilean mills, and other minor repairs made.

Wasp No. 2, on May 1, declared its first dividend since the rebuilding of its mill, which was destroyed by fire in January 1910. The new plant was started in December. The plant is treating 500 tons per day, and the average bullion recovery is $2 per ton. Mining and cyaniding costs are less than $1 per ton. It is expected that the Castle Creek company's dredge, near Mystic, will be in operation before June 15, as it is practically completed. Another dredge is to be put in farther down the stream, J. Charles Sherman, of Pactola, having charge of this latter concern.

SALT LAKE, UTAH

SMELTER WINS SMOKE DAMAGE SUIT.—GOOD ORE AT ALTA.—UTAH SILVER PRODUCTION.—NOTES OF PROGRESS.—INCREASED PRODUCTION AT UTAH CON.—NEW LEAD FURNACES.

The U. S. S. R. & M. Co. has won the last of the smoke-damage suits brought against it, the jury, in the suit of Walter Steadman for $14,000 damages for death of sheep, bringing in a verdict for the company. The Sierra Nevada Prospecting Co., which sent out E. B. Learned to locate claims, has received a report that he has located some claims at Rose Springs from which rock has been sent in running $12 to $178 in gold. The roads to Alta have cleared of snow, and the mines of that camp are beginning to ship. The recent discovery in the Utah Mines Coalition at Alta has broadened into 8 ft. of shipping ore. The International Smelting company is handling more copper ore than ever before at its Tooele plant, the average running from 600 to 700 tons per day. The regular 2% quarterly dividend is promised this month. According to a circular from the U. S. Geological Survey, Utah was second in silver production in 1909, with a record of 10,551,100 oz., second in amount of ore treated with 5,119,325 tons, and sixth in gold production, with 203,818 oz. The Burro mine in City Creek canyon, within ten miles of Salt Lake City, will begin shipping ore this month. The Columbus Extension in the Alta district will extend its main tunnel 800 ft. farther to a point under the old Toledo shaft. The Utah Metals tunnel in Bingham is now in 5000 ft., or about half way through the mountain. Two shifts are averaging 5 to 6 ft. per day, at a cost of $11 per foot. The old Maxfield Mining Co., operating in the Big Cottonwood district, has changed its name to the Salt Lake Power & Mining Company.

By reason of improved conditions in the lower levels of the Utah Consolidated, that company has been able to increase its shipments to the Tooele smelter, that now amount to 500 tons of ore daily. The increased tonnage is due to the development which has been in progress during the last four months below the main haulage-level. The Tooele plant of the International S. & R. Co. is treating 700 to 800 tons of copper ore per day. Many contracts with operators for lead ores have been made by this company, and it has been decided that the two lead furnaces being built shall have the capacity of 500 tons each, instead of 250 tons, as originally planned.

GLOBE, ARIZONA

THE OLD DOMINION TO INCREASE MILL CAPACITY.—MIAMI MINE AND MILL.—ARIZONA COMMERCIAL.—INSPIRATION.—SUMMIT AND WARRIOR.

It is learned that the Old Dominion Mining & Smelting Co. has decided to add a 500-ton unit to its concentrator because of the existence of large bodies of concentrating ore in the United Globe ground. Plans for this addition are not yet perfected, but a set of 13 by 16-in. rolls and a 6-ft. Chilean mill are now being erected. During April the Old Dominion company concentrated 11,085 tons of ore and smelted 29,275 tons of charge. Its production for the month was 2,515,000 lb. of copper. The electric locomotive that was started on the fourteenth level in March has proved so satisfactory that another locomotive of the same type and size is to be put in use on the sixteenth level. The Kingdon shaft is now about 360 ft. deep. Sinking on 'A' shaft (the main shaft) has been begun. It will be sunk to the depth of 1800 ft. The new 'high line' connection with the Arizona Eastern road's main track will soon be completed. It will reduce the grade from 4% maximum to 2.8% maximum, and will be in operation by July. A shed is being built over the ore-bins at the smelter; a perfect mixing system direct in the bins will be completed by June 1.

The Miami mine and mill are working satisfactorily, although the mill is running at but half capacity because of the unfinished state of units 4, 5, and 6. The rest of the equipment of unit No. 4 will soon be ready, but it will be some time before the other two units will be operating. The three now in operation are handling 1500 tons of ore daily. The metal recovery at the mill is 75%, a saving the management expects to increase. The concentrate is averaging above 40% copper, which probably will be increased to 42% in the near future, and allowing for a loss of 2% at the smelter, there will be a net saving of 40%. The caving system is only advanced to the extent that light sets have been erected between the capping and the orebody. When the stopes and pillars recede as the ore is drawn out, these timbers will fall or be shot down, thus forming a mat of timber between the receding ore and the settling cap. The Miami company now employs about 500 men.

The Arizona Commercial cross-cut north from the 1000-ft. station has extended through the Black Hawk vein, 35 ft. in width, and is continuing north to explore the Old Dominion fault. The vein shows heavy mineral impregnation, but because it is badly broken where cut, it is impossible yet to get an assay that would give an average value. A drift is being run along the foot-wall of the vein, and cross-cuts will be cut through the vein at intervals. Copper glance ore running almost 80% was

MIAMI PORTION OF GLOBE DISTRICT.

cut by the winze below the seventh level. The ore was found where the diamond-drill had penetrated the glance, 90 ft. from the collar of the winze. The ore will not be developed until the winze has been sunk to the 800-ft. level. The shaft is now about 1100 ft. deep and is sinking at the rate of 2 ft. per day through the hard diabase. At the Superior & Boston excellent ore has been uncovered 35 ft. southwest from the south station of the 1000-ft. level. The ore is heavy in iron and contains glance, chalcopyrite, specks of cuprite, and silver. It is 20 ft. wide where found. The Great Eastern vein (which contains the ore) was missed in the development work for the past two months because of the increase in the dip of the vein. The Great Eastern vein is identical with the Black Hawk vein of the Arizona Commercial; and in all the workings above the 1000-ft. level in both properties the vein has dipped north at an angle of about 47°. The Superior & Boston management went far enough north to cut the vein at its supposed dip before driving westward to catch it. The revelation in the A. C. a few days ago of the abrupt 'straightening up' of the vein at the 1000-ft. level, led the other mine's management to abandon the west drift and start another southwest from the shaft. It caught the ore in 35 ft. The Live Oak's new shaft (No. 2.), being sunk by McIvors brothers and Ross, who made the best record for one week that has been made in the district, now has a depth of over 200 ft. Work preparatory to blocking out ore is in progress at the old shaft. Four drills are being operated on the property.

The Inspiration company has received its generator,

electric locomotives, and much of the underground haulage-equipment. The rails in the levels are being bonded and the wires are being strung. With exception of a drift to the east from the Colorado shaft at the 500-ft. (3350 ft. above sea-level) level there is not much underground work being done at the property, everything awaiting the building of the power-plant. Four drills are in use. The Summit company still finds high-grade ore on the 400-ft. level south, having cut it again in the vein sooner than expected from its features on the upper levels. The cross-cut being driven to the west to cut the Pasquale vein is about 300 ft. from the station. It has passed through the Intermediate vein. The vein is so small that it is improbable the company will develop it. No ore is being taken from the mine except such as is broken during development. The Warrior Development Company continues to ship from 100 to 125 tons of 10% chrysocolla daily to the El Paso smelter. Considerable development work is being done, and a churn-drill is being operated on the western part of the Warrior group. The German Copper Co. has been organized and will start work on its ground 2 miles north of Globe. The Manitou Copper Co. is an organization that has taken over the Five Points and Manitou properties about 8 miles west of Miami. Work on a 500-ft. shaft on the former group will be begun at once, a hoist will be erected, a pump installed, bunk-houses, blacksmith-shop, and carpenter-shop built.

EASTERN OREGON

BEN HARRISON MINE.—CORNUCOPIA MINES CO.—GOOD SHOWING ON THE GORMAN.—MORNING AND RED BOY.—SALE OF MORMON BOY.

The Ben Harrison, situated on Clear creek in the Greenhorn district, Grant county, was recently purchased by Ohio investors, headed by A. L. White, president of the Lima Locomotive & Machine Co. Air-compressors, Leyner drills, and other appliances for effective work have been provided, and about 50 men are on the payroll. The mine has ore-bodies from 12 to 15 ft. wide, the ore assaying from $15 to $20 per ton. W. C. Fellows is in charge.

The Cornucopia Mines Co. owns 41 quartz claims, 22 of which are patented, all situated at Cornucopia, Baker county. The shipping point is Robinette, on the Northwest railroad, 25 miles from the mines. The mines produced steadily for a number of years under the ownership of the late John C. Searles, and have recently come into the possession of Benjamin B. Lawrence and associates, of New York, who intend to add a new mill and cyanide plant. Two-fifths of the mine product is free-gold ore, which, with some concentrate, runs from $150 to $200 per ton. Several carloads are now in transit to the Oregon-Idaho sampling works at Baker. Present equipment includes a 20-stamp mill operated by electric power. About 70 men are employed. Robert M. Betts is manager.

The Gorman adjoins the Humboldt on the east end and covers the same vein that is opened in the Rainbow and Humboldt. The wash is deep on this group, and the biggest showing of quartz float to be found in the Northwest is strewn over the surface, some of the boulders weighing two tons. For years people have been hauling away this float to near-by mills and arrastres and treating it at a profit. Spokane people have become interested in the Gorman, and a force of men is now at work to open the vein. The adit is in 500 ft. and by driving 200 ft. farther the vein will be opened.

The Morning group of 10 claims has been bonded and is being developed by Frank E. Pearce, formerly superintendent of the Iron Dyke mines. The property is situated 9 miles from Austin, on the Sumpter Valley railway, in Grant county. The property is equipped with a 5-ft. Bryan mill, and concentrators. Ore 20 ft. wide can be mined and milled at a profit, and some shipping ore is in sight. Over 4000 ft. of work was done in the past, but the new work, under Mr. Pearce's direction, shows better results.

The Red Boy, which has been inactive for several years, is now owned by Ray Nye and associates, of Fremont, Nebraska. Mr. Nye arrived at Baker recently for the purpose of re-opening this property, and is arranging to sink 500 ft. below the present lowest level. The mine was formerly a dividend-payer. The location is near Granite, Grant county, 18 miles from Sumpter. It is equipped with a 20-stamp mill, hoisting machinery, air-compressors, and electric power. An ample development fund has been provided by the owners to carry out their plans. John Farrell is in charge.

The Mormon Boy group, in the Cable Cove district, near Sumpter, has been taken over by Sidney C. Love of New York, who is giving the development work his personal attention. The mine has a 3-ft. orebody; 2 ft. of this is of milling grade, and 1 ft., next to the foot-wall, is shipping ore. A cross-cut, 200 ft. below the old workings, is being driven, by which the vein will be reached at 175 ft. from the portal. Fifty tons of $115 ore is now piled up on the dump, and this will be forwarded to the Oregon-Idaho sampling works at Baker.

MEXICO

NO BULLION TO BE HANDLED BY MEXICAN NAT. RAILWAYS.—FEDERALS IN AGUA PRIETA.—CONDITIONS ON WEST COAST.—END OF TEZIUTLAN COPPER CO. SUIT.—MOCTEZUMA DAM.—MINING IN OAXACA.

A recent general order of the Mexican National Express Co. against the acceptance of money or bullion for shipment is affecting mining companies in Mexico. The order is expected to continue in effect until all danger of loss at the hands of revolutionists or bandits is past. Considering the unsettled conditions and traffic interruptions, shipments of ores and bullion over the National Railways of Mexico have been well maintained up to this time. So far the greater part of the decrease in earnings of the system has been chargeable to the falling off in passenger receipts. Ore, bullion, and oil shipments constitute over one-fourth of the total freight handled by the National Railways. The taking of Juarez by the revolutionists was followed by the announcement that the repair and operation of the Mexico Northwestern line would be permitted. This is important to some of the mines of western Chihuahua. As a result of the fighting around Agua Prieta, no trains were operated for nine days over the Nacozari railroad, which handles the shipments of the Moctezuma Copper Co., the Lucky Tiger Gold Mining Co., and other mines. The recent abandonment of Agua Prieta by the Federals caused apprehension among the companies using the Nacozari railroad, as it left them without customs facilities. However, the revolutionists have occupied Agua Prieta, and it is stated that they will handle customs affairs there, as they are doing at Juarez. Cananea was recently surrendered to the revolutionists, but the rebel occupation has not interfered with the operations of the Cananea Consolidated Copper Co. There is little fear of interruption there, unless rail communication with the United States is cut, shutting off fuel-oil supplies. If the port of Naco, also abandoned by the Federals, remains closed, all Cananea shipments will have to be handled through Nogales. A number of Southern Pacific bridges in Sonora and Sinaloa have been destroyed, and traffic is demoralized. The revolutionary activity in Sinaloa has greatly curtailed mining operations in that State. Mazatlan, the principal Sinaloa seaport, is under siege. Durango is without railroad service. Levies have been made on foreign as well as Mexican mining companies by armed bands, some of them posing as revolutionists, and others as bandits. Revolutionists have entered Pachuca, but there has been no attempt to interfere with operations in that district. Operations in the important El Oro district have continued without interruption. Disturbed conditions have affected mining to some extent in the Taxco district of Guerrero and the Zacualpan district of Mexico.

A Federal court decision, confirmed by the Supreme Court of Mexico, has lifted the embargo on the Teziutlan Copper Co., resulting from a judgment rendered last June. This

judgment was for ₱23,059,084 in favor of the Compañia Explotadora Mexicana, of Mexico City, against George D. Barron, at one time prominently identified with the Teziutlan enterprise. It disclosed the fact that the case had been in the courts since 1900. The Compañia Explotadora was organized in 1895 by men well known in Mexico, the object being to acquire and develop mines in the Teziutlan district of the State of Puebla, and Mr. Barron was elected president and general manager. The case against Barron was based on the allegation that the company authorized him to acquire the Aurora and other mines, which have since become big copper producers, and that, instead, he took titles in his own name and later transferred the mines to the Robt. S. Towne interests, which control the Teziutlan company.

The Moctezuma Copper Co., the Phelps-Dodge concern operating in Sonora, is building a dam to hold storm-water for use at its 2000-ton mill at Nacozari. Scarcity of water at the end of the long dry season each year has forced the company to curtail operations. It is believed that the storm-water gathered will be sufficient to give the mill an adequate supply throughout the year. The production of the Moctezuma company in the first quarter of the year was 5,738,054 lb. of copper, as against 5,852,608 lb. in the

THE NATIVIDAD MILL, SIERRA JUAREZ, OAXACA, MEXICO.

first three months of 1910, and 6,500,583 lb. in the same period of 1909.

In spite of conditions prevailing in several regions of the country, mining in Oaxaca seems to improve a good deal, owing to the fact that in some of the operating mines workable orebodies have been found recently. Among the mines that are now in good shape is the Natividad mine, a Mexican company situated in Sierra Juarez, 36 miles north of the city of Oaxaca. This mine is in an old mining camp of somewhat complicated geological structure composed of black slate and limestone cut by several instrusive bodies and dikes, the former much eroded. In the Natividad mine there are three parallel veins near each other, two of them large (from 4 to 12 ft.), and the other a narrow but sometimes very rich one. The three are flat veins dipping to the west, while their strike is north-south.

The veins have a brecciated structure and are composed of quartz and pieces of slate or porphyry through which are disseminated the metallic minerals, mainly gold, a little silver, and variable amounts, though always abundant, of zinchlende and galena. Iron pyrite is present always in the veins and is associated with the gold. The ores occur in pockets of variable size, but large enough to pay big profits when a pocket is found. The mine has at present two orebodies in hand, and the ores left in the old workings are also worked. The Natividad company has a 70-ton cyanide plant that may be increased to 100 tons when the new power plant is finished. With the new ditch at present being constructed, a head of 600 ft. is obtained and 800 hp. will be developed. The mill has 30 stamps, two tube-mills, and employs Pachuca tanks with a modified method of agitation. Owing to the character of the gold and especially the silver, recovery is not very high, but the company expects to obtain better results by improving the concentration.

This company has not paid dividends for several years, but there is every prospect that it may pay some in the near future. Well informed people say that the ore actually developed represents a gross value of ₱1,500,000. The Sierra Juarez is a country magnificently carved by erosion, with deep *barrancas* and steep mountains, while big blocks have been displaced by faults. The old carving work has been refilled with more recent volcanic overflows, mainly of andesitic character, cut again by younger active erosion.

GOLDFIELD, NEVADA

April Report Goldfield Con. M. Company

In his report for April, J. F. Thorn, general superintendent, gives the following figures:

During the month of April, the total production of the company was 28,253 tons containing $1,061,496, or an average extraction of $35.75 per ton, or 95.16%. The total net profit to the company was $796,151, or $28.18 per ton. The development work amounted to 3961 feet.

The total cost of mining, development, transportation, milling, office and general expense was $7.68 per ton, distributed as follows:

Mining:		
Development	$1.11	
Stoping	2.21	
		$3.32
Transportation		0.09
Milling		2.22
Marketing		1.10
General expense		0.37
Bullion tax		0.52
Construction		0.06
Total cost of operation		$7.68

During the month 330 tons of ore was mined from the sill-floor of the 136 stope on the second level of the Combination mine that averaged $200 per ton. Another orebody was found 50 ft. west of the 136 stope that will probably connect up with the main stope, making a stope 75 ft. long and 10 to 15 ft. wide.

In the Mohawk mine the 260 sill-floor on the second level, and the 354 sill-floor on the third level were considerably extended. One thousand two hundred and twenty-three tons of ore that averaged $30 per ton was mined from the 354 sill. The 384 and 385 drifts, on the third level, on the foot-wall of the 354 stope were extended 100 ft. through ore that averaged $20 per ton. The foot-wall was not exposed, but the indications are that the orebody will be about 10 ft. wide, and is now opened up 200 ft. in length; the face of the south drift still being in ore.

In the Clermont a winze is being sunk through the 604 orebody to connect with a raise from the 1200-ft. level of the Grizzly Bear. The winze was started in the hanging wall of the orebody and was rather low grade, but it is now down 50 ft. (on the incline) and is averaging $50 per ton. It is hoped to have the raise and winze connected about the first of June, and will then have good air and can rush development work on the 1200-ft. level. Two hanging wall cross-cuts are being driven on this level (one north and one south of the Grizzly Bear shaft) and the quartz mass is wider and stronger than on the 1000-ft. level of the Clermont. The 700-C hanging wall raise, which is practically a cross-cut on the 1200-ft. level 200 ft. south of the shaft, cut six or seven feet of ore that averaged $12 per ton. The air on this level has been very bad, and until the winze and raise are connected it will not be possible to do much work on this orebody. The mines as a whole are looking well, and are producing about 940 tons per day, which is all being treated at the mill.

General Mining News

ALASKA

W. H. Parsons, of the Dexter-Horton National Bank of Seattle, estimates an output of $10,000,000 in gold from the interior camps of Alaska this season, including Fairbanks, the Koyukuk, and Iditarod.

Juneau District

The report of the Alaska Treadwell Gold M. Co. for the month ended April 15, 1911, shows 31,416 tons of ore crushed in the 240-stamp mill, and 20,636 tons in the 300-stamp mill, a total of 52,052 tons. In the former mill 600 tons of concentrate was saved, in the latter 407 tons. Estimated gross value of free gold recovered, $68,187.67; estimated gross value of concentrate, $42,239.88; total, $110,427.53. Estimated realizable value, $105,987.76; operating expenses, $95,889.98, leaving an operating profit of $10,097.78. Construction expenses, $10,013.11. Yield of ore milled, $2.12 per ton. Stock of ore broken, 20,911 tons; development work, 198 ft. in ore, 576 ft. in waste.

Prince William Sound

A. Von Gunther has purchased from Arthur Zilberman an interest in the Ground Cliff group of mining claims, situated near Valdez. A 7-ft. vein contains a good grade of gold ore. The Glacier group, situated at the head of Mineral creek, was sold to A. G. Brown and M. S. Griffith. Assays of surface ore across an 8-ft. vein are said to have shown $28 per ton.

ARIZONA

Mohave County

The Needles Mining & Smelting Co. is erecting a 2-mile aerial tramway, Trenton Iron Co. system, from the Banner mines to the foot of Stockton hill. It is stated by the *Miner,* published at Kingman, that the Santa Fé company is to build an 8-mile railroad branch from Berry station, 6 miles east of Kingman, to the lower terminal of the tramway for the haulage of ore mined in the Stockton hill camp, where the Needles M. & S. Co. has done a great deal of development.

The Tom Reed Gold Mines Co. recently made a clean-up of gold and silver bullion worth $76,500, as the result of 30 days run of its 20-stamp mill, and this is the largest product for any month since the mill was started.

The following data, taken from reports of mining companies to the county assessor, show the output of various mines of this county for the year ended May 1, 1911: Gold Road, $603,262 in gold, $6992 in silver; Tom Reed, $484,717 in gold, $5822 in silver; Needles M. & S. Co., $2007 in gold, $1419 in silver, 134,258 lb. lead, 95,844 lb. zinc; Golconda, $15,447 in silver, $18,189 in gold, 6,038,574 lb. zinc, 32,634 lb. lead; C. O. D., $14,268 in silver, $2666 in gold, 26,049 lb. lead; Adams lode, $1504 in silver, 4895 lb. copper. Totals: Value of gold and silver, $1,156,279; zinc, 6,134,418 lb.; lead, 192,941 lb.; copper, 4895 pounds.

Rich gold ore has been found in the low hills near Boundary cone, half way between Gold Road and Needles. The ore comprises quartz, containing free gold and oxidized iron.

Pima County

The Mines Company of America, which controls the Silverbell, Tombstone, Saddle Mountain, and other mines, also the smelter at Sasco, is reported as having decided to blow-in the furnaces of the Sasco plant to treat ore from the Saddle Mountain mine, situated at Christmas, in Gila county. Recent development in this mine of massive bodies of copper ore is said to be such as to assure a tonnage sufficient to keep the plant in operation. A considerable percentage of this ore is sulphide. Winkelman is the nearest shipping place, and this is close to Hayden, where the Ray Con. smelter is being built.

Pinal County

Two sections of the concentrating mill of the Ray Consolidated, situated at Hayden, on the Gila river, are treating over 2000 tons of ore daily, and it has been demonstrated that each section has the capacity to concentrate 1200 tons per day. The third section probably is in operation by now. Five more sections of similar capacity are under construction; the eight sections, when all are complete and in operation, are expected to treat close to 10,000 tons of ore per day.

CALIFORNIA

Amador County

The 40-stamp mill of the Bunker Hill company operated 26 days in April, mostly on ore taken from the 1950-ft. level. The bullion output for the month amounted to $27,000. It is claimed the vein has considerably widened at 1950 ft. depth.

The Central Eureka's 40-stamp mill was put in operation April 2, on ore of good grade that is being mined on the 1500, 2700, and 2800-ft. levels. This mine was profitably operated from 1900 to 1906, and was closed down in 1908, when the orebody was found to have pinched at the 2500-ft. level. Some time later than this an orebody corresponding to that of Central Eureka was found below the 2500-ft. level on the South Eureka, which led to the opening of the big reserves of ore now being mined on the 2700 and 2800-ft. levels of the Central Eureka. This important work has been performed under the superintendency of James Davis. The property is on Sutter hill, between Jackson and Sutter Creek.

Butte County

The Burlington Gold M. Co., having four patented claims close to Forbestown, has put in a gasoline hoist, and is letting a contract for 100 ft. of driving; the intention is to sink a shaft. The object of this proposed development is to be able to further define the ore-shoot found in the north-south vein on which a 435-ft. adit has been driven. The latter work shows the vein to be 4 ft. wide. Assays of a number of samples show an average of about $8 per ton.

Calaveras County

The Lightner Gold M. Co. started 20 stamps in its 60-stamp mill on May 15, and expects soon to have all stamps in operation. The new shaft, sunk during last winter, has a depth of 425 ft. Cross-cuts are being driven to the vein

NEW SHAFT, LIGHTNER MINE.

from the 300 and 400-ft. stations; the cross-cut from the 200-ft. station has been finished. The old shaft, 255 ft. from the new one, is used for taking timbers into the mine. The ore runs about $4 per ton. A new 250-hp. electric hoist has been put in use at the new shaft. The air-compressors are also electrically operated. The Lightner Gold M. Co. purchased the property from the old Lightner M. Co., and the litigation, recently mentioned, is between the old company and J. D. Coleman, and does not concern the Lightner Gold M. Co., which has undisputed control of the property. The operations are superintended by Bayles C. Clark, formerly of the South Eureka mine; J. R. Farrell, of San Francisco, is consulting engineer. The property is at Angels Camp.

The Melones Mining Co. mined and milled 148,900 tons of ore for the year ended October 1, 1910, at a total cost of $1.08 per ton. This mine, situated at Carson Hill, was

opened in 1895, after Eastern investors had become interested through the efforts of W. C. Ralston. The ore is worked by the shrinkage system and there are stopes 30 ft. wide by 350 long. The mill has 100 stamps, by which an average of 4.41 tons per stamp was crushed during the year named. The ore milled yielded $1.98 per ton, 42% of which was recovered by amalgamation, 58% by concentration. The extraction was 88%. The property is equipped for operating by both electric and water-power. W. G. Devereux is manager.

Inyo County

The Keane Wonder M. Co. has given George Wingfield an option on its mine and mill, situated on the west slope of Funeral range, facing Death valley, about 20 miles southwest of Rhyolite, Nevada. The mine has been under examination by F. J. Siebert for Mr. Wingfield. Homer Wilson, one of the stockholders, has had the management of the property, and two years ago built a 20-stamp mill and cyanide plant, since the completion of which 27,000 tons of ore, averaging about $12 per ton, has been treated.

Kern County

A small tonnage of ore taken from the King Solomon mine, Randsburg district, milled $240 per ton by amalgamation. Sinking on the property is in progress, and drifts on the vein are driven from the 50-ft. station. The property belongs to J. J. Miller. It contains the extension of the Butte lode.

Nevada County

(Special Correspondence.)—The Coan Mining Co. has begun operations, the results of which indicate that its property is developing into one of the good mines of the county. The 10-stamp mill is proving the ore to be similar to that of the other mines along the same lode, such as the Champion and Spanish. Ten men are employed. Dan McDonigal, formerly of Alleghany, is manager. The Pittsburg 20-stamp mill is working with two shifts on ore taken from the 1300-ft. level. M. B. Kerr is manager. At the Champion mill 20 stamps are dropping on good ore. It is stated that the North Star Mining Co. expects to take over the Champion group.

Nevada City, May 16.

The Arctic group of 12 claims, belonging to Ole Helgeson and Martin Van Berg, and situated on Canyon creek, 7 miles east of Washington, has been leased and bonded to J. P. Flint and associates. The claims cover a mineralized zone, said to contain seven parallel veins of gold ore in granite. Canyon creek cuts through the vein system at right angles, exposing the formation and making it possible to open the veins at a depth of 1000 to 1500 ft. by adit-levels. It is announced that a mill for amalgamation, concentration, and cyanidation, to be equipped for treating 250 tons of ore per day, is to be built at the mine this season, and that the plans are made and that orders for the machinery have been placed. The ore-dressing is to be done by crushers, rolls, and conical pulverizers. The equipment is to be hauled to the mine from Emigrant Gap.

The work of unwatering the old shaft of the Brunswick mine, Grass Valley, is in progress. It was allowed to fill with water two years ago. The pumping out of this shaft is expected to result in draining the new 450-ft. shaft, in which work is to be resumed as soon as it is free of water.

San Diego County

The Universal M. & D. Co. is developing what formerly was known as the Noble mines, situated 60 miles northeast of San Diego. It is claimed that a large tonnage of ore has been exposed; that there are four veins, the ore found in which assays $5 to $45 per ton in gold that occurs partly free and partly associated with arseno-pyrite. There is a small mill on the property. The mines are in the Julian district.

Shasta County

The executive committee of the Shasta County Farmers' Protective Association, after hearing the report of Frank Gould, who spent two months in analyzing the fumes emitted by the smelter at Coram, decided that the Balaklala Copper Co. was not complying, according to its ideas, with the conditions of the decree of the U. S. circuit court made July 24, 1910, and concluded to place the evidence before the court and ask that action be taken to enforce the decree, which may result in the closing of the plant. The Balaklala company has made heavy expenditures and brought to bear much skill in diluting the gas and precipitating solid matter, but the farmers demand that none of the latter be allowed to escape.

Sierra County

(Special Correspondence.)—Sinking is progressing at the Standard mine, in Sailor ravine, and the manager contemplates getting a small compressor and air-drills. It is probable that a 5-stamp mill will be erected this summer. At the Sierra Buttes 37 men are employed and 20 stamps are operating. The flume has been repaired sufficiently to carry water for power purposes. Plans are being made to improve the mill so as to lessen the cost of treatment. The Rio Antigua Co. of Los Angeles has renewed its bond on the South Fork property at Forest, and it is understood that operations will be resumed. Several rich leads of gravel have been opened, and it is expected to intersect the main channel by extending the adit.

Downieville, May 20.

Siskiyou County

The Grizzly mine, idle for 25 years, is being cleaned out, so that it may be examined by those who are considering a proposal on the part of the owners to sell it.

Tuolumne County

(Special Correspondence.)—The original Black Oak vein, from which more than a million dollars was taken, and which was lost a few years ago, was uncovered on the fifteenth level last week. It is about 5 ft. wide and contains rich ore. The finding of the vein below the fault is of great interest, and it is believed the sale of the property, owned by Scott, Dowe & Co., to the present operators, a company headed by Charles Knox, is assured. R. C. Knox is superintendent. Operations ceased at the Berkeley mine a few days ago and simultaneously a suit was instituted in the Superiar Court of this county by the Berkeley Mining Co. against Ida Klein, William Beddig, Louis H. Beddig, and L. G. Baum for the recovery of $32,000 expended in equipping the property with machinery and making other improvements and for an additional sum of $10,000, which was the initial payment made in November, 1910, on the purchase price of the mine. In the complaint the defendants are accused of 'salting' the mine and of making sundry misrepresentations, on the strength of which the plaintiff company alleges it purchased the mine and erected machinery, including a 10-stamp mill. The men to whom the property was sold are W. J. Wyeth, G. E. Turman, and R. F. Buzard. The Flotilla Gold Mining Co. will commence the development of the Blue Bell group of three claims, four miles south of Tuolumne. A cross-cut will be driven to tap the Blue Bell vein at a vertical depth of 410 ft. The shaft and drifts on this claim reveal a vein 4 to 7 ft. wide. 18 in. of which will mill about $12 per ton in gold. The ore also contains 1% sulphide which assays $450 per ton. The officers of the company are C. H. Burton, president; D. Pennington, vice president, and U. S. Burton, secretary-treasurer. The mill just completed at the Gianelli mine is making its initial run on ore that is high grade. A. C. Mohr and F. J. Gellespie have purchased the Rawhide Extension mine and intend to commence operations.

Tuolumne, May 20.

COLORADO

Lake County (Leadville)

William Harvey and his associates have leased a part of the Resurrection mine, and intend shipping ore through the Yak tunnel. The Louisville mine, also being operated through this tunnel, is yielding 35 tons per day of zinc sulphide. The Maid of Erin, Wolftone, and Henrietta, now referred to as the Nicholson mines, are producing 150 tons per day of zinc ore, which is shipped to the Kansas zinc smelters. It is said the output of these mines is to be in-

creased to 200 tons in June, and to a still greater tonnage by July. The body of zinc ore exposed in the Chrysolite mine is 10 ft. wide, the ore mined averaging 36% zinc. Shipments from the New Monarch mine, Big Evans gulch, continue at 100 tons per day, the ore having a value of $20 to $25 per ton.

La Plata County

The owners of the Neglected mine are reported as having decided to erect a 7-mile aerial tramway from the mine to Hermosa, where a mill and cyanide plant are to be built. Tests were made by John Gross to determine as to the adaptability of cyanide treatment to the ore.

Ouray County

The Mono-Baltic Mining & Smelting Co., of Boston, is erecting a smelting plant at Ironton, the old Saratoga mill building being utilized. This company is developing a number of mining claims, and is said to have plenty of ore.

Park County

The Colorado Gold Mining & Smelting Co., owner of the new pyritic smelter at Alma, recently purchased the Grover and Winnie patented claims and the Atlantic group of 23 claims. The price reported is $30,000.

Summit County

(Special Correspondence.)—The St. John 500-ton mill, which was completed last November, but was operated only

ST. JOHN MILL, MONTEZUMA.

30 days to make a few tests of the dump ore, of which there is a large tonnage, is to be put in operation again this month. The company has signed a contract with the Montezuma Automatic Transportation Co. whereby the latter is to deliver crude ore and concentrate from the St. John mine to the Colorado & Southern railroad at Key-

PENNSYLVANIA MILL, ARGENTINE.

stone. This is an old property that formerly operated at a profit. It is now equipped with electric power. It is understood that the mine is to be retimbered.

The Pennsylvania mill is being enlarged to 250 tons capacity, by the addition of another set of 14 by 27-in. rolls, and two 6-ft. Chilean mills; the method used for concentration during the last year resulted in making a saving of from 75 to 80% of the value. No changes except as to capacity will be made, and the enlarged mill will be in operation by July 1.

Montezuma, May 10.

IDAHO

Boise County

(Special Correspondence.)—The Golden Age Mining Co., E. R. Abernethy, manager, operating near Grimes pass, on the eastern rim of the Boise basin, five miles above Pioneerville, has the mine opened to a depth of 250 ft. by means of a 1200-ft. cross-cut. The vein strikes northeast-southwest, and occurs in granite and porphyry. The two parallel veins, developed near the surface, have been opened on the lower level. A Sullivan single-stage air-compressor has been ordered, and as soon as it is ready for use work will be commenced on a vertical, 2-compartment shaft, to be sunk in the hanging wall, starting at the lower cross-cut. The property has a 15-stamp mill, with plates, classifiers, and tables, in which 40 tons of ore, running $10 to $12 per ton, is being treated daily. About 75% of the total saving is effected by amalgamation. Three classes of concentrate are made, consisting of lead-zinc, which carries the greatest values; a straight iron sulphide, running $50 to $60 per ton; and a second-class concentrate, which is stacked at the mill to await future treatment with cyanide. The concentrate is hauled to Boise, a distance of 49 miles, at a cost of $7.50 per ton. An interesting feature in mining here is the soft character of the ore, only 1000 lb. of powder having been used to mine 6000 tons of ore.

Idaho City, May 20.

(Special Correspondence.)—E. S. Robinson is operating, as lessee, the Boise Basin Hydraulic & Power Co.'s placer property lying east of Placerville. This property consists of 500 acres of placer ground, having an average depth of 65 ft., 40 ft. of which contains gold in paying quantity. The prospect shafts sunk ahead of hydraulic operations show an average of 30c. per cubic yard. Hydraulic operations were commenced about April 1, with a force of 18 men, at an average wage of $3.50 per day. Water is flumed and ditched from Grimes creek, a distance of 35 miles. When a full head is running, about 1000 in. is available, which is sufficient to keep the two No. 3 Hendy giants in operation; the working head is 165 ft. This year the season is expected to last till August 1, and the amount of dirt to be moved is estimated at 115,000 cubic yards.

Placerville, May 20.

Idaho County

The Hercules mine, 15 miles east of Elk City, owned by Johnson and Comley, is fairly well developed by surface work, and a 405-ft. cross-cut, the latter giving a depth of 230 ft. on the vein. Drifts, amounting to 200 ft., have been driven from the place where the vein is tapped by the cross-cut; this work shows the vein to be 6 ft. wide, and to contain some rich ore. The same vein was opened by another cross-cut, 90 ft. below the apex, and a raise was driven in ore to the surface. The Anaconda mine, in Ten-Mile district, has been leased for a year to W. Newton, C. Whipple, B. Jones, G. McDonald, and F. and C. Smith. The property has a 900-ft. cross-cut, by which the vein was not opened as expected. The lessees will work at a higher point where the ore is exposed. They expect to operate the 5-stamp mill, and will form a company called the Idaho Leasing & Exploration Company.

MONTANA

Silverbow County

(Special Correspondence.)—Miners are at work in the Colorado mine of the Davis-Daly company for the purpose of doing development work on the 1700-ft. level, in accordance with the recommendations of W. H. Wiley, who examined the mine some time ago, and they declare that the rich body of ore, uncovered on that level some time ago, still continues and will run about 10% copper.

The High Ore mine, which had to be closed down last fall in consequence of a fire in the lower levels, is being operated again, about 500 tons of ore per day being hoisted. All sign of the fire, which at one time was threatening, has disappeared, and the air is as clear as it ever was.

Butte, May 20.

NEVADA

Elko County

The Tuscarora-Nevada Mines Co., controlling a number of mines in Tuscarora camp, has placed W. A. Farish, Jr., in charge, and is having the orebodies sampled. The properties are well developed, the deepest workings being through a 600-ft. shaft. The formation of the district is made up of rhyolite and andesite, the ores occurring mostly on the contact of these two. The stock of the company is said to be in control of New York men.

Humboldt County

The Salt Lake-Winnemucca company, in which J. H. and J. P. Turner and others are concerned, has leased a block of ground on the Adamson-Turner group, near Winnemucca; the block leased is 900 ft. north of the Adamson-Turner shaft. The owners of the group are having a 200-ft. cross-cut driven to open the vein at greater depth. The heading of this work is now close to the vein.

Lander County

(Special Correspondence.)—The Austin Manhattan company recently shipped 600 sacks of high-grade ore from the Jack Pot, 200 sacks from the Panamint, and 250 sacks of concentrate from the mill.

Austin, May 10.

Lyon County

(Special Correspondence.)—The stockholders of the Nevada-Douglas Copper Co., at a recent meeting held at Salt Lake, elected officers as follows: President, A. J. Orem; vice-president, James G. Berryhill; second vice-president, L. H. Curtis; treasurer, W. V. Rice; secretary, Frank M. Orem; general manager, W. C. Orem. The mine of the company is in the Yerington district, at the terminus of the railroad which is built from Wabuska into this district. This company is under contract to ship a specified tonnage of ore to the smelter that the Mason Valley Mines Co. is building at Thompson, near Wabuska.

Mason, May 20.

Storey County (Virginia City)

The Mexican G. & S. M. Co. has been having tests made on ore from its mine to determine the character of treatment to be adopted for the proposed mill. The ore contains gold and silver, associated with sulphide material, in a gangue of quartz and silicified porphyry. There are low percentages of lead and zinc, but these do not figure on the commercial side. It is probable that the mill treatment to be adopted will not differ much from that in use at the Tonopah mills. For the week ended May 20, there was mined 51 cars of ore, averaging $75.84 per ton, on the south drift from the east cross-cut No. 2, and 51 cars of ore, running $11.70 per ton, on the north drift, same cross-cut, at the 2300-ft. level; on the 2400-ft. level, 51 cars of ore, averaging $14.70 per ton, were taken from the west cross-cut off the north drift; there were 66 cars of ore, assaying $89.66 per ton, taken from the twelfth floor of the raise between the 2500 and 2400-ft. levels; also, 9 cars of ore, assaying $33.73 per ton, at the foot of this raise. Shipments to the smelter for the week amounted to 8 railroad-car loads.

The Union shaft, used jointly for the Mexican, Union, and Sierra Nevada mines, has a depth of 2000 ft., from the bottom of which is a drift 1450 ft. east. A winze is being sunk at the farther end of this drift by the Sierra Nevada and Union companies, the winze having reached a depth of 300 ft. The new orebody in the Mexican mine, now of so much interest, was found by sinking a winze from its 2200-ft. level, and cross-cutting at 2500 ft. The latter winze is on Mexican ground 140 ft. from its boundary with the Union; another cross-cut was made from the winze to the orebody at 2400 ft. Then a raise was driven on the vein from the 2500 to the 2400, the upper part of the raise being in ore that sampled over $100 per ton. The ore-shoot at and above the 2500-ft. is pretty well demonstrated, but what lies below this is yet to be determined by lowering the water-level by means of the pumping plant at the 2100-ft. station of the C. & C. shaft, which discharges water into the Sutro tunnel at the 1700-ft. station. The Mexican company is shipping its high-grade ore to the smelters, reserving its low-grade for the mill that is to be built this season.

The Julia Con. M. Co., which has an area of ground at Virginia City, lying in the vicinity of the Exchequer, Bullion, and Potosi, operated profitably from 1875 to about 1880, but since that date the property has been idle, and within that period the Julia shaft and workings have badly caved. Records of those early operations indicate that extensive bodies of ore, assaying $10 to $20 per ton in gold and silver, were opened on the 1600 and 1800-ft. levels. This ore was not mined, as it was too low grade to handle profitably at that time. In order to re-open the old workings and get at the orebodies, a drift is being driven from the 2000-ft. station of the Ward shaft, and the Julia ground will be tapped at about 300 ft. beyond the present heading.

White Pine County

(Special Correspondence.)—A new steam-engine of 50-hp. capacity is being put in position at the Zack shaft of the Ely Consolidated company and will be in use in a few days. The management has demonstrated the existence of extensive bodies of sulphide ore running 6% copper on the 500-ft. level, which has encouraged it to sink deeper, and for this purpose the new engine is to be utilized. About 600 ft. of work has been done on the 500-ft. level, the greater portion of which is in commercial ore, much of it averaging 6% copper.

The Steptoe Valley Mining & Smelting Co. is now using oil for fuel in two of its reverberatory furnaces at McGill, which it is estimated will effect a saving of at least $25,000 per year in cost of fuel. The other three reverberatories will be equipped for oil burning during the year, as this kind of fuel is giving good satisfaction. The power plant probably will not be equipped for using fuel oil during this year, as there is a large tonnage of coal on hand, which will be used up before making the change. When the entire plant is equipped for oil burning, it is expected that a saving of $100,000 per year will be made by changing from coal to oil. Basic converters are being provided at the converter plant, one of which will soon be in use, and two others later in the summer. The concentrating-plant is treating an average of 10,000 tons of ore daily.

A definite statement has come from what seems to be reliable source that the Eureka-Palisade railroad will be reconstructed during the present year. This will result in reviving the mining industry of Eureka, Windfall, and Hamilton, which has been inactive since this railroad was washed out 18 months ago.

The management of Boston-Ely has found sulphide ore of importance in the west cross-cut on the 1245-ft. level, which is expected to lead to deposits of commercial ore beneath the water-level. The Boston-Ely has made a long, hard fight, and present indications are that it will yet win out by bringing in another producer for the Ely district.

The Giroux Consolidated, which has the best-equipped shaft in the State, will soon be in the producing class. Its cross-cut on the 1200-ft. level is now nearing the orebodies developed in the old Alpha workings, while the cross-cut on the 1400-ft. level is also being driven in the same direction, but the heading of which will not reach the ore zone for two or three months. No announcement has been made recently by the management of the company in regard to the erection of a plant for treating its ores in the district, but it is probable that shipments of high-grade ore will soon be commenced.

Ely, May 22.

UTAH

Beaver County

The Utah M. M. & T. Co., developing the Hub and Lady Bryan claims in Star district, 10 miles from Milford, has completed its main working shaft to a depth of 400 ft., and

cross-cuts have been driven to the vein from the 300 and 400-ft. stations. Drifts have been extended on the vein at the 300-ft. level, and a considerable tonnage of ore has been stoped and shipped. Some ore is also mined from the bedded veins which come into the main lode. The bins are full of ore and there is a big tonnage exposed in the mine. C. T. Birchard of Boston is the company's manager.

JUAB COUNTY

The Carisa Gold & Copper M. Co., having 57 acres of patented ground in Tintic district, near that of the Centennial Eureka, has leased a part of the property to Fred T. Williams, of Park City, who is to begin development and mining. Operations are to be continued also on company account. The ore shipments from Tintic district for the week ended May 20 were 146 cars. The five largest shippers were the Iron Blossom, 33 cars; Centennial Eureka, 29; Dragon, 27; Colorado, 10; Grand Central, 7 cars.

TOOELE COUNTY

(Special Correspondence.) — The Consolidated Mercur company sent $50,000 in gold to the Government assay office at Salt Lake as a result of April operations. The mill treated about 22,000 tons of ore, indicating how low a grade of ore is being handled at this mine. The Utah mine, at Fish Springs, produced nearly $7000 worth of ore during the first two weeks in May. This mine has been producing silver-lead ore for twenty years of a grade high enough to make it profitable to haul it by wagons 75 miles to the nearest railroad station.

Mercur, May 22.

CANADA

BRITISH COLUMBIA

(Special Correspondence.)—James Breen, of Spokane, who owns 75% of the stock of the McKinley Mining Co., having a partly developed mine on the north fork of Kettle river, 34 miles up-stream from Grand Forks, has bonded the property to the British Columbia Copper Co., at $100,000, one condition being the continuous development during the next 12 months. The B. C. company is to develop more extensively by means of a long adit.

Grand Forks, May 20.

(Special Correspondence.) — The Rambler-Cariboo M. Co., having properties near McGuigan, with W. E. Zwicky as manager, has opened on the 1250-ft. level a shoot of ore, containing 6 to 8 in. of clean galena. Other openings on the orebody are on the 700, 800, 900, and 1050-ft. levels. It is said the shoot is 35 ft. long on the 700-ft. level, 82 ft. at 800, and 200 ft. in length on the 900. The shoot is only partly developed at the 1050, but where the ore is exposed it has a width of 4 ft., and consists of galena. Ore from the 900-ft. level sampled 65% lead, and 117 oz. silver per ton; the clean ore taken from the 1050-ft. level ran 75% lead and 250 oz. silver.

Sandon, May 19.

(Special Correspondence.)—The Soho Con. Mines, Ltd., which formerly shipped ore of the value of $45,000 from its silver-lead mine near Sandon, will resume work again June 1. The property adjoins the Rambler-Cariboo, in McGuigan basin. J. C. Ryan, manager, states that the ore will be hauled to Kaslo by rail, then shipped to Trail by water.

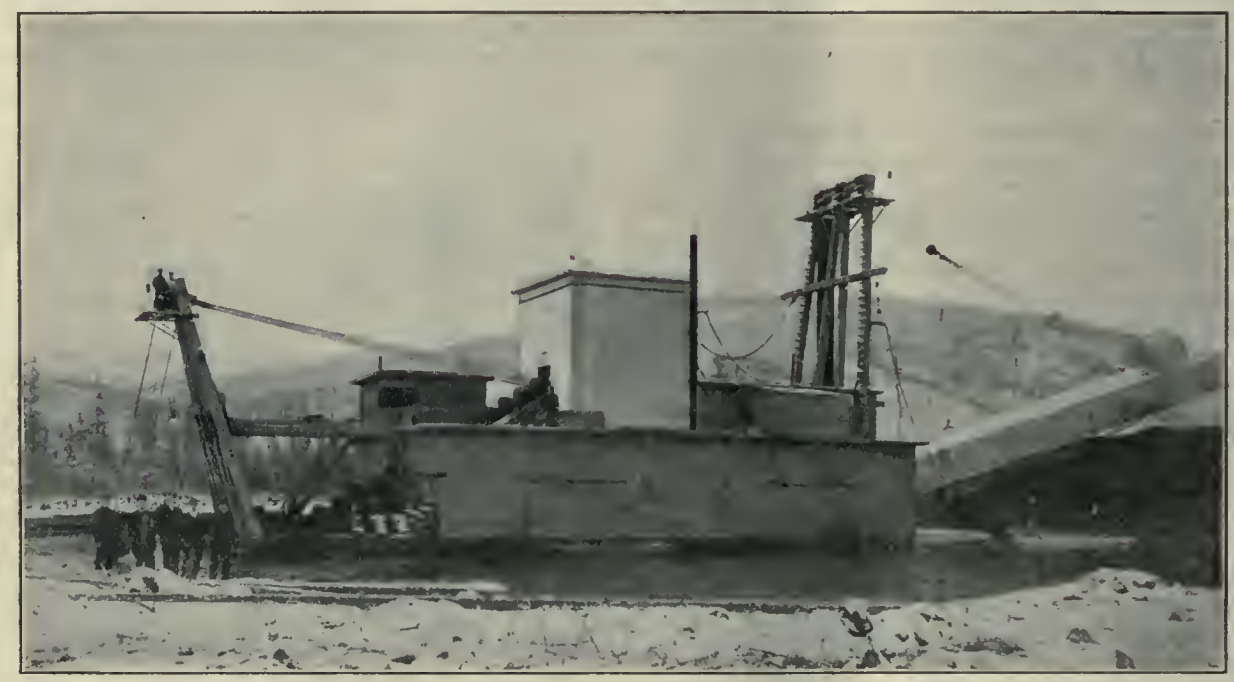
Sandon, May 15.

(Special Correspondence.)—The Granby Con. Mining, Smelting & Power Co., which has purchased the mines of the Hidden Creek Copper Co., near Observatory inlet, on Portland canal, has decided to erect a smelter in the vicinity of the property, but the plant will be on deep water, so that the slag can be disposed of economically. The new cross-cut being driven is to tap the copper lode at a depth of 800 ft.; the portal of the cross-cut is a mile from the site selected for the smelter.

Prince Rupert, May 16.

(Special Correspondence.)—The Kootenai Mines, Ltd., has become owner of the Granite-Poorman mine, situated in Nelson country, by the payment of $10,000 on the old Duncan-United Mines bond.

Nelson, May 18.



CANADIAN-KLONDIKE DREDGE ON BEAR CREEK, NEAR DAWSON.

YUKON

The ice in the Yukon river started to go out May 15, and the steamer *Canadian* sailed from White Horse, May 19, with passengers and freight for Dawson. A heavy output of gold dust is anticipated this season from the Dawson district, as the result of dredging and hydraulic mining. The main operations are on the upper tributaries of the Klondike river, comprising Bonanza, Hunker, and Bear creeks. The most extensive dredging operations there are those of the Yukon Gold Co., though the Canadian-Klondike M. Co., Northern Light, Treadgold, and others are operating several dredges. The Canadian-Klondike company, having two dredges on Bear creek, began work with one dredge before May 1, Joseph W. Boyle being manager.

Decisions Relating to Mining

Specially reported for the MINING AND SCIENTIFIC PRESS.

INJURY TO MINER—ASSUMPTION OF RISK

An experienced blaster in a granite quarry is presumed to have knowledge of such open and obvious dangers incident to doing blasting as such a skilled person of ordinary intelligence and knowledge possesses, whether they arise from the business, the particular manner in which it is conducted, or the use of defective or unsafe appliances. Such an experienced blaster is presumed to know the nature and condition of the blast-holes as to roughness and unevenness of the side or of sharp projections of the rocks in the walls, and knowing these facts he is charged with the knowledge that the use of a steel rod in a blast-hole might produce a spark by contact and friction with the rock, and thereby produce premature explosion. The danger from premature explosions arising from the use of a steel rod in a blast-hole is the result of known and obvious conditions of the operations of natural laws, and it cannot be said to be a secret and an unknown danger which an intelligent and experienced blaster does not comprehend. It is not improbable that an expert blaster has more knowledge concerning the art and a better comprehension of such dangers than the employer himself, who is held to have full knowledge of such in the conduct of his business; and the dangers incident to the mode of blasting are the risks and hazards which attend such work, and are the obvious and known dangers incident to the manner of conducting the blasting operations and which are assumed by the servant in his employment and undertaking the work. It is immaterial that an experienced blaster, injured by a premature explosion caused by a spark in the use of a steel rod in the blast-hole, had no knowledge of the process and dangers of blasting except what he had acquired while at work in the quarry of his employer, as such want of knowledge from other sources does not relieve him of the assumption of the risk of danger arising from the use of a steel rod in loading blasting-holes with powder, where he did in fact comprehend and understand the danger.

Brotzki *v.* Wisconsin Granite Co., (Wisconsin) 125 Northwestern, 916. April 1910.

BREACH OF CONTRACT TO LEASE OF MINE—PROFITS

In an action for breach of a contract to lease the right to operate a mining claim on a royalty, proof that the owner stated to the complainant that he would make out a lease of the claim and that the terms of the royalty would be 40%, and that the lease was to commence at a date named and extend to another named date, was held sufficient as to the terms of the lease and as a basis for the recovery of damages. It was held also that the lessee would be entitled to such profits as would have been derived from the premises for the full period of the term for which the lease was to have been made, and that proof of such profits might be made by showing the profits made under a like lease of the same property to other parties during the same period, if it is shown that the lessee would have worked the premises practically in the same manner had the lease been executed to him according to the agreement.

Hjelsberg *v.* Chilberg, 177 Federal, 109. Feb. 1910.

MINERAL RIGHTS IN RAILROAD RIGHT OF WAY

A deed conveying to a railroad company a right of way containing the clause "coal rights reserved," was held to reserve the title to the coal under the right of way and that it separated the title to the coal from the title to the surface, together with the mining rights connected with it, and that the grantor could mine and remove the coal and could use the space where the coal was found in any way he pleased and as though no conveyance of the surface had been made.

Atterbury *v.* Blair, (Illinois) 91 Northeastern, 475. April 1910.

Personal

Professional men are invited to send news of their engagements and travels. Such news is interesting to friends.

HOWARD D. SMITH is in London.

GELASIO CAETANI is in New York.

C. A. FISHER was in Texas last week.

T. R. MARSHALL has moved to Mexico City.

H. A. J. WILKINS has returned to New York.

F. G. COTTRELL has gone to Placerville, California.

EDMUND JUESSEN has returned from Blair, Nevada.

FREDERICK G. CLAPP is examining oil properties in Mexico.

C. F. TOLMAN, JR., will spend next year in European travel and study.

BERNARD MACDONALD was at La Jolla, California, and has gone to New York.

GEORGE S. RICE, of the U. S. Bureau of Mines, will sail for Europe June 17.

E. COPPEE THURSTON arrived in New York on May 12 from South America.

F. W. BRADLEY and ERROL MACBOYLE will sail from Seattle for Juneau, May 31.

CHARLES JANIN and H. FOSTER BAIN left on Thursday for Globe, Arizona, and Denver, Colorado.

W. A. FARISH, JR., is superintendent for Tuscarora-Nevada Mines Co., operating at Tuscarora, Nevada.

FRANK L. COLE and RUSSELL Y. HANLON have formed a partnership at Manila as consulting mining engineers.

W. H. NORTH, formerly of Wallace, Idaho, is now with the Standard Silver-Lead M. Co., Silver, British Columbia.

F. H. RICKER, of the Merrill Metallurgical Co., is at Colorado City preparing drawings for changes at the Union mill.

MORTON WEBBER, of New York, has been in eastern Canada on examination work on behalf of the C. L. Constant Company.

E. S. BASTIN and J. M. HILL will return to Colorado June 1, to resume the geological survey of the Central City quadrangle.

GEORGE H. CUSHING has been made secretary of the local executive committee of the American Mining Congress, for the Chicago meeting.

R. H. CHAPMAN will continue his work for the Canadian Geological Survey another season and will make headquarters at Victoria, B. C.

BURROUGHS EDSALL has been engaged in re-opening the old silver mines on Blind Spring Hill at Benton, California, since January 1, 1911.

D. C. JACKLING, general manager, and FRANK JANNEY, mill superintendent, for the Utah Copper Co., are inspecting the Ray and Chino mills.

CHARLES H. FULTON, president of the South Dakota State School of Mines, at Rapid City, has resigned to take the chair of metallurgy at the Case School of Applied Science, Cleveland.

Major SHERWOOD A. CHENEY, of the Corps of Engineers, has been appointed a member of the California Débris Commission in the place of Captain THOMAS H. JACKSON, Corps of Engineers, relieved.

FERDINAND H. GRASER has resigned as secretary of the Nevada Wonder Mining Co. to become assistant secretary of the Colombia Consolidated Goldfields, Inc., with offices in the Bailey building, Philadelphia.

WILLIAM B. FISHER, who for the past four years has been manager for the Salt Lake Copper Co., with offices at Salt Lake City, has resigned to enter the employ of the American Smelting & Refining Co., his headquarters being in the New York office.

Company Reports

LIBERTY BELL GOLD MINING COMPANY

The annual report of this company for the year ended September 30, 1910, shows that during the year its mine at Telluride, Colorado, produced 887,606 tons of ore, which, when milled, produced stamp bullion to the value of $511,410, cyanide products worth $318,045, and concentrate to the value of $125,498, other incidental receipts making a total of $988,604. The total operating expense was $706,458, leaving a profit balance of $282,147. The following comparative table of receipts and costs per ton is of interest:

RECEIPTS.

	Rate per Ton.		
	1910.	1909.	1899-1910.
Stamp bullion	$ 3.82	$ 3.06	$ 4.18
Cyanide products	2.38	2.06	1.95
Concentrate	0.94	0.43	0.83
Slag	0.03	0.02	0.02
Ore proceeds (133,899 tons)	$ 7.17	$ 5.57	$ 6.98
Boarding-house, tram, rents, mine-commissary profit, interest and profits from investments	0.21	0.33	0.15
Average receipts per ton milled	$ 7.38	$ 5.90	$ 7.13

EXPENSES.

	Rate per Ton.		
	1910.	1909.	1899-1910.
General expenses (133,899 tons)	$ 0.41	$ 0.39	$ 0.78
Mining (134,321 tons)—			
Operating	2.32	2.36	2.75
Development work (5374 ft.)	0.29	0.49	.....
Tramming (134,373 tons).	0.19	0.29	0.36
Milling (133,899 tons)	1.73	1.67	1.72
Treatment and shipping costs	0.32	0.19	0.31
Stamp bullion (59,873 oz.)	0.04	0.03 per oz. bullion	
Concentrate (2503 tons)	14.97	12.98 per oz. concentrate	
Cyanide bullion (174,764 oz.)	0.02	0.02 per oz. bullion	
Average cost per ton milled	$ 5.27	$ 5.40	$ 6.07
Profit per ton milled	$ 2.11	$ 0.51	$ 1.08

The decrease of 24c. per ton in mining cost and 10c. per ton for tramming is noteworthy. During the year extensive alterations have been made in the mill, and it is hoped thus to decrease the cost of milling. The following table shows the work of the mill for 1910:

ORE MILLED, 1910.

(133,899 tons.)

Gross values per dry ton milled, and percentages.

	Gold.		Silver.		Value.	
Recovered—	Oz.	%	Oz.	%	$	%
In stamp bullion	0.178	57	0.254	7	3.82	46
Concentrate	0.026	8	0.651	19	0.94	11
Cyanide products	0.086	28	1.162	34	2.41	29
Total recovery	0.290	93	2.067	60	7.17	86
Lost—						
In tailing	0.021	7	1.381	40	1.17	14
Total content	0.311	100	3.448	100	8.34	100

The percentage of recovery has continually increased and is now 8% better than the average for the last 12 years. Depreciation has been provided for, $30,836 being set aside for this purpose. The net gain for the year was $282,147; dividends amounting to $143,606 were paid, corresponding to 22% on the capital; the balance added to that of the preceding year amounting to $629,525. The schedule of stocks and bonds shows that these amount to $190,215. The capital is given as $700,000; 9445 shares have not been issued.

Market Reports

LOCAL METAL PRICES.

San Francisco, May 25.

Antimony	12—12¾c	Quicksilver (flask)	46.50
Electrolytic Copper	14—15¼c	Tin	45—46½c
Pig Lead	4.75—5.70c	Spelter	7—7¾c

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

METAL PRICES.

By wire from New York.

Average daily prices in cents per pound.

Date.	Electrolytic Copper.	Lead.	Spelter.	Silver, per oz.
May 18	11.95	4.36	5.34	53⅜
" 19	12.00	4.36	5.31	53⅜
" 20	12.00	4.36	5.34	53⅜
" 21	Sunday.	No market.		
" 22	12.05	4.36	5.34	53¾
" 23	12.08	4.36	5.34	53⅝
" 24	12.10	4.36	5.34	53¼

ANGLO-AMERICAN SHARES.

Cabled from London.

	May 18. £ s. d.	May 25. £ s. d.
Camp Bird	1 12 0	1 11 6
El Oro	1 4 6	1 4 3
Esperanza	1 11 3	1 10 3
Dolores	1 5 0	1 5 0
Oroville Dredging	0 6 3	0 6 9
Mexico Mines	8 1 3	8 0 0
Tomboy	0 15 0	0 15 0

(By courtesy of W. P. Bonbright & Co., 24 Broad St., N. Y.)

MINING STOCK QUOTATIONS—NEW YORK.

(By wire from Catlin & Powell Co., New York.)

	Closing prices, May 25.		Closing prices, May 25.
Amalgamated Copper	$ 67¼	La Rose	$ 4⅜
A. S. & R. Co.	79½	Mason Valley	9¼
Braden Copper	4⅜	Miami Copper	20⅜
B. C. Copper Co.	5¼	Mines Co. of America	6¼
Butte Coalition	19⅞	Nevada Con	19⅛
Chino	24⅜	Nevada Utah	¾
Davis Daly	1⅜	Nipissing	10⅝
Doble	3½	Ohio Copper	1⅝
Dolores	5½	Ray Central	1¾
First National	1¾	Ray Con	17⅜
Foley O'Brien	1¾	South Utah	⅞
Giroux	6¼	Superior & Pittsburg	16½
Goldfield Con	5⅞	Tenn. Copper	38½
Greene-Cananea	6⅞	Trinity	4¼
Guanajuato Con	½	Tuolumne Copper	4⅝
Hollinger	12½	United Copper	3½
Inspiration	8¾	Utah Copper	47⅝
Kerr Lake	6⅜	Yukon Gold	37⅛

COPPER SHARES—BOSTON.

	Closing prices, May 25.		Closing prices, May 25.
Adventure	$ 6½	Mohawk	$ 44
Allouez	31	North Butte	33
Atlantic	6	Old Dominion	42¼
Calumet & Arizona	56½	Osceola	———
Calumet & Hecla	470	Parrot	12½
Centennial	12½	Santa Fe	1¼
Copper Range	62¼	Shannon	10⅞
Daly West	5	Superior & Pittsburg	15¾
Franklin	10⅛	Tamarack	36
Granby	33	Trinity	4
Greene Cananea, ctf.	7	Utah Con	15¾
Isle-Royale	15¾	Victoria	1⅝
La Salle	3¾	Winona	8
Mass Copper	5	Wolverine	110

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

SOUTHERN NEVADA AND COMSTOCK

San Francisco, May 25.

Atlanta	$ .11	Nevada Hills	$3.02
Belmont	6.25	Pittsburg Silver Peak	.70
Booth	.08	Round Mountain	.56
Columbia Mtn	.04	Sandstorm Kendall	.03
Combination Fraction	.07	Silver Pick	.04
Florence	1.40	Tonopah Extension	1.00
Goldfield Con	6.05	Tonopah of Nevada	6.13
Gold Kewenas	.05	West End	.52
Jim Butler	.25	Belcher	.85
Jumbo Extension	.27	B. & B.	.68
MacNamara	.11	Con. Virginia	1.37
Mayflower	.05	Mexican	4.50
Midway	.20	Ophir	2.40
Montana Tonopah	.82	Savage	.36

(By courtesy of San Francisco Stock Exchange.)

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EDITORIAL

THE stratigraphy of the Globe-Ray region has taken on added importance with the development of the great masses of copper-bearing porphyry. On another page Mr. F. L. Ransome points out some differences in the sections at Ray and Globe, giving the results of the most recent study of the area.

IN the development of a prospect the problems which arise are numerous and varied. The keeping of adequate records with a minimum of effort is not the least of these, and many of our readers will find much that is helpful and suggestive in the discussion of 'Simple Mine Bookkeeping', by Mr. K. C. Parrish.

AUSTRALIAN contributions to the advancement of the art of cyanidation have been noteworthy. We present this week a discussion of the methods of slime agitation practised in Kalgoorlie, by Mr. M. W. von Bernewitz. The metallurgist of the Associated is in a position to speak as one having authority, and his contribution will be read with interest.

THE one hundredth meeting of the American Institute of Mining Engineers will be held June 6 to 10 at Wilkesbarre, where, in the anthracite region of Pennsylvania, the Institute was organized forty years ago. Excursions to near-by collieries and coal breakers, the Bethlehem steel works, and the Lehigh University, will be among the features of the meeting. A list of more than thirty papers is announced and it is safe to say that none will prove of greater general interest than the 'Reminiscences of the Beginning of the Institute' by the veteran Secretary, Dr. R. W. Raymond.

AN interesting international incident is the recent visit to Berlin of Charles M. Schwab to confer with leaders of the Russian and Scandinavian steel industries. The export to the United States of Scandinavian iron ore and the expansion of the Swedish and Russian navies were the topics under discussion. At home it is announced that Mr. W. E. Corey and Mr. H. C. Frick have acquired 30,000 acres of coal land near Blairsville, Pennsylvania, and will proceed to erect a large steel plant at that place. The steel trade is now improving, and orders have been issued to blow-in several furnaces that have been shut down.

THE retirement of Mr. Lewis T. Wright from the active management of The Mountain Copper Company, Ltd., takes from us a brilliant scientist, who has added lustre to the mining fraternity. It is but seldom that an engineer combines with business ability such a mastery of pure science as does Mr. Wright. This extraordinary knowledge of pure science is the more remarkable in his case, since Mr. Wright represents a class of engineer that has few representatives today. He is the product of the old system of apprenticeship, as contrasted with the technical graduate. At the age of nineteen he was junior assistant engineer of

the London Gas Light & Coke Company, and at twenty-seven, chief engineer of the Corporation Gas Department of Nottingham. Later he went to Buenos Ayres as chief engineer of the gas company there, finally entering the employ of the Rio Tinto Company, Ltd., to solve the problems arising at its American venture at Kennett. His brilliant work there in the development of pyrite smelting and the advancement of the metallurgy of copper is too well known to our readers to need any recital. Mr. Wright has now retired to London, though it is possible that he may return to the United States, for a period at least. He is succeeded in the management of The Mountain Copper Company, Ltd., by Mr. William F. Kett, who has for many years ably seconded Mr. Wright's labors as his chief assistant.

THE merger of copper interests, so long mooted, seems now a possibility. The basis upon which to come together is naturally a matter of discussion. The plan has been suggested of forming four groups, Butte, a southwestern group, a Utah group, and a Mexican and South American group. As a preparatory step it is proposed to gather the 'porphyry coppers' into a single corporation with D. C. Jackling at its head. The copper market has begun to advance, but it is not at all unlikely that the merger discussion is intended more largely for market effect than with a view to action. It is difficult to see how the controlling interests in copper can even now get together without finding themselves outside the pale of the law. It is realized by both producer and consumer that a great waste of natural resources is involved in the production of copper under present circumstances. A large quantity of metal is being placed on the market at no profit, and an almost equally large amount is being produced at an actual loss. Taking depreciation charges and the lessening of ore reserves into consideration, it is doubtful whether profits as now computed should not be materially reduced in estimates. It is certain, at least, that nothing will be done toward forming a merger until after the United States Supreme Court hands down its decision in the Tobacco Trust case.

The Supreme Court Decision

Umslopagus, wise, black, and ancient, meditates in one of Rider Haggard's Allan Quartermain stories on the limitations of mankind, saying, "Human nature is like an iron ring; you can polish it and polish it, you can even bend it in a little on one side, whereby you will cause it to bulge out on the other, but it is an iron ring just the same." The world has always gone its way striving for the next turn in the hard and dusty road to lead it into rich pastures along shaded paths. Always the promised land will be seen from the next hilltop. For many months discussion in the business world has centred about the Trust cases before the Supreme Court of the United States. At length patience has been rewarded and the decision in the Standard Oil case has been handed down. Everyone in the 'Who's Who' of the business world has been careful to be interviewed therein. The fact that a scathing rebuke was administered to the defendant, the Standard Oil Company, is the matter last and least discussed. The exceedingly human thing about all of the discussion is that this new turn in the road reveals very much the same old landscape, the same wearying problems of the same old world.

So far as Wall Street is concerned, it has adopted the attitude of the late Tom Reed, Speaker of the House of Representatives, who, having answered an annoying member on the floor, turned to the House with: "Having embalmed that fly in the amber of our remarks, we will take up the regular order of business." All through the Street there is a bold putting forward of the best foot, with an outspoken invitation to the public to join in the activity supposed to be ready to begin. There are those who yet insist that the important economic question involved is still unsettled, and the noise of discussion drowns the hum of the stock market. Sales of securities have been negligible for a long time. Any event that would serve as an excuse for urgent invitation would answer for stock market purposes. Time and proper perspective only can make possible a just estimate of the judgment of the Court. The comment of the day is meaningless, and already the hope is expressed that the decision in the Tobacco case will, when rendered, shed further light. Already the next turn in the road, the new hilltop, has been sighted. Mr. Justice Harlan's vigorous dissenting opinion establishes a strong foothold for those who would combat the position taken in the majority opinion. Wall Street professes to see a great victory and an era of expansion, development, and prosperity is at hand.

Many Inventions

In a notable address delivered at the dedication of the new mining building of the University of California in 1907, Mr. T. A. Rickard pointed out the great need of some arrangement in university work whereby the professors of technical branches might find ample opportunity for keeping more closely in touch with the development of actual practice than they, as now situated, are able to do, and suggested that the most feasible way to secure this would be for someone of great wealth to endow the departments so liberally that a double staff might be employed, half of which should be engaged in carrying on the teaching work, while the rest were in the field observing practice. But since no wealthy patron of learning has so far shown a disposition to provide the necessary endowment, Mr. J. F. Kemp has found opportunity in a busy life to devote time to the solution of this problem, and we are enabled to present upon the following page, the details of his invention which makes it possible for a professor to be absent from his classroom for long periods without serious loss to the academic work. Education has so universal an appeal that our readers will find much of interest in Mr. Kemp's solution of this educational problem.

The principal question of every student is how to secure a real education. An education is an individual possession, therefore a solution of the problem must be an individual solution. Generalization upon a subject of so varied an aspect is impossible, except the generalization that an education can never consist of the mere obtaining of information upon certain selected topics. What more his nature needs, each student must find for himself, aided by the men under whom it is his privilege to sit while yet an undergraduate. The 'freshwater college', as Holmes half-contemptuously designated it, has been a powerful factor in the development of education in America, and one of its great elements of strength has been the opportunity afforded for the students to come into closer personal contact with their instructors. A great university affords but little opportunity for this, and there are many Columbia students who would rate above the hours spent upon petrography and paleontology those when,

"Now every year, it doth appear,
The men of rocks sit down
To eat a bite, and with good right
The long year's efforts crown.

So take a cup and fill it up
To friends now far away,
And quaff again the cup amain
To those who with us stay."

The Photophonic Lector

By J. F. Kemp

*The photophonic lector is nothing more nor less than an endeavor to have professors as well as other people profit by the marvelous latter-day inventions such as the photographic camera, the telephone, and the phonograph. Almost every calling except our own has been benefited by them. The camera, to be sure, has been useful, but the telephone has proved a great drawback. It places us in such easy communication with the Dean and the President that nowadays it is impossible to get any time to ourselves. So far as professors are concerned, the phonograph might just as well never have been invented. I therefore determined to combine the principles of all three in the photophonic lector.

The photophonic lector is a device which will take the place of a professor in a lecture-room. It is designed so that a book or a typewritten manuscript may be inserted in a proper carrier, so arranged that by mechanical fingers moved by adjustable clockwork the pages are turned from time to time and at the exact instant. This is easy of attainment and means no more than doing with a machine what is done by the man of limited intelligence who turns the pages of a music score for a performer at the piano. In the photophonic lector the book or manuscript is carefully boxed so that none of the fierce light thrown upon its pages by an electric arc lantern escapes into the room. That is to say, we have the pages illuminated in the most brilliant manner, so that the contrasts of black and white stand out very sharply. I should mention that typewritten matter must be prepared with a good, fresh, black ribbon. Blue or purple ink will not answer, nor can we use carbon copies, which are naturally somewhat blurry and indistinct. Not every typewriting machine is well adapted to making the copy. It requires one with a sharp, clear-cut, staccato mechanism, and the operator must have the same characteristics. An easy-going operator who slurs things over, or who makes irregular spaces between the words, or who, above all things, has to rub out mistakes, will not answer. Nevertheless, all these precautions can be easily observed with proper care in selection.

Now when the book or manuscript is set up in the *camera illuminata* of the machine and when the mechanical fingers for turning the page at the proper instant have been adjusted by a few screws, and the time interval has been exactly set for the number of lines, then the fierce white light of the electric arc is focused upon the page, so that it shines with a radiance like the grand display of the orb of day. This brings us to the second unit in the device.

Close beside the arc-light lantern is set a second box with an arrangement of lenses in a tube, and provided with a little window not unlike the slit of a spectroscope or, again, much the same as we find in the panoramic cameras that sweep the entire arc of the horizon. Let us call it the transmission telescope. The slit in the shutter before the objective glass is just the right size to take in one letter. The telescope is moved by clockwork so that when it is set at the beginning of the first line of the exposed page it focuses upon the first letter, and then the half of the shutter at the right-hand side of the slit is swept by the clockwork swiftly from left to right, picking up letter after letter, so as practically to spell out the word and transmit its image backward. By a simple device which depends on the effect of light upon a selenium cell, the right-hand side of the shutter opens until it encounters the blank white space between two words. So long as a dark letter is transmitted the slit widens, but the instant a white space is met the slit is closed. Thus for an incredibly short time the entire word is transmitted to the sensitive selenium cell of which I will speak in a moment, and then the shutter closes. By careful adjustment this has been made to correspond exactly with the time period occupied in the pronunciation of a word by a speaker who talks at a moderate speed and with musically modulated tones. A very short space will thus automatically be given to words of one syllable, while to certain terms in petrography or in the biologic branches a quite appreciable interval is assigned. The transmission telescope plays along the line until it reaches the end. The clockwork already adjusted snaps it off, drops it the proper distance, and returns it to the beginning of the next line where it automatically begins. It required much experimenting to perfect this, but, after all, speech is slower than sight, and the difficulties are not so great as with the moving pictures which deceive the eye. In fact, you will at once see that the problem is much the same, and if before you had ever seen a moving-picture show I were to have proposed these two things, you would have said that the moving picture was the more difficult.

Thus the transmission telescope plays along from line to line, the words are flashed back to the selenium cell, the page is covered and instantly turned over by the mechanical fingers, and a new one is begun. The movement is gently and musically modulated; the sentences are carefully prepared beforehand, and polished with great literary care and skill. The process has, really, many advantages over the ordinary lecture.

All that now remains is to have the words as they are flashed upon the selenium cell, which I will hereafter call the speaking retina, or *retina parlans,* so affect an electric current that they will pass to a telephone and be uttered to an audience through the medium of a megaphone. That is why I selected selenium. This element, as you know, has its powers of transmitting an electric current affected by the impact of rays of light. Thus, years ago, Graham Bell, in Washington, set up a telephone on the roof of one building, so arranged that the vibrations of the disc affected a beam of light which was flashed by the instrument to a selenium cell in the circuit of another telephone on a fairly remote roof. The interruptions of the beam of light so affected the selenium cell that it caused the receiving telephone to transmit the speech of the first one to the auditor. Precisely the same thing is done by the *retina parlans,* which is in the telephonic circuit. As the letters build up the syllables, the syllables blend together to form the word, which is emitted by the megaphone and passes on to the audience. At the same time when only the white light of the spaces between the words reaches the selenium cell, the disturbance is so great that the vibrations are too quick for speech. They belong among those ultra-violet wave lengths in the realms of silence outside the field of speech. They do operate, however, to close the shutter.

Much experimentation was of course required in the early adjustment of the instrument, but on the whole I found it less difficult than I had anticipated, and as I discovered that I could slip in, for instance, Geikies' 'Founders of Geology', and recalling the charming and well-modulated tones of the gifted author, could by the adjustment of a few screws, apparently hear him before me, I felt enchanted by the results.

But having gone so far, I was led into further experimentation. I reasoned this way. If the photophonic lector succeeds with English, why not with French and German. On trial, it gave me back these languages perfectly, and I was so carried away that I read half of De Launay's great treatise on 'La Geologie et Les Richesses Minerales de l'Asie' at a sitting. Of the natural results of this discovery I will speak in closing. But at the time I reasoned further and then experimented with success as follows:

If we pass a ray of white light through a prism—or, better yet, through one of Rowland's famous gratings—it is broken up into the prismatic tints, any one or two of which we can preserve and transmit by cutting out or absorbing the others.

Now in the case of the photophonic lector the speech is entirely due to the transmission of certain forms of light rays, which spell out certain words. But if I could interpose in the track of those beams, say of German words,

*Address delivered before the Geological Journal Club, Columbia University, May 3.

a grating of the proper construction to turn them into the English equivalents, why, a German lecture would be automatically translated into English and would issue from the megaphone as such. It was so simple that I wondered no one had thought of it before. All I needed to do was to take a few lines of German and start them through. Then I slipped in gratings ruled in various patterns until one gave a fairly good approximation to English speech. Then by slight variations of the shape of the spaces in the grating I finally found the secret. I put in Credner's 'Elemente der Geologie', and presto! it came out in beautiful English. Similar experiments produced a French grating, and I could easily prepare one in almost any language. What I most wanted, however, was Chinese, since, the proper grating once secured, the priceless literature of this ancient kingdom would be mine. So I printed with good black India ink the characters:

壽福

and then experimented with gratings until from the megaphone came forth, "Good luck, health and happiness," and success was mine. Now, with the proper alteration in the transmission teleseope so as to begin in the upper right-hand corner and move downward, we can automatically translate any Chinese work.

But, someone says, all this is very interesting as a scientific experiment, but what will be the applications? Well, without elaborating at too great length, the following occur to me:

First: Sabbatical leaves of absence are made easy. A professor writes out his lectures on a typewriter. He leaves them arranged in serial order, and one for each day, with an assistant. The assistant prepares the instrument and throws in an electric attachment which is connected with the bell in the university circuit. The striking of the bell starts the photophonic lector and immeditely there issues from the megaphone in musically modulated tones: "Gentlemen, we saw at the last lecture that the toes of trilobites are only found upon coral reefs in the calcirudites", etc. The assistant, having meantime marked the roll, leaves the room precisely as if the lecture were an examination conducted on the honor system. For the class the hour passes delightfully. The carefully polished sentences roll forth. There are no trembling "er—er—er"s. The style is immeasurably better than the extemporaneous lectures to which we are accustomed, for of course no professor would ever make a record of what he has the assurance to utter off-hand.

Promptly when the fifty minutes are up, the bell rings and by the same act the electric connection shuts off the photophonic lector. A half-minute is required for the class to recover from the spell which has enchained them, and, forgetful even of cigarettes, they quietly disperse. How different from the present customary beginning, with a professor interrupted and upset by late-comers; irritated that a colleague has kept the class overtime; annoyed by the low hum of conversation; his subconscious self aware of the presence of books or papers not connected with the subject; his faltering utterance; his mixed sentences: why, the contrast is something indescribable.

Second: Let us apply it to exchange professors. At present the Kaiser Wilhelm professor must speak English. The Theodore Roosevelt professor, German. By these conditions the choice is much restricted. But were the appointee provided with a photophonic lector and the proper grating, he could write out his lectures in his native tongue and hear them issue in choice English or German from the megaphone. He might sit beside the instrument and smile or make a few gestures at appropriate times, or he might stay away altogether. He might even remain at home and only send his manuscripts across the ocean—thus avoiding possible conflicts with other exchange professors and exciting frightful jealousies—and in this way immensely relieving the anxieties of the university authorities who would otherwise have to bear with him: there is much to be said for the photophonic lector.

On the other hand, I must admit there are grave dangers lurking in the instrument. Professors having once written out their lectures, might be satisfied, and to an even greater extent than now be led to use the same old matter over and over. They might be tempted to stay away from the classroom; they might be constantly off on remunerative expert work while the photophonic lector delivered the instruction. It is conceivable that their classes might never see them; that the name of a professor might mean to the students nothing but a sound issuing from a megaphone. From this horrible prospect I recoil. I regret the invention of the machine. I take it all back. I assure you it is all moonshine. In fact, you all know that selenium was named from Seléne, the Greek word for the moon. I confess this is all moonshine; in fact, it is only a selenium sell.

The Bullfinch Boom

Although the water-supply and railway have reached Bullfinch, and the strike has been settled, there appears to be, apart from that engendered by the unexpected arrests in connection with the Chaffinch affair, comparatively little general interest in the locality. It is now being regarded as a 'one-mine' place, and nothing, except the finding of payable ore outside the Bullfinch Proprietary, is likely to stimulate any fresh interest in the field. The Railway bill, which was rushed through Parliament during the height of the boom with such undue haste, would not have had much chance of being passed had its passage been delayed in any way pending further developments on the field. It appears that even the Mount Jackson field, to the north of Bullfinch, about which much has lately been heard, is by no means likely to become what the optimists have predicted for the place. Apart from the lack of water, a difficulty which in the fullness of time can and will be overcome, the work so far done indicates that the so-called reefs principally consist of small quartz leaders, which, although carrying fair values at the surface, rapidly become impoverished if sunk upon. It may be pointed out that the field is by no means new. It has been fairly well tested in the past; a mining township was established, the ruins of which, including a well built hotel, are still standing. The abandonment of the place appears to have been caused by not so much the lack of water as the lack of payable ore. Small working parties may perhaps be able to do fairly well here and there on this field; but the nature of the reefs appears such as to make their successful exploitation by a company impossible.—*Australian Mining Standard.*

Extraction of Gold and Silver From Slag

By E. R. Haggin

The question as to what to do with poor slag carrying gold and silver is constantly coming up, and the following method of dealing with it may be of interest. The slag was taken from a poorly-fluxed melt and assayed 112.5 oz. Ag and 2.41 oz. Au per ton. A charge of 20 kg. was ground in a small tube-mill for 12 hours, when only 5½% was retained on a 200-mesh screen; this part containing 48% of the silver and 53% of the gold, so that a good concentration of the precious metals was obtained in the tube-mill. The slimed portion assayed 60 oz. Ag and 1.12 oz. Au per ton; this was agitated for 120 hours with 0.5% KCN solution at a dilution of 2 to 1. The residue then assayed 3.2 oz. Ag and 0.06 oz. Au per ton. The extraction by agitation was 91% of the silver and 92% of the gold; the combined extraction by concentration and cyaniding being 96.6% of the Ag and 97.5% of the Au. A further improvement might be found in crushing originally in strong cyanide solution, cleaning out the tube-mill, and melting the + 200-mesh material, the slimed product going on to the ordinary slime treatment.

Geology of the Globe District, Arizona

By F. L. Ransome

*Study during the past season of the geology of the Ray quadrangle, which adjoins the Globe quadrangle on the south, has brought out some facts which necessitate changes in the stratigraphic column as given in earlier publications on the Globe district.[1] As active mining development is in progress in both quadrangles, it seems desirable to at once place this information on record for the benefit of mining engineers interested in the geology of the region.

It may be remembered that the Globe district is a veritable mosaic of small fault blocks, none of which contains a full section of the Paleozoic sediments. Consequently the supposed stratigraphic succession of the rocks was made

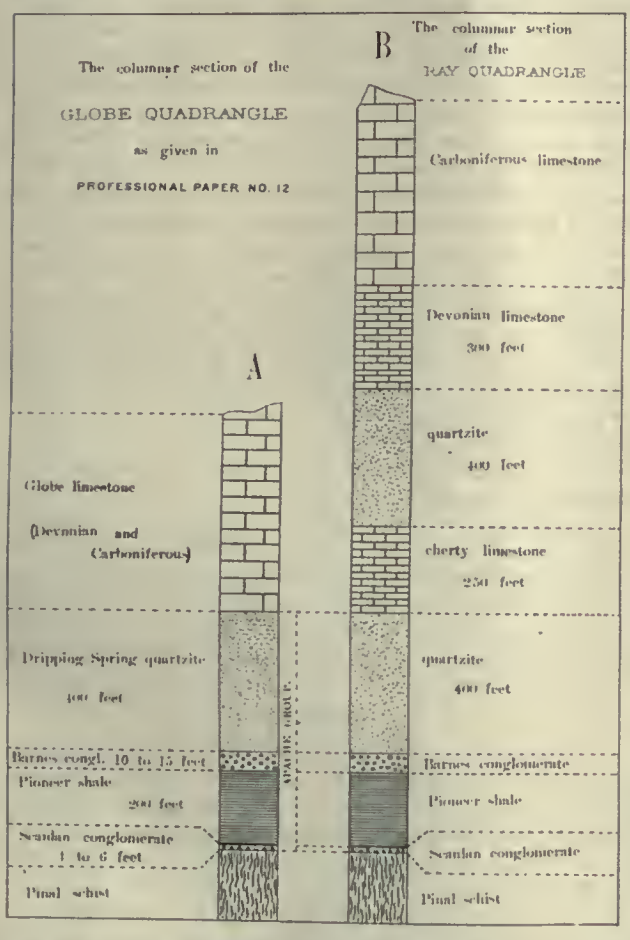


FIG. 1. DIAGRAM ILLUSTRATING THE STRATIGRAPHIC SUCCESSION IN THE GLOBE-RAY REGION.

out by piecing together fragmentary data from various blocks. Inasmuch as no single block shows more than one limestone, it was assumed that all of the limestone belonged to the Devonian-Carboniferous formation that was designated the 'Globe limestone'. Consequently, wherever quartzite was found directly underlying limestone it was supposed to belong to one formation named the 'Dripping Spring quartzite'. The stratigraphic sequence as worked out at Globe about nine years ago is given under A in the accompanying diagram (Fig. 1), in which the thicknesses given for the Ray quadrangle are preliminary estimates subject to revision. When the study of the Ray quadrangle was taken up in 1910 it was soon apparent that the interpretation of the stratigraphic data in the Globe area needed revision in some particulars. Between the Barnes conglomerate and the base of the Devonian limestone there proves to be two thick formations of quartzite separated by about 250 ft. of cherty limestone as shown under B in the diagram. The lower quartzite, for which the name Dripping Spring quartzite will probably be retained, differs from the upper quartzite in being generally thinner bedded and free from pebbles. These with other differences, once regarded as mere areal variations but now known to be characteristic distinctions, make it possible to recognize the two quartzites wherever they occur in the Ray quadrangle, and probably the identification could now be made in the Globe quadrangle also. The cherty limestone, of which a characteristic exposure is shown in Fig. 2, contains, so far as known, no fossils, and, having some resemblance to the lower, thin-bedded, unfossiliferous part of the Devonian, it is perhaps not altogether surprising that it should, in the absence of an unbroken section, have been included with the Globe limestone of the Globe quadrangle. This cherty limestone, both in the Globe and Ray quadrangles, is the formation most extensively invaded and disrupted by diabase, the limestone in some places occurring as scattered blocks in a great diabase sill or being entirely cut out by the eruptive rock. Consequently, in the Globe work the chertiness was plausibly accounted for as a result of local metamorphism,

FIG. 2. CHERTY LIMESTONE, RAY.

whereas it is really characteristic of the formation. Moreover, a reconnaissance into the Ray quadrangle while the study of the Globe area was in progress failed to reveal the true stratigraphic situation for the reason that the traverse crossed the horizon of the cherty limestone at a place where only intrusive diabase was exposed. It is easy with retrospective wisdom to say that more study should have been given nine years ago to the region around the Globe quadrangle. Since, however, economic work must as a rule be done within an estimated time, and with a limited sum of money, it may readily be understood that the unexpected intricacy of the faulting within the Globe area left little time or funds available for extensive supplementary reconnaissance.

The age of the formations below the Devonian limestone has not been definitely determined, but it is hoped that some information on this point may be obtained during the coming season. The formations between the cherty limestone and the Pinal schist, the Apache group of the Globe report, are still provisionally assigned to the Cambrian. The cherty limestone and the upper quartzite may possibly be Ordovician or Silurian. No fossils have been found below the Devonian. In the Ray quadrangle it has been practicable to map separately the Devonian and Carboniferous limestones. The adjustments in nomenclature necessitated by these changes are still under consideration. Geographic names will undoubtedly be given to the cherty limestone and the upper quartzite. The name 'Globe limestone' has no further use in its original application, and possibly 'Apache group' may also be dropped.

*Published by permission of the Director of the U. S. Geol. Survey.

[1] Ransome, F. L. 'Geology of the Globe Copper District, Arizona.' Prof. Paper U. S. Geol. Surv. No. 12, 1903. Globe Folio, No. 111, 1904.

Careful reëxamination of the Globe quadrangle would show that some small masses mapped as Globe limestone, particularly those enclosed in diabase, are really the cherty limestone. The block of limestone at the Arizona-Commercial mine northeast of Globe, for example, is composed of the cherty limestone. Here, too, doubtless belongs the block inclosed in diabase in the foot-wall of the Old Dominion mine (see Prof. Paper No. 12, Fig. 7), an occurrence that was rather puzzling when this was supposed to belong to the same general horizon as the limestone in the hanging wall. The little patch of so-called Globe limestone on the top of Barnes peak shown in Fig. 2, Prof. Paper No. 12, is the cherty limestone, as are probably most of the small areas of limestone shown on the Globe geologic map between Barnes peak and Jones gulch.

Detection of the Platinum Metals

By L. J. Curtman and P. Rothberg

*For a long time it has been known that the platinum metals present the rather remarkable phenomenon of condensing relatively large volumes of gases upon their surfaces at room temperatures, and also, that this property is especially pronounced if the metals are in that finely divided state obtained by the reduction of their salts. In 1823 Döbereiner showed that the occlusion of gases by platinum sponge, particularly in the case of a mixture of hydrogen and air, was accompanied by the oxidation of hydrogen to water, and it was noted that this reaction took place so rapidly and energetically as to cause the platinum sponge to glow intensely. From the early investigations of Döbereiner to the present day, this occlusion of gases by platinum has been the subject of much research, and, among other things, it has been shown that hydrogen in the occluded state acts in the same manner as nascent hydrogen, and that, in general, the presence of metallic platinum in the finely divided state greatly accelerates the oxidation of many oxidizable gases.[1]

Although this property of platinum has been made use of in the analysis of gases and in various commercial processes, the authors are not aware of any record which shows that the occlusion of gases and their oxidation in the presence of the platinum metals, more particularly the glow accompanying the oxidation of some gases, has been utilized as a method for the detection of platinum and its allied metals. It was the object of this investigation to determine the reliability for qualitative purposes of the 'glow reaction' obtained by passing a mixture of air and illuminating-gas over very finely divided platinum. To that end it was necessary, first, to decide upon a simple method of carrying out the reaction; second, to determine the minimum amount of each of the platinum metals that would give the test; and third, in the case of platinum, to ascertain the influence and possible interference of other substances.

Method of Making Tests.—The following method was selected, and though it may not be the most delicate or refined method possible, it has decided advantages as a practical method, because of the simple apparatus necessary and the great rapidity with which it may be applied.

The substance to be tested is brought into solution by any of the common methods, and about 0.2 c.c. of this solution is absorbed in a piece of thin asbestos paper by alternately dipping the paper into the solution and heating until the required volume has been absorbed. Experience showed the above volume (0.2 c.c.) to give the best results in these tests. The moist paper, held by one end in a pair of tongs, is now heated to redness in the Bunsen flame, then removed, and after the redness has ceased, but while the paper is still hot, it is brought into a stream of a mixture of illuminating-gas and air from a Bunsen burner. If platinum is present, the asbestos paper will begin to glow. The glow must last for some time and can be brought back after it has once died out by again heating the paper and holding it in the stream of gas. The burner must be arranged to supply a fairly good mixture of illuminating-gas and air, and the pressure must not be too great.

It is also essential, for the greatest sensitiveness of the test, that the asbestos paper be very thin. In these experiments pieces of asbestos paper 0.5 by 3.0 cm. and 0.3 mm. thick were employed, only approximately half being used to absorb the liquid. The intensity of the glow can be somewhat increased by having the gas warm. This can be easily accomplished by slightly warming the upright tube of the burner before passing the gas through it. All the results given below, however, have been obtained with the gas at room temperatures.

Determination of the Limits of the Test.—To determine the smallest quantity of each of the platinum metals that would give an unmistakable glow under the conditions of the above method, experiments were performed and it was found that the smallest amount of platinum which would give a reliable glow was 0.002 mg. The limit for palladium under the conditions of the test was found to be 0.0005 mg., while iridium requires 0.005 mg., and rhodium 0.0009 mg. Osmium and ruthenium gave negative results, probably due to the volatility of their salts. Experiments were also undertaken to determine what effect the presence of other substances has upon the test, and, in general, it may be said that all substances which, after ignition, leave a heavy residue on the asbestos paper, impair the sensitiveness of the test in so far that quantities of platinum near the limit will not glow under these conditions. Also, solutions which are acid with strong nitric acid attack the asbestos paper, swelling it up and thus also decreasing the sensitiveness of the test. It can, however, be seen from the above results that none of the common metals offer any interference to the glow tests unless present in quantities that are considerably larger than the quantity of platinum. Furthermore, the test was applied directly without going through any separations, to a sample of 'black sand' of California, to platinum residues, sweepings, and various forms of platinum waste. In each case a good test was obtained. Tests made on solutions of palladium containing respectively lead, arsenic, and sodium (the least favorable of the common metals) seem to warrant the belief that palladium will be as little affected by the presence of other metals as was found in the case of platinum.

Summary

1. The oxidation of the constituents of illuminating-gas, particularly of hydrogen, with finely divided platinum, palladium, rhodium, or iridium as catalytic agent is accompanied by a glow which is distinctly characteristic of these metals. Hence this glow may be used as a qualitative test for these metals.

2. This test is sensitive to extremely small quantities of the metals, the limits being: platinum, 0.002 mg.; palladium, 0.0005 mg.; rhodium, 0.0009 mg.; and iridium, 0.005 milligram.

3. The presence of other substances does not for practical purposes interfere with this test. In fact, the test may be applied directly to a solution without preliminary treatment for the separation of other substances.

4. In an analysis where all the platinum metals are to be considered, this test may serve to show the presence of the platinum group with the exception of osmium and ruthenium, and also to confirm the presence of platinum, palladium, rhodium, and iridium, when the metals have been separated. In most practical work, the 'glow reaction' becomes distinctly a test for platinum, the most common metal of the group. For this latter purpose the glow test recommends itself strongly, because of its sensitiveness and the rapidity with which it gives results.

*Abstract of a paper presented at the March meeting of the New York Section of the American Chemical Society.

[1] W. Henry, *Phil. Trans.*, Vol. 14, p. 266 (1824); Phillips, *Am. Chem. Jour.*, Vol. 16 p. 163.

Platinum most commonly occurs in placer deposits, in the native state, though usually alloyed with iron and frequently with copper or other metals. It also occurs as the mineral sperrylite, $PtAs_2$, associated with certain copper and nickel ores.

Slime Agitation at Kalgoorlie

By M. W. von Bernewitz

Not so long ago mill-men endeavored to make as little slime as possible, and what was made was considered a nuisance. Nowadays, however, the general practice is to make as much as possible, consequently new processes of agitating and filtering the pulp had to be devised, and are being introduced almost continually. We have the choice of the ordinary, A. Z., Kalgurli, inverted cone, Brown and its modifications, silica sponge, air-lift, centrifugal pump, and numerous other styles of agitators, each with its advantages and disadvantages. Agitation as practised at Kalgoorlie, has never been described in a general way, so these notes may be of interest to mill-men.

The following table shows how the ore is crushed and ground in our mills:

Name.	Manner of reduction to slime.
Associated	Ball-mills and pans.
Associated Northern	Ball-mills and pans.
Gt. Boulder Perseverance	Ball-mills, pans, and tubes.
Gt. Boulder Proprietary	Ball-mills, Griffin mills, and pans.
Hainault	Stamps and pans.
Ivanhoe	Stamps and pans.
Kalgurli	Ball-mills and pans.
Lake View & Star	Stamps, pans, and tubes.
Oroya Links	Stamps, pans, and tubes.
South Kalgurli	Ball-mills and pans.

The product in the dry-crushing mills will average about 87% through 150 mesh, while in the wet-crushing plants it will be over 90 through the same screen.

Each system in use calls for some little comment by way of explanation: The A. Z. agitators were introduced at the Associated mill after a long test with the ordinary type. The roasting used to be poor with some of the furnaces, and as the A. Z. agitator showed as much as 4% better results than the latter they were erected. As regards time of agitation, power consumed, and loss of cyanide, it is a case of 1 to 1½ hours, 12 hp., and 1 lb. KCN per ton, against 2 to 12 hours, 2½ hp., and about 1½ lb. KCN respectively, to which must be added the increased extraction. These vats are small, but of course the gear may be made for any size tank.

The three propeller blades are fixed on a vertical, gear-driven spindle, revolving at 60 r.p.m. The sprindle is arranged for upward and downward thrust by having ball-bearing in the head-frame, from which it is suspended. The blades are set at an angle of about 25°, and work in a 6-ft. ring, made of plate about 12 by ½ in., bolted to the bottom of the vat, and standing about 6 in. above the bottom in order to allow the pulp to circulate to the sides. Directly under the propeller, a false-bottom is bolted to the vat to prevent the sandy particles scouring the bottom. The gear and head-frame stand on 10 by 6-in. H-iron bolted across the top of the vat, and from this are suspended baffle-plates which extend nearly across. The propeller is not started until the vat is half full of slime, and it may be stopped for any time and re-started, the bottom being scoured clean. This is one good point in the A. Z.; a very sandy pulp rarely prevents its starting. When full of slime, the flow from the periphery to the centre is at the rate of about 3 ft. per second, the pulp thereby being in violent agitation, and all parts thoroughly exposed to the air. This is where the main advantage of the A. Z. lies, and other ordinary types fail. It may be thought that the consumption of cyanide would be high on account of such violent agitation and exposure to the air; but this is not so, and, providing the solution is in good order, even though the roasting is poor, it will keep up its strength well, as the following tests show:

	Per cent KCN			
At start of agitation	0.072	0.062	0.066	0.064
After ½ to 3 hr. agitation.	0.062	0.056	0.060	0.052

A peculiar point worth notice is that slime which has been agitated for four hours or so, shows at times a higher residue than that which had only one to two hours. Of course, being a gold-bearing ore, solution is effected much quicker than if it contained silver; and it was pointed out to me by an American mill-man that the A. Z. would not pay in agitating silver ore, this requiring up to 90 hours in a Pachuca tank. This is no doubt due to long contact with the air used. Would not a fast-running machine of the A. Z. type expose the pulp to the air sufficiently in a shorter time? In adding cyanide to the A. Z., it is not broken up at all, but lumps of as much as 30 lb. weight are thrown into the slime without damage to blades or gear.

A. Z. AGITATORS AT THE ASSOCIATED.

Agitation at the Associated Northern calls for little note. If the roasting and subsequent grinding is good, the agitators do good work, and an ordinary circulating solution of 0.04% KCN is sufficient for solution of the gold, this strength being made up to 0.08% before passing through the extractor boxes. At times extraction falls off, and blowing compressed air in different points of the pulp has been tried, but somehow it is not of much benefit.

VACUUM PLANT REMOVING OROYA-EXPLORATION DUMP FOR RE-TREATMENT.

The ordinary agitator acts like a buddle, in that coarse particles settle in the bottom, due to a concentration. This concentrate is shoveled out occasionally, and assays as high as $25 per ton, part of the value being in the form of fine amalgam washed over from the pans. This is dried, sent to the mills, and re-treated. The Perseverance has a very large agitation plant doing good work. The ordinary vat calls for no comment; but Mr. Wright, the metallurgist, has devised a new scheme for more rapid circulation of the slime. At an angle of 45°, from the central spindle toward the side of the vat, fixed to the stays of the agitator arms are several pipes up to 10-in. diam., with their tops almost submerged below the surface of the pulp. By the centrifugal force imparted, the pulp is forced from the bottom of the pipes to the top, and flows out in a good stream, thus ensuring that the slime at the bottom of the

vat is well mixed with the top section. Mr. Wright believes that it only takes a few minutes with large pipes to circulate all the pulp in a vat.

The ordinary practice is followed at the Great Boulder. The Hainault has devised a collecting and thickening vat, the slime from this is circulated by a Frenier special pump, and then flows over a sort of cascade for aeration to an agitator of the ordinary style, prior to filter pressing. With the ordinary type, the Ivanhoe agitates its slime with bromocyanide. Air agitation is in use at the Kalgurli in tanks somewhat similar to the Brown system, only that they are smaller, and there is no central lift. This system has been in use for nearly ten years, a considerable time before the latter came into use. The tanks are 12½ ft. deep. The first 7 ft. is 6 ft. diam., and from that point the remaining 5 ft. tapers off to 18 in. at the bottom. For the air, there are two 1-in. pipes fitted near the bottom of the tanks, and a little air at 35-lb. pressure is admitted. The pulp first boils quietly. It takes about 20 min. to fill each from the settlers, and about 20 min. to empty by means of a slime-pump which fills the presses, there being a discharge-pipe and valve at the bottom. Each agitator will deal with 24 tons daily.

The details in the following table of the Lake View & Star and Oroya Links refer to the plants re-treating old residue, using the ordinary agitator; and agitation costs are somewhat high on account of a high consumption of chemicals, etc., in treating dumps from previous wet treatment, as decomposition of minerals has set in. Most of the foregoing methods of agitation have been in operation in Western Australia for many years, and apparently give the desired results.

TABLE GIVING DETAILS OF AGITATORS IN USE

	Name	Type	No.	Size Ft.	Capacity Tons Dry Slime	Method of Agitation	Speed R.p.m.	Time Hr.	Hp.	Gear	Strength of Cyanide %	Cost Per Ton
(1)	Associated	A. Z.	6	17 by 6	22	Propeller	60	1½	12	Bevel	0.065	$0.24
(2)	Associated Northern	Ordinary	5	22 by 6	32	Ordinary arms	6	4 to 8	2½	Worm	0.08	0.26
(3)	Great Boulder Perseverance	"	24	20 by 4½	15	"	6	2	2½	Bevel	0.07	0.22
(4)	Great Boulder Proprietary	"	18	(22 by 5) (18 by 5)	40	"	6	3 to 8	2½	Worm	0.08	
(5)	Kalgurli	Air	20	12½ by 6	4½	Air		3½	2	Bevel	0.07	0.21
(8)	South Kalgurli	Ordinary	5	21 by 9	40	Ordinary arms	14	4 to 6	2½	"	0.06	
(7)	Hainault	"	3	(24 by 7) (22 by 6) (15 by 5)		Frenier pump and cascade	7	4 to 5		"		
(8)	Ivanhoe	"	11	20 by 8	53	Ordinary arms		18	3	"	0.08	0.23
(9)	Lake View & Star	"	6	20 by 6½	44	"	11	4 to 6	2	"	0.05	
(10)	Oroya Links	"	6	17½ by 9	50	"	13	7 to 8	2½	"	0.02	

Note.—Those marked 1 to 6 are in dry-crushing mills; 7 and 8 wet-crushing mills; 9 and 10 are treating old residue. The reason of the much greater capacity in agitators of the same size is due to the extra thick slime run in from the settlers, or from the dumps. The horse-power of an agitator is rather hard to determine from an engine, unless motor driven.

Conversion Table, Chains to Feet and Feet to Chains. By R. F. MORTON

Conversion Table
Chains to Feet

R.F.Morton, C.E. Mills Bldg. San Francisco

Chs.	Feet	Chs.	Feet	Chs.	Feet	Chs.	Feet	Chs.	Feet	Chs.	Feet
1	66	51	3366	.01	.66	.51	33.66	.001	.066	.051	3.366
2	132	52	3432	.02	1.32	.52	34.32	2	.132	52	3.432
3	198	53	3498	.03	1.98	.53	34.98	3	.198	53	3.498
4	264	54	3564	.04	2.64	.54	35.64	4	.264	54	3.564
5	330	55	3630	.05	3.30	.55	36.30	5	.330	55	3.630
6	396	56	3696	.06	3.96	.56	36.96	6	.396	56	3.696
7	462	57	3762	.07	4.62	.57	37.62	7	.462	57	3.762
8	528	58	3828	.08	5.28	.58	38.28	8	.528	58	3.828
9	594	59	3894	.09	5.94	.59	38.94	9	.594	59	3.894
10	660	60	3960	.10	6.60	.60	39.60	.010	.660	060	3.960
11	726	61	4026	.11	7.26	.61	40.26	11	.726	61	4.026
12	792	62	4092	.12	7.92	.62	40.92	12	.792	62	4.092
13	858	63	4158	.13	8.58	.63	41.58	13	.858	63	4.158
14	924	64	4224	.14	9.24	.64	42.24	14	.924	64	4.224
15	990	65	4290	.15	9.90	.65	42.90	15	.990	65	4.290
16	1056	66	4356	.16	10.56	.66	43.56	16	1.056	66	4.356
17	1122	67	4422	.17	11.22	.67	44.22	17	1.122	67	4.422
18	1188	68	4488	.18	1188	.68	44.88	18	1.188	68	4.488
19	1254	69	4554	.19	12.54	.69	45.54	19	1.254	69	4.554
20	1320	70	4620	.20	13.20	.70	46.20	.020	1.320	.070	4.620
21	1386	71	4686	.21	13.86	.71	46.86	21	1.386	71	4.686
22	1452	72	4752	.22	14.52	.72	47.52	22	1.452	72	4.752
23	1518	73	4818	.23	15.18	.73	48.18	23	1.518	73	4.818
24	1584	74	4884	.24	15.84	.74	48.84	24	1.584	74	4.884
25	1650	75	4950	.25	16.50	.75	49.50	25	1.650	75	4.950
26	1716	76	5016	.26	17.16	.76	50.16	26	1.716	76	5.016
27	1782	77	5082	.27	17.82	.77	50.82	27	1.782	77	5.082
28	1848	78	5148	.28	18.48	.78	51.48	28	1.848	78	5.148
29	1914	79	5214	.29	19.14	.79	52.14	29	1.914	.079	5.214
30	1980	80	5280	.30	19.80	.80	52.80	.030	1.980	80	5.280
31	2046	81	5346	.31	20.46	.81	53.46	31	2.046	81	5.346
32	2112	82	5412	.32	21.12	.82	54.12	32	2.112	82	5.412
33	2178	83	5478	.33	21.78	.83	54.78	33	2.178	83	5.478
34	2244	84	5544	.34	22.44	.84	55.44	34	2.244	84	5.544
35	2310	85	5610	.35	23.10	.85	56.10	35	2.310	85	5.610
36	2376	86	5676	.36	23.76	.86	56.76	36	2.376	86	5.676
37	2442	87	5742	.37	24.42	.87	57.42	37	2.442	87	5.742
38	2508	88	5808	.38	25.08	.88	58.08	38	2.508	88	5.808
39	2574	89	5874	.39	25.74	.89	58.74	39	2.574	89	5.874
40	2640	90	5940	.40	26.40	.90	59.40	.040	2.640	.090	5.940
41	2706	91	6006	.41	27.06	.91	60.06	41	2.706	91	6.006
42	2772	92	6072	.42	27.72	.92	60.72	42	2.772	92	6.072
43	2838	93	6138	.43	28.38	.93	61.38	43	2.838	93	6.138
44	2904	94	6204	.44	29.04	.94	62.04	44	2.904	94	6.204
45	2970	95	6270	.45	29.70	.95	62.70	45	2.970	95	6.270
46	3036	96	6336	.46	30.36	.96	63.36	46	3.036	96	6.336
47	3102	97	6402	.47	31.02	.97	64.02	47	3.102	97	6.402
48	3168	98	6468	.48	31.68	.98	64.68	48	3.168	98	6.468
49	3234	99	6534	.49	32.34	.99	65.34	49	3.234	99	6.534
50	3300	100	6600	.50	33.00	1.00	66.00	.050	3.300	100	6.600

Conversion Table
Feet to Chains

R.F.Morton, C.E. Mills Bldg. San Francisco

Feet	Chains	Feet	Chains	Feet	Chains	Feet	Chains	Feet	Chains
1	.015	51	.773	100	1.515	.01	.00015	.51	.00773
2	.030	52	.788	200	3.030	.02	.00030	.52	.00788
3	.045	53	.803	300	4.545	.03	.00045	.53	.00803
4	.061	54	.818	400	6.061	.04	.00061	.54	.00818
5	.076	55	.833	500	7.576	.05	.00076	.55	.00833
6	.091	56	.848	600	9.091	.06	.00091	.56	.00849
7	.106	57	.864	700	10.606	.07	.00106	.57	.00864
8	.121	58	.879	800	12.121	.08	.00121	.58	.00879
9	.136	59	.894	900	13.636	.09	.00136	.59	.00894
10	.152	60	.909	1000	15.152	.10	.00151	.60	.00909
11	.167	61	.924	1100	16.667	.11	.00167	.61	.00924
12	.182	62	.939	1200	18.182	.12	.00182	.62	.00939
13	.197	63	.954	1300	19.697	.13	.00197	.63	.00955
14	.212	64	.970	1400	21.212	.14	.00212	.64	.00970
15	.227	65	.985	1500	22.727	.15	.00227	.65	.00985
16	.242	66	1.000	1600	24.242	.16	.00242	.66	.01000
17	.257	67	1.015	1700	25.758	.17	.00257	.67	.01015
18	.273	68	1.030	1800	27.273	.18	.00273	.68	.01030
19	.288	69	1.045	1900	28.788	.19	.00288	.69	.01045
20	.303	70	1.061	2000	30.303	.20	.00303	.70	.01061
21	.318	71	1.076	2100	31.818	.21	.00318	.71	.01076
22	.333	72	1.091	2200	33.333	.22	.00333	.72	.01091
23	.348	73	1.106	2300	34.848	.23	.00348	.73	.01106
24	.364	74	1.121	2400	36.364	.24	.00363	.74	.01121
25	.379	75	1.136	2500	37.879	.25	.00379	.75	.01136
26	.394	76	1.152	2600	39.394	.26	.00394	.76	.01152
27	.409	77	1.167	2700	40.909	.27	.00409	.77	.01167
28	.424	78	1.182	2800	42.424	.28	.00424	.78	.01182
29	.439	79	1.197	2900	43.939	.29	.00439	.79	.01197
30	.455	80	1.212	3000	45.455	.30	.00455	.80	.01212
31	.470	81	1.227	3100	46.970	.31	.00470	.81	.01227
32	.485	82	1.242	3200	48.485	.32	.00485	.82	.01242
33	.500	83	1.258	3300	50.000	.33	.00500	.83	.01258
34	.515	84	1.273	3400	51.515	.34	.00515	.84	.01273
35	.530	85	1.288	3500	53.030	.35	.00530	.85	.01288
36	.545	86	1.303	3600	54.545	.36	.00545	.86	.01303
37	.561	87	1.318	3700	56.061	.37	.00561	.87	.01318
38	.576	88	1.333	3800	57.576	.38	.00576	.88	.01333
39	.591	89	1.349	3900	59.091	.39	.00591	.89	.01348
40	.606	90	1.364	4000	60.606	.40	.00606	.90	.01364
41	.621	91	1.379	4100	62.121	.41	.00621	.91	.01379
42	.636	92	1.394	4200	63.636	.42	.00636	.92	.01394
43	.651	93	1.409	4300	65.152	.43	.00652	.93	.01409
44	.667	94	1.424	4400	66.667	.44	.00667	.94	.01424
45	.682	95	1.439	4500	68.182	.45	.00682	.95	.01439
46	.697	96	1.455	4600	69.697	.46	.00697	.96	.01455
47	.712	97	1.470	4700	71.212	.47	.00712	.97	.01470
48	.727	98	1.485	4800	72.727	.48	.00727	.98	.01485
49	.742	99	1.500	4900	74.242	.49	.00742	.99	.01500
50	.758	100	1.515	5000	75.758	.50	.00758	1.00	.01515

Simple Mine Bookkeeping

By K. C. Parrish

In small mines in the process of development where the superintendent or foreman must do his own accounting, simple forms and explanations for bookkeeping are badly needed. This has often been commented upon by the mining journals, and especially by the men actually in the field. Large properties can afford to engage trained men for this clerical work. In my experience the practical miner or young graduate, when placed in charge of a small crew of men or a small property, has some difficulty in adapting to his own use the complete and sometimes complicated systems of bookkeeping used at large properties, and such references are the only ones he is apt to find. Frequently he is not fortunate enough to obtain even these. His inquiries concerning mine accounting are generally answered by a man trained in bookkeeping, but who, not being a practical mining man, ordinarily fails to appreciate what data are most essential and the great importance of simple forms. A sense of proportion must be cultivated by the new man, who has everything in charge, so that he will not waste his time on non-essentials in clerical work.

As a result of experience and observation I have worked out some simple forms for bookkeeping for the small mine and prospect, which forms can be used and enlarged as the mine develops. For convenience, I have divided this system into three parts: (1) preliminary development; (2) development and mill installation; (3) producing stage.

Each one of these parts is arranged so as to give (A) a scheme used in the western United States, and (B) another in a remote Spanish-American country. It is only with the first, I (A), 'preliminary development,' that we are concerned in this article.

I (A)

Suppose that one man has been placed in charge of from eight to twenty men, opening up a prospect under favorable conditions in the western United States, and that he must report to a manager or board of directors once a month, besides sending a weekly letter. This man has been selected more for his knowledge of mining and his ability to handle men than for his knowledge and experience in business. He is supposed to devote most of his energy to the actual work, and not to give much time to mine accounting, especially at the expense of the work. At the same time, both he and the manager, or directors, must keep in close touch with the work, so some definite system of accounting must be used.

The following is a summary of the books needed. Those in parentheses can be omitted if necessary.

Time book.
(Development book.)
(Supply book.)
(Pay-roll.)
Cash book.
Order book.
Assay book.
Assay and development map.
(Contract book.)
(File.)
(Journal.)
(Ledger.)
Check book.

For this preliminary development no card system, loose-leaf system, or special filing system is necessary. These can be developed as may be found advisable, without confusion, as the general scheme need not be changed.

Time Book

There are several forms of time books, each having its particular use. For the mine office the style as shown is most desirable, as it is larger, giving plenty of space for daily notes. It may also serve as the pay-roll sheet.

Names	1	2	3	4	5	6	Sunday	Total time on claim	Cash	Rate	No. of shifts	Rate	Total	Amount due	Signature
Henry Miller	P 1	P 1	O	O	P 1	P 1		9 7/8 hrs 9 7/8 hrs	12 cts	—	26	3.33⅓ 3.00	85 cts	73 cts	
Wm Owens	P 1	P 1	P 1	P 1	P 1	O		8 18 5 hrs	50 cts	—	30	3.50	105 cts	75 cts	
Frank Martin	S ½	S ½	A 1	A 1	A 1	A 1	S 1	4 hrs 9 1/4 hrs	0	4 cts	28	3.17 3.00	97 cts	95 cts	
John Henry	P 1	P 1½	P 1	P 1	P 1	P 1	P 1	9 hrs	0	—	3½	3.00	96 cts	96 cts	
S Coors	P 1	O	P 1	P 1	P 1	P ½	P 1	9 hrs	6 cts	—	30	3.00	90 cts	84 cts	

FORM I. TIME BOOK.

Development Book

This may be included in the time book, by setting aside an extra double page each month. It is especially desirable in small operations, where the work is more or less temporary, to cut down the number of books kept, especially if there is no regular office. Each place worked in the mine should be represented by a letter or mark, which can be written daily in each square of the time book to show where the man works each day. At the end of the month, the number of shifts worked in each place can be counted and entered under head of 'Number of Shifts', in the development book. 'Feet Advanced' and other simple data can be entered as shown, thus giving a handy record of all the work. In cases of dispute you can tell where a man has worked each day. This can be expanded indefinitely; but in large operations it is necessary to have a separate book for such data.

	No. of shifts	Feet advanced	Total Distance	Distance from measuring peg	Total labor cost	Labor cost per foot
(d) Drift No. 1	60	40	180	50	$180.00	$4.50
(e) Drift No. 2	37	20	60	60	112.00	4.00
(s) Shaft	180½	53	120	62	540.00	10.20
(h) Hoist	90				270.00	
(b) Blacksmith	Hoist	man paid $34 extra			34.00	
(c) House	60				210.00	
(r) Roads	140				420.00	
(x) Contracts						
(v) Installing Pump	31 ⅓				95.00	
TOTAL	599	121	360		$1861.00	

FORM II. DEVELOPMENT BOOK.

Supply Book

Instead of using a separate book, a double page of the time book may also be set aside each month for a supply book, as shown. Time books are large and cheap, and with the data thus concentrated there is les sdanger of loss. An invoice of all ordinary supplies should be taken on the first of every month, and written in the supply book. The supply account should be kept not only to ascertain the amount of supplies used, but to stop any leaks, and to find out what supplies will be needed, so that there will be no shortage and expensive delays. On careful perusal the form shown will be self-explanatory; it may be reduced or enlarged as desired, and will show the approximate cost of supplies as needed in handling the work. The accounts in the time, development, and supply books, as outlined above, are primarily for the use of the man in

SUPPLIES

	Powder,	caps,	fuse.	candles	steel,	timber,	lagging,	etc.
On hand January 1st								
Rec'd during Jan.								
Sum								
On hand Feb. 1								
Difference is amount used during January.								
Cost of supplies used								
Amount used per ft.								
Cost per ft.								
Total cost per ft supplies								
Total cost per ft. of labor								
TOTAL								

FORM III. SUPPLY BOOK.

charge, but as the average man will not keep up these cost tables for his own benefit, it is important that a report of costs should be required each month.

Cash Book

A cash book, properly ruled and headed, will give the directors and the home office most of the desired information. The figures from the cash book are kept in the home office, and from them the annual cash statements and reports are made. This form of cash book makes it unnecessary to keep accounts in ledger form with different parts of the work, and hence saves a large amount of bookkeeping. I will describe its use in detail, even at the risk of explaining that which may seem obvious. The study of this cash book will amply pay for the effort required.

First, select your headings; be sure that they are what you want, and do not try to start with too many. The idea of this kind of cash account is, that when, for example, a bill is paid, the total is put under 'credit', as in the ordinary cash account, and, at the same time, this bill is subdivided and the amounts put down under their respective heads, as 'Mine Supplies', 'Power', 'General Expense', etc., as in the examples given.

As a rule, payments on account of labor are not entered in the cash book until the end of the month, as it is not convenient to divide labor costs during the month. For convenience, each of these subheadings in the cash book is lettered, so that at the end of the month, or when the pay-roll is made out, these letters can be used on the time book or pay-roll, to indicate under what heading the payment should be placed, so that they may be easily transferred to the cash book, either in detail or as a whole. The column marked 'Transfer to Cash Book' in the time book contains the segregations of the labor costs which are to be entered in the cash book. It is not necessary to make out this pay-roll separately from the time book, and not at all, as far as the payments to the men are concerned. When the work assumes large proportions, it is made out to more carefully divide the labor costs, and to have a more complete record of such a division. This extra pay-roll can be made out in either of two ways: the workman's name appearing on the pay-roll the same number of times as the number of headings under which his work comes; or the workman's name is only written once, but there are as many columns as there are divisions of labor in the cash book.

Before bills are filed away, and at the time they are paid, and the amounts entered, and divided on the cash book, a note should be made on them showing the segregations. These can be used for reference.

At the end of the month all the money received would be listed under 'debit' and all the moneys paid out under 'credit'. The difference will be 'cash on hand'. The sum under 'credit' must equal the sum of the totals of the columns marked (a), (b), (c), etc., and for this reason the cash statement can be made out at the end of the month as shown in Form V.

Form V

Cash Statement of 'The Mutual Mining Company'
For the Month of..... 19....

Jan. 1—Balance on hand.....	$1230.46	
" 8—Draft 4/1/11 from Chicago..	2500.00	
" 31—Mine labor		$ 832.00
Surface labor		304.00
Mine supplies		100.10
Construction and machinery..		1580.68
Mine timber		170.00
Power		208.00
General expense		14.60
Superintendence		295.00
Feb. 1, 1911—Balance on hand.....		226.08
	$3730.46	$3730.46

Cash books ruled for this kind of work can be purchased at any good supply-house. The same is true of the large-sized time books and pay-roll. If cash is handled at the mine, it is always convenient to keep a small note-book with the cash, in which to enter all cash paid out. Payments of bills are checked off in this note-book when entered in the cash book. This applies also to money advanced for labor or merchandise when charged on the pay-roll or ledger. With this little book, the cash is checked up. A check book answers the same purpose and is preferable when it can be used.

CASH STATEMENT of the MUTUAL MINING CO. NEVADA. for the Month of 1911

			Dr Cash Received	Cr Cash paid out	(A) Mine Labor	(B) Surface Labor	(C) Mine Supplies	(D) Construction & Machinery	(E) Mine Timbers	(F) Powder	(G) Genl Expense	(H) Superintendence
Jan	1	Bal on hand	1230 46									
	8	Draft 4/1/11 from Chicago	2500									
	15	John Carter - 500 logging @ 12		60					60			
	20	" buggy & team		3							3	
	21	Geo Carson timber		110					110			
	20	Stationery		6 30							6 30	
		6 mapsgumes for men 6 ea		5 30							5 30	
	22	H C Henry - lumber		212 42				212 42				
		C H Carter - hardware		33 56				33 56				
		" " - bill # 343		102 10			98 10			8		
		John Carter fire wood 50 ct		200						200		
	31	Wm Smith Contract road work		420				420				
		J Geo Logan pump & fitting # 1465		502 50				502 50				
		freight on same		23				23				
		freight on mine supplies		6			6					
		Wm Smith Contract on bridge on road		70				70				
		C H Carter - fittings # 360		14 20				14 20				
		Pay roll		1441	832	304		305				
		Superintendent		175								175
		Night foreman		120								120
Feb	1	Balance on hand (Bank 105.92 Cash 120.16)		226 08								
			3730 46	3730 46	832	304	100 10	1580 68	170	208	14 60	295

FORM IV, CASH BOOK.

Order Book

For small operations this is only a memorandum book to keep track of the prices of supplies; to make note of the supplies needed, and other information pertaining to them.

Assay Book

Every assay taken is numbered and the number entered in this book with a full description of the sample and where it was taken. At least a couple of lines should be

left between samples so as to put down results. In small operations no other book need be kept for assays.

Assay and Development Map

This map should be drawn on a scale of from 20 to 40 ft. to an inch. This does not come under the head of accounting, so it will not be discussed in detail, but it is a part and not the least of the clerical work the superintendent must perform. It must be remembered that the real object of the work is to determine the size, extent, and value of the ore, so this is more important than accounting and comes first. It pays to have a good map of the mine workings, both in plan and vertical projection, placed on a table where it is easily accessible at all times, as it is from such maps that the ideas for future work are gathered and digested. Upon these are written the assay-value and width of the veins or stringers at the proper points, cross-veins, faults, and dikes. This information should be brought up to date every month, no matter how rough the monthly survey may be, or how poor the draftsman. It is to obtain this information that the mine is being developed, and adequate records must be kept of it. This is the best way for every purpose.

Contractor's Book

In this book all data pertaining to contracts should be kept; however, if the number of contracts is small, they can be noted in the development book, assay book, or ledger.

Journal

In the journal all daily transactions are recorded, buying, selling, or receipt of wood, timber, lumber, etc., and they are checked off only when they are entered in the ledger or paid.

Ledger

A ledger account is kept with all persons with whom business is done regularly. Ledger accounts are not ordinarily necessary in small operations, as the labor will be kept track of in the time book, pay-roll, and check book, or the cash 'memo' book, and the bills show the accounts with firms. The petty accounts show in the journal.

File

This can be any ordinary index file, in which all bills that have been paid can be filed away according to the name. There are a great many good systems of filing, especially those which eliminate the journal and ledger work, but I do not think the small mine need bother with such refinements. The bill file can be eliminated in preliminary work, especially when some one checks up the monthly bills and statements, by simply putting in one large envelope all the bills that have been paid and notes pertaining to them for that month, so that the bills for each month that have been paid are kept separate. In this manner the accounts are easily checked. Keep copies of every letter, statement, and bill sent to the home office.

Check Book

This does not need special explanation. Do not neglect to number all the checks issued and to keep the balance on hand to date on the stub of the check book. Have your bank render a statement of your account just before payday, and return the paid checks, which serve as receipts in case of dispute.

Summary of the Month's Work and Cash Statement

Cash book.
Pay-roll (from time book).
All bills and letters pertaining to same.
Check book, showing balance.

With these the monthly cash statement is made out. (Form V.)

Supply sheet.
Order book.
Disputed bills and letters pertaining to them.

With these he writes his agent or merchant, giving orders for supplies, and answering or asking questions.

Development sheet.
Supply sheet.
Assay and development map.
Notes on cost of work and supplies.

From these, together with the cash statement, he gives his observations and extra data on costs per ton per foot developed, work done and plans as to future work, being careful to distinguish between what are known facts and what are only surmises and indications.

Tungsten Deposits of Stevens County, Washington

By L. K. Armstrong

Tungsten was discovered in Stevens county, Washington, about five or six years ago, in Cedar Canyon district, 25 miles west of Springdale. Since that time mining has been carried on intermittently, shipments of concentrate having been made to Germany. For a time there was litigation and operation at a loss, but recently legal questions have been settled and capital has been obtained to put in an ore-dressing plant, and the mine is being operated at a profit. These deposits occur in quartz veins in granite and extend southwesterly to the Spokane Indian reservation. The mineral is wolframite.

Northeast from Springdale about 12 miles, and about 12 miles north from Deer Park, is another locality where tungsten occurs. This occurrence is even more interesting than that at Cedar Canyon, as it is found where the granite has intruded through the sedimentary rocks, in both of which the tungsten mineral hübnerite is found. Work here has thus far been confined to a section of land the title to which is vested in the State, and leases on a 5% royalty have been obtained. The strike of the contact near which operations have been conducted is nearly southwest. Operators on the northeast quarter of the section are working in the granite, while those on the southeast quarter are working in the sedimentaries, each driving toward the contact. Operations up to this time have not been continuous, nor concentrated at one point. To the north the ore occurs in the granite as replacing the original minerals which were doubtless somewhat shattered along the line of contact at the time of the intrusion. So far as I am aware, there is no other mineral than hübnerite in the granite. On the south side of the contact, in the shales which have been split and broken along the line of fracture to some distance from the intruded rock, there is a series of quartz veins which have formed in the bedding planes of the sedimentaries at several points of fracture which carry rich deposits of hübnerite in bunches and short shoots; and isolated from these are pockets and streaks of a bismuth mineral which has been designated by the U. S. Geological Survey as cosalite. An analysis of this made at the laboratory showed 45.25% bismuth, 33.66% lead, 16.58% sulphur, 0.80% silver, 1.16% copper, the balance being gangue and moisture. Pyrite, hematite, and limonite are found both in the veins and the adjacent shales.

Some interesting legal questions may arise when mining from the north and south shall have reached the contact of these rocks, although, title having passed to the State previous to the discovery of mineral, the law of apex cannot be applied. Something like 3½ tons of concentrate, carrying over 60% tungsten trioxide, was marketed from one of these properties some months ago, for which they were paid $8.50 per unit of 20 lb., f. o. b. Denver. The ore was obtained from a vein in open-cuts and a shaft in the shales, and was milled on the ground. Specimens of hübnerite have been exhibited which are said to have been found 5 to 10 miles to the northeast of the last-named locality, and if the statements prove correct the belt will have a total length, from east to west, of 40 to 50 miles. The field is a good one to investigate and will be likely to develop some good mines.

The Matabichouan River Power Development

By Franklin Thomas

*The streams of northern Ontario, with its rugged topography, abound in water-power, but the development of these sites would not be justified, in the majority of cases, because of a lack of market for the power. With the discovery of silver at Cobalt about six years ago, and the subsequent development of mining operations, there arose a demand for power. For several years each mining plant provided its own power supply as best it might, usually with high cost of equipment, and invariably high cost of operation, and often with unsatisfactory results. A large part of this power was consumed in driving air-compressors, the compressed air being used to operate rock-drills, pumps, and hoists.

With the growth of such a favorable market for power it is natural that the adjacent water-power sites should be regarded as furnishing the solution of the power problem. Accordingly the Mines Power, Ltd., was formed with E. A. Wallberg, of Montreal, as president, to furnish both electric power and compressed air to customers in this district, this power to be generated at a hydro-electric station on the Matabichouan river, about 23 miles south of Cobalt. A development with a normal output of 8000 hp. has been made at this place, which is the largest available site within this radius. With individual mines generating their own power, the cost ranged around $150 per horse-power, while the electric power is sold at $50 per horse-power per year, and the compressed air at $60 per horse-power.

The power-site on the Matabichouan river was admirably adapted to economic development. As shown on the accompanying map, the Matabichouan river serves as a connecting link for several adjoining lakes and finally drains the Bass lakes into Lake Temiskaming, which in turn feeds the Ottawa river. Almost at the outlet of the First Bass lake the river commences a descent of nearly 300 ft. in a succession of rapids, the course of the stream meanwhile describing a bend and doubling back so that the foot of the rapids—which is two miles from Lake Temiskaming—lies not far from a bay of the First Bass lake, but on a lower level. The construction work was done by E. A. Wallberg, with J. R. Nichols as superintendent. Messrs. Smith, Kerry, and Chase, of Toronto, made the designs, and members of their staff acted as resident engineers.

The flow of the river is extremely variable. In May and June, after the spring thaws and rains, it develops into a flood, while in September, before the fall rains, and in March, before the spring water, the minimum flow of 90 second-feet, equivalent to about 2000 hp., is reached. This condition necessitates the construction of an extensive storage system, which will be referred to later. At full load the turbines require a total of 365 second-feet. By constructing a dam, which raised the level of First Bass lake about 40 ft., the head-water is brought up to the brow of the hill leading to the foot of the rapids. This also furnishes additional storage, giving a good operating margin at the plant.

A canal 800 ft. long and 20 ft. wide, submerged at the new lake level, providing a channel for the head-water with a uniform depth of 20 ft., leads up to the intake, where the water passes into two steel pipe-lines, each 5 ft. diam. The pipe-lines are 1200 ft. long and pass under the floor of the power-house. The power-site lies within a timber limit owned by the Shephard & Morse Lumber Co., of Ottawa, and in an unsettled region, so camps had to be erected to house the workmen, the site cleared of timber, and transportation of material and plant provided for. Operations were begun about June 1, 1909, immediately after the close of the log-drive. While the site was being cleared, supplies were brought up by rail to Temiskaming, on the Canadian Pacific railway, at the foot of Lake Temiskaming, 40 miles from the work, and transferred to scows, which were drawn by steam launches to the foot of the rapids on the Matabichouan, near the site of the power-house.

A railway was constructed, leading from the scow landing to the foot of the hill, near the power-house site, then up an incline 1400 ft. long to the upper level, and half a mile farther to the site of the main dam. Horses furnished the motive power for the railway, except on the inclined portion, which was operated by a hoisting engine and cable. Nearly all the supplies and materials necessary were brought in before the close of navigation, about December 20. After the close of navigation, a good winter road was made, for the most part across lakes, to Temagami on the Temiskaming & Northern Ontario railway, eighteen miles distant.

Sand for concrete was obtained near the mouth of the river on the shore of Lake Temiskaming, while a quarry and crushing plant near the site of the dam, supplied the greater part of the crushed stone required. Approximately 40,000 bbl. of International portland cement was consumed in the various structures. The laborers employed included French Canadians, who were used mostly on the clearing, crib-work, rough carpenter work, and concreting, Italians for excavation, and Indians from the Caughnawaga Reserve near Montreal for trestle-work, steel-work, handling machinery, and concreting. These last were especially good in general work as a result of their experience in a structural works near their reservation. The summer of 1909 was required to clear the site of the operations, to make excavations, and to set up the necessary plant.

In order to clear the surface of the bedrock for the dam in the river bed, about ten feet under water, a crib dam was built, which would carry the natural flow of water along the river bank and discharge below the crest of the rapids so that it would not run back and interfere with the excavation. With this arrangement the river section of the dam was put in, then the sluice closed and the water held back while the sluice was torn out and this section of the dam brought up temporarily out of reach of the water.

The main dam rests upon a solid rock foundation throughout, abutting against the rock at the east end and penetrating a gravel and clay bank some 30 ft. at the west end. A trench 1 ft. deep and 2 ft. wide was made in the bedrock to give a bond with the concrete. The rock was thoroughly cleaned and washed, then grouted before concreting in any section was commenced.

The dam, which is of solid concrete, has a top width of 2½ ft., the top being 3 ft. above high-water level, with a down-stream batter of 1 in 2, and an up-stream batter of 1 in 12. The length of the dam is about 700 ft, and in the river bed reaches a total height of 53 ft. Expansion joints occur at 50-ft. intervals, and this furnishes a convenient unit for pouring. The regulating section comprises three waste sluices 14 ft. wide, draining 12 ft. below high-water level, and a long sluice 20 ft. wide and 8 ft. deep. The sluices are separated by piers which support a reinforced-concrete deck. Drop-logs of 1 sq. ft. cross-section, handled by winches, serve as gates. West of the regulating section is a spillway 50 ft. long at the high-water level.

The concrete in all the structures was 1-3-5, and was mixed as wet as practicable. Large stones varying from one-half to a cubic yard in volume, were freely used as displacers in the concrete. These were obtained from the quarry, and deposited so as to be not less than 1 ft. apart. A 4-ton cableway 800 ft. long was erected over the centre-line of the top of the dam, and proved very useful in aiding excavation, and in subsequent handling of forms and displacers. The mixing plant for the dam consisted of two half-yard Ransome mixers, fed by gravity from bins which were kept stocked by cars of materials hauled up an incline. Water was pumped to a tank on a level with the bins. With this arrangement, each turned out two mixes every five minutes. The concrete was conveyed to place by 1-yd. steel dump-cars, running on a double-track trestle along the up-stream side of the dam. There was a slight grade in favor of the loaded cars. Hoppers were placed at inter-

*Abstract from *The Transit*, University of Iowa.

vals along the trestle; from these, by swinging chutes, the concrete was deposited as desired. The concreting operations were carried on throughout the winter of 1909-1910, work being suspended only on a few occasions of severe cold. Steam-coils were placed in the bins feeding the mixers, to heat the water. With this arrangement zero weather presented no serious obstacle. After pouring stopped in any section, the forms were covered and live steam turned into the forms.

The main dam backed up the water on the four Bass lakes and on Trout lake, an area of 2 sq. mi. Above these lakes, the river follows a narrow channel to the outlet of Rabbit lake, nine miles from the main dam. At a convenient location here, as shown on the map, a crib dam was built, capable of storing 13 ft. of water on this lake,

MAP SHOWING MATABICHOUAN RIVER POWER DEVELOPMENT.

which has an area of 8 sq. mi. The dam is provided with three regulating sluices with drop-log gates. The other cut-off dams were constructed on other bays of the lake, only one of these being provided with a sluice, which permits the flow of water either through the river channel or through Ross and Cooper lakes. To take advantage of the latter condition, an old logging-dam at the outlet of Cooper lake was rebuilt, giving several hundred acres additional storage.

The Rabbit lake dam is capable of backing the water up to the outlet of White Bear lake, where a dam, similar to the main dam on Rabbit lake has been constructed, capable of storing 8 ft. of water on White Bear lake, an area of 4 sq. mi. This dam is 10 mi. by water from Rabbit lake dam. Attendants are stationed at the Rabbit lake and White Bear lake dams. These dams furnish ample storage for present requirements, but should it prove necessary, there are one or two other storage areas which might be utilized. The total drainage area tributary to the plant is 350 sq. mi., but the total run-off could not be retained, owing to the immense quantity of water required to float logs through the numerous rapids of the Matabichouan. Nearly 500,000 logs pass through the river and the main dam annually.

The intake consists of two forebays, each 8½ by 15 ft. behind the drop-log gates. At the high-water level there is 20 ft. of water over the mouth of the penstocks, one of which leads from each forebay. These are 1200 ft. long, 5 ft. diam., and reach the power-house by four grades of nearly equal length, increasing toward the power-house. The pipes are spaced 11½ ft. c. to c. at the upper end, and 10 ft. at the power-house, and supported by concrete saddles spaced 12 ft. apart along the pipes. The penstocks were supplied by the Jenekes Machine Co., of St. Catherines, Ontario, and were shipped in 12-ft. lengths. The plate varied in thickness from 5/8 in. at the power-house to 3/8 at the top. At high-water the total head is 317 feet.

The power-house is of reinforced-concrete throughout, 60 by 110 ft., containing four Francis type turbines direct-connected to rotating field generators, and two Doble wheels direct-connected to the exciters. Two turbines and one exciter wheel are run on each penstock. The turbines are single runner wheels with side-discharge, designed for 2750 hp. maximum, fitted with 25-in. gate-valves to shut off the wheel-cases, and controlled by Jens-Orton-Boving governors. The generators are 1875 k.v.a., 2400-volt, 3-phase, 60-cycle machines running at 600 r.p.m. The exciter wheels are controlled by needle-valves. Each exciter is rated at 100 kw., 800 amp., 120-125 volts, and is capable of exciting all four generators. The four transformers, 1875 k.v.a., 2400-44000 volts, 3-phase, 60-cycle, are water and oil cooled. A storage battery with a capacity of 80 ampere-hours is provided for emergency uses, to furnish power for the electrically operated switches, and to be available for lighting purposes.

The transmission line is double, 24 mi. long, of No. 0, 7-strand, aluminum cable. A telephone line runs along one pole line, the wires being transposed at every third pole, and a telephone transformer is placed at each station to counteract induction effects. The voltage is higher than customary for the present distance of transmission, to allow for a possible extension of the line. Effort was made to get the plant in operation as early as possible, and the wheels started after an interval of slightly more than nine months had elapsed since the first clearing on the site had been made.

There are sub-stations at Cobalt, Brady lake, and Beaver lake, the two former containing air-compressors, and the latter transformers only. In each of the compressor stations there are two 1000-hp. motors driving separate two-cylinder air-compressors. The air coming from the first compressor is under a pressure of 45 lb. per square inch, and comes from the second at 110 lb. pressure. The air then passes to the drying chamber, where the moisture is removed, which prevents freezing in cold weather. From the stations, the air is delivered through 10-in. cast-iron mains, carried on the surface of the ground to the users at the various mines. The Cobalt and Brady lake stations are ten miles apart and two pipe-lines are connected so that one station may relieve or supplement the other. In addition to compressed air, electric power is distributed from the sub-stations. The service given has been very satisfactory, and has greatly reduced the cost of power in mining.

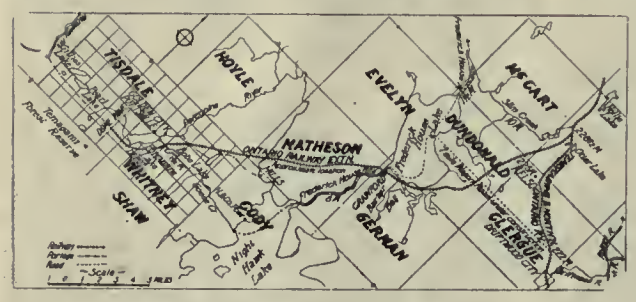
PORCELAIN INSULATORS are formed in plaster or steel molds from a plastic mixture of finely pulverized clay, feldspar, and quartz. After being dried and glazed they are burned in potters' kilns. The clays used are the white clays which are found only in mountainous regions. The body-mix for these insulators is of the same sort as is used in china dishes. Some insulators have been made from such fire clays as are used in the manufacture of stoneware, jugs, and crocks, but these have not so high a dielectric strength as may be obtained in the artificial porcelain mix. The composition of insulator bodies is not as important a factor as the development of dielectric strength of clay insulators as is structural density, and it is for this reason that in some cases insulators of high dielectric strength have been lathe-turned from some of the fine-grained rocks, such as the soapstones.

The Porcupine Gold Area

By Ralph A. Meyer

Until the last two or three years the Porcupine area was difficult of access and little prospecting was done. Practically all the information concerning it was contained in the reports published by the geologists who accompanied Mr. Niven, the Ontario land surveyor, in his base-line work, and the township surveyors in the years 1896-9 and 1903-5. The first real prospecting in the area was performed in 1906 on the Wilson claim now known as part of the Timmins mine. In 1909, during the month of June, interest was revived in the district by numerous discoveries, following which a brief examination and report was made by James Bartlett, one of the Government geologists. Since then approximately 10,000 claims have been staked.

The greater amount of development has been performed in Tisdale township on such properties as the Timmins, Dome, Foster, Vipond, Crown Chartered, and Armstrong-McGibbon. But there are several properties in the adjoining townships, namely, Whitney, Shaw, Deloro (formerly known as the Temagami Reserve), Carmen, Langmuir, El Dorado, and Denton, among others, where phenomenally rich surface showings have been discovered.

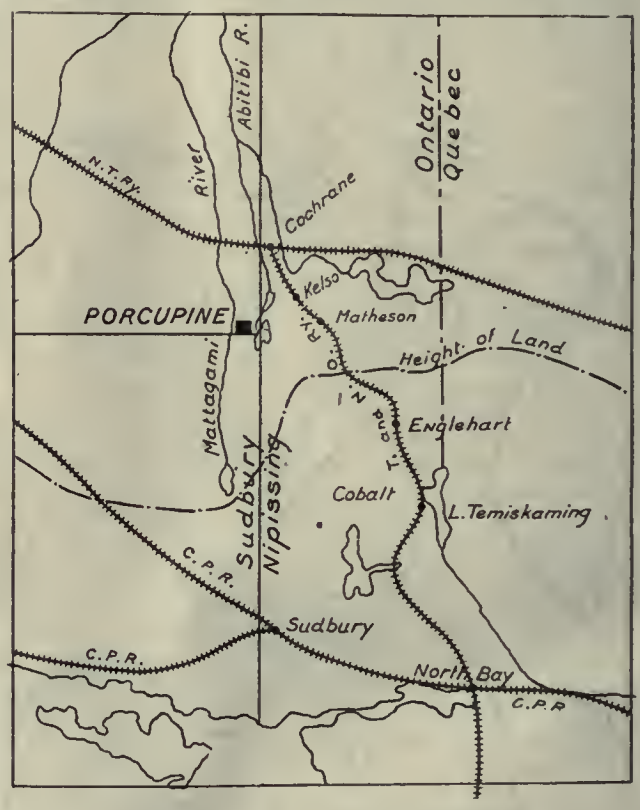


RAILWAY EXTENSION TO PORCUPINE.

These claims have been purchased for large sums of money and are at the present time being actively developed and prospected. I wish strongly to emphasize the fallacy of the general belief that all the 'pickings of the pie' are in Tisdale township. It does not follow because the Ontario Government has decided that each township shall be six miles square that mineral occurrences cease at the approach of a division line. The unitiated are prone to regard those lines as stone walls. The public should not be too easily captivated by spectacular free-gold showings. The required tonnage will be obtained from the sulphide deposits; and in my opinion there is no doubt even at the present early stage that the necessary tonnage exists. Both the Dome and the Timmins properties are erecting mills of 40 and 30 stamps respectively, equivalent to a daily capacity of approximately 350 tons. Several of the smaller properties, as well as those that are in earliest stages of development, have and are constructing small mills. I personally believe that certain parts of the district will develop the greatest free-milling ore mines in the history of gold mining on the North American continent.

Porcupine may be reached by driving a distance of 34 miles from Kelso on the Temiskaming & Northern Ontario railway. This is known as the winter route. During the summer and spring months, the journey has been performed by driving and launches. The first portion of the journey is a 12-mile drive; 7 miles on a fairly good Government wagon-road, and 5 along the shore of Frederickhouse lake on a gravel bed, to what is known as Crawford's stopping place, at the junction of Frederickhouse lake and the Frederickhouse river. From this point gasoline launches run up the Frederickhouse river, across Night Hawk lake in a northwesterly direction to what is known as Hills, a distance of approximately 14 miles. From this point, the journey is completed by driving on the Government road to Porcupine townsite, better known as Golden City, a distance of 8 miles. Both during the summer and winter months the total journey from Kelso to Porcupine can be made in a day, and during the winter season, it takes a considerably shorter time, as the entire distance is traversed in sleighs.

The Ontario Government is at the present time extending the railway from Kelso to Porcupine, the road has been completed and trains are already running to Frederickhouse. The Government expects to have the entire track laid by the end of June of this year. Even under present conditions one is able to reach Kelso, within 34 miles of the camp, from New York in a Pullman car, the journey being completed within 1½ days. In the history of gold mining in America, such easy access to a gold camp from the large centres, such as New York, Chicago, Pittsburg, Boston, and Toronto, has never been known before. This is important, as those who invest appreciable sums of money in Porcupine are in the position to make frequent visits and keep in touch with their various enterprises more satisfactorily than if the seat of operations were remote, in Alaska, for example.



MAP SHOWING SITUATION OF PORCUPINE.

There are three townsites, all on Porcupine lake (which is approximately 2 miles long, ½ mile wide, and 913 ft. above sea-level). The townsite known as the Provincial, or Golden City, is at the extreme north of Porcupine lake; that known as Porcupine, where the greatest amount of activity has so far been displayed, is at the extreme northwest side of the lake. Since the location of the railway has been definitely decided upon, there is no doubt that the Provincial townsite and the one at the extreme south end of the lake will be the most active ones, as there will be a depot at each of them. The Recorder's Office and several stores are at Golden City. A postoffice and hotel known as the 'Shuniah,' as well as two banks are in Porcupine.

At the time of writing, three other hotels are under construction in addition to a postoffice and theatre at the south end. There are already five banks in the camp. The townsites are all on flat country partly composed of 'muskeg' (a local term designating swampy ground). The camp is connected with the outside by telephone; two lines are in operation, one to Kelso and the other to Matheson. The former is operated chiefly for local calls, while the latter is used mainly for the forwarding of telegrams. The telephone system is controlled by a private company.

At present the properties have to generate their own

power, but such will not be the case nine months hence, as a syndicate has leased Sandy falls, on the Mattagami river, in Mountjoy township, six miles distant from the centre of operations. Two 3000-hp. units will be erected, enough to supply electric power for operations as well as motive power for the generation of compressed air for the entire camp.

The greater part of the surface area is low and wet; this considerably hampered prospecting last summer. But about a dozen valuable discoveries have been made in the so-called swamps since the freeze-up. There is no doubt that as soon as mining operations are in full swing, these swamps will be drained, as the water is only surficial. The rock surface is occupied by a well-banded clay, together with some sand and gravel. Overlying the clay is a layer of vegetable mould, from a few inches to a foot or more in thickness. Outcrops of compact rock occur irregularly, somewhat resembling the undulated surface of a calm sea.

Since some of the outcrops are small they are difficult to detect. In some sections the rocks rise into ridges or dikes, which extend across several claims. In most cases the rocks do not rise to a greater height above the general level than 50 ft.; rarely to as much as 100 to 150 ft. the area lying between the mouth of Porcupine river and Porcupine lake has a maximum elevation of about 970 ft.; the southwestern portion of Tisdale is considerably higher, reaching an elevation of 1000 ft. The lakes are narrow and the rivers have cut deep. The greatest depth of Porcupine lake has been found to be 20 ft. The oldest series, the Keewatin, is like the rocks of this age found in various parts of the province of Ontario from the Quebec boundary on the east to Manitoba on the west. The series is here much more disturbed in many places than it is in the Cobalt area. Some of the Keewatin rocks have escaped dynamic metamorphic agencies sufficiently to show their general character. Most of the Keewatin in the Porcupine area as elsewhere, consists of dark colored or greenish schistose rocks of basic composition. Quartz porphyry is quite a common rock. While it occurs characteristically in dikes it is also found in large masses. Associated with the Keewatin, especially in the southern part of Whitney township and southeastern portion of Shaw, there is much iron formation. This iron formation is what is known as 'jaspilite,' consisting of thin alternate bands of magnetite and silica. In certain instances the Keewatin rocks contain calcite, dolomite, and other carbonates.

A belt of Huronian fragmental rocks outcrops at various places in the northern part of Whitney township and southwest through Tisdale township. It has been subjected to great metamorphism, and in some instances has been rendered highly schistose. Several dikes of olivine-diabase, cutting the Keewatin have been found in the area. Both serpentine and sericite-schists occur, being mostly associated with the quartz-porphyry and rhyolite. Some of the schists are impregnated with pyrite and ferruginous dolomite, which at the surface cause the rocks to weather to a rusty-brown color, due to iron oxide. The general strike of the schist is northeast. There is pronounced evidence of glacial action over the entire area.

Outcrops of quartz are numerous. They are found both in the Keewatin and Huronian. The age of the rock does not seem to have any bearing on the character of the vein, either as to form or to gold content. The quartz deposits of the Porcupine area are probably connected with the great granite intrusions which took place in post-lower-Huronian times. The quartz has been deposited from the impure waters, highly heated and under great pressure, which worked through the rocks after the granite intrusion. The veins vary in width from a few inches to 30 and 40 ft., the average width being about 3 to 4 ft. In many instances the orebodies cut across the strike of the schist; in such cases they vary considerably in width from point to point. In individual cases masses of quartz 75 to 100 ft. in width occur, which are rich in free gold.

A feature not to be overlooked is the persistence of the veins, which in the majority of cases can be traced for hundreds of feet, and in individual cases for thousands of feet; both hanging and foot-walls are exceptionally well defined. The area over which these veins occur is very extensive (covering an approximate acreage of 50 sq. mi.), and is likely to be largely extended by future discoveries.

TRENCHING TO PROSPECT VEINS ON LOW GROUND.

NEAR VIEW OF WORK AT DOME MINE.

CROSSING SANDBAR AT MOUTH OF FREDERICKHOUSE RIVER.

SHUNIAH HOTEL, PORCUPINE.

California Oil Production

The April output of California oil wells, according to figures compiled by the *Oil World*, was 6,544,128 barrels, which is a gain of 406,080 bbl. over that of March. This is exclusive of 399,674 bbl. of oil consumed as fuel in connection with operations in the field. In the following table is given, in barrels, the production by districts for April and March:

District—	April.	March.
SAN JOAQUIN VALLEY.		
Coalinga	1,382,770	1,516,320
Kern River	1,076,000	1,048,300
Maricopa	389,380	279,605
Midway	1,677,700	1,633,442
McKittrick	419,300	475,300
Total	4,945,150	4,952,967
COAST REGION.		
Santa Maria-Lompoc	699,916	535,000
Summerland	5,410	5,607
Total	705,326	540,607
SOUTHERN FIELDS.		
Salt Lake-Sherman	237,325	245,904
Los Angeles City	36,500	37,000
Whittier-Coyotes	93,941	86,225
Fullerton-Puente	476,045	432,500
Newhall	11,240	11,900
Ventura	37,601	34,500
Total	892,652	848,029
Grand total for State	6,543,128	6,341,603

Kalgoorlie, Western Australia

During March this State produced $1,792,000 in gold. The yields from the principal mines were as follows:

Name.	Tonnage.	Yield.	Profit.
[4]Associated	[1]5,435	$ 60,500	.....
Associated Northern Blocks.	1,261	18,500	.....
Bullfinch Proprietary	230	39,000	.....
Chaffers	3,435	22,500	$ 170
Golden Horse-Shoe	26,377	185,000	17,500
Golden Ridge	2,763	32,500	15,000
Great Boulder Perseverance.	20,344	144,500	41,000
Great Boulder Proprietary..	18,221	240,000	120,000
Great Fingall	10,606	77,500	11,500
Hainault	4,870	34,500	3,750
Ivanhoe	10,104	20,500	90,000
Kalgurli	10,820	115,000	52,500
Lake View Consols	[2]8,142	8,500	2,400
Lake View & Star	13,314	82,000	[3]6,000
Oroya Black Range	4,590	46,000	12,000
Oroya Exploration	[2]22,425	21,500	[3]8,000
Oroya Links	7,969	42,500	4,400
Sons of Gwalia	13,500	118,000	42,000
Sons of Gwalia South	2,189	18,000	4,400
South Kalgurli	9,528	59,500	10,000

[1] Five weeks run with part of new mill.
[2] Residue treatment.
[3] Loss.
[4] Profits, or otherwise, not stated.

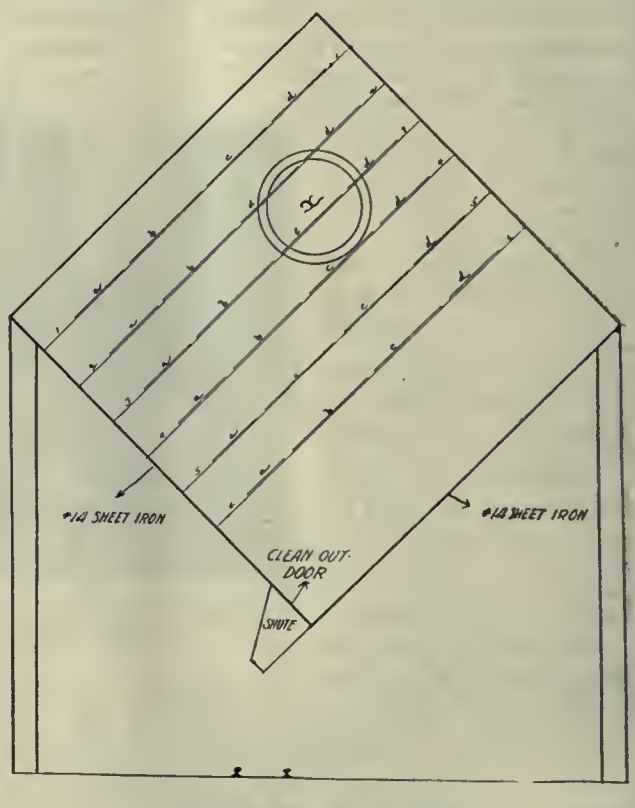
The following table, showing details of the gold production for the past eight years, is of interest:

	1903.	1904.	1905.	1906.	1907.	1908.	1909.	1910.
Tons* treated	2,160,657	2,432,171	2,643,423	2,878,251	3,008,043	3,081,824	3,105,004	2,884,298
Value of yield	$41,675,000	$40,645,000	$39,090,000	$36,875,000	$35,510,000	$33,895,000	$33,480,000	$30,200,000
Value per ton	$18.48	$16.02	$14.18	$12.30	$11.36	$10.56	$10.34	$10.08
Men employed	17,329	16,848	16,832	16,608	16,058	15,130	16,007	15,471
Profits disbursed	$10,120,000	$10,255,000	$10,835,000	$9,965,000	$8,690,000	$7,435,000	$6,795,000	$5,140,000
Working costs†	.....	.....	.....	.....	.....	$4.62	$4.78	$4.82

*2240 pounds. †Per ton.

Dust-Collecting System

Dust gives rise to many problems in and around mills. Entirely aside from the health of employees, a question sufficiently serious to warrant attempts to correct the evil, dust is injurious to machinery, and decreases output, since men will not work at full vigor continuously in the dust. In American mills relatively few attempts have been made to collect and settle the dust, presumably because dry-crushing is no longer common. At the old or No. 1 mill of the American Zinc Extraction Co., at Leadville, a dust-collecting system was built. The following description is based upon notes and a sketch furnished by C. A. Lemke, superintendent. The crushers and other machinery were housed-in and connected with exhaust fans and a settling-chamber. Two No. 35 B. F. Sturtevant centrifugal exhaust fans with 13-in. intake opening and outlet of the same size were used. The pipes connected with the intake of the fans were made of 26-gauge galvanized iron, the joints being riveted and soldered. The fans were placed on the top floor of the mill, and these 13-in. pipes ran vertically to the basement. Smaller pipes, ranging in size from 3 to 5 inches in diameter, and made of the same material, were connected at one end with the main pipes, and at the other with the feed-boxes of the separators, with the conveyor housings, with the heads of the elevator housings, and with the automatic scales. All joints were made air-tight by riveting and soldering. The pipes connected to the exhaust end of the fan were of the same material as the intake pipes, and led into the dust-chambers, where the dust was collected. These chambers are about 120 ft. long, with a stack 18 inches in diameter at the end farthest from the fan. They are shaped as shown in the sketch below and contain baffles about 12 in. apart. The dust was caught by these baffles and, as they are inclined at a steep angle,



DUST-COLLECTING CHAMBER.

it slides off them into the bottom of the chamber, where it is scraped out by hand into a small mine-car and trammed to a dust-bin.

The Mololoa Mines

STAFF CORRESPONDENCE

The Mololoa mines in the Hostotipaquillo district of Jalisco, famous *antiguas* of western Mexico, have been purchased by Makeever brothers, of New York, who are now operating in the Hostotipaquillo and San Sebastian districts of Jalisco. The Mololoa Mining Co. is being organized to take over and operate the properties, and a mill will be erected within a year. The Mololoa mines have an interesting history. They were opened by the Cora Indians some time before the Spanish occupation. When the Spanish invaders reached that part of Mexico their fame was such that Gines Vasquez del Mercado, the Spanish captain, sent to pacify the Coras, was disappointed at not finding a mountain of practically pure gold and silver. Among his followers, however, were men more easily satisfied, and they eagerly continued the work started by the Indians. Old records show that in the seventeenth century the mines passed into the possession of one Tomas Treviño, and a partner, who also acquired mines across the Santiago river, some distance north. For purposes of communication they established a system of fire signals between the two camps. Treviño worked the Mololoa mines with such success that he aroused the envy of other Spaniards who conspired to get possession of the properties. With his fire signals as evidence, they accused him before the Holy Inquisition of practising diabolical rites, and he was taken to Mexico City, tried, convicted, and burned to death in 1645. His partner secured what he could hurriedly, wrecked the mine workings, and escaped from the country through the port of San Blas. The Mololoa mines were reopened in 1904, after a long period of idleness, and since that time have yielded much rich ore. A fault interfered with operations for a time, but last year the vein extensions were found and the rich ore-shoot re-opened.

Production on the Rand

The March gold output of the Rand, amounting to 676,056 fine ounces, valued at £2,871,740, constituted another record, but even this will be passed as soon as the mills recently erected at Randfontein, City Deep, Roodepoort, and Bantjes can be put on anything like full production. It was known that the East Rand Proprietary mines were in temporary trouble over the repairs to the Angelo shaft, and that it would cost them, for at least one month, the credit hitherto enjoyed of being the premier producer on the Rand, but no one seemed to anticipate that they would sink to third position on the list. However, such proved to be the case, the 300 stamps dropped in February at the big Randfontein Central mill doing so well that they not only brought the production higher than that of the East Rand Proprietary mines, but came very near that of the Crown Mines, which made a much better showing than usual; otherwise the Randfontein property would have figured as the largest producer on the Rand, and with only one-half of its big mill at work. The first declaration from the Randfontein property of 55,026 oz. was the result of over six weeks work with the 300 stamps of the new mill, but it not only shows excellent work under the circumstances, but also that both the Crown Mines and the East Rand Proprietary mines cannot, as previously pointed out, hope for the position of premier gold producers of the world when the Randfontein mines and mills all get into full swing. The ultimate output of the Randfontein consolidated property is expected to be in the neighborhood of 100,000 oz. per month, and that of the Crown Mines 90,000 oz., but both these properties have a large amount of work yet to do before they can be expected to approach these figures. Last month the Crown Mines were at the head of the list with an output of 55,717 oz., but the present equipment of the Randfontein property is considered as equal to a monthly production, when in full swing, of 80,000 oz., so that it is possible that ere long there may be an interesting competition for the position of premier gold producer of the world. The following are the six leading gold-producers on the Rand for March:

	Stamps.	Tube-Mills.	Tons Milled.	Output, oz.	Value.
Crown Mines	630	19	130,000	55,717	£236,671
Randfontein	700	19	.....	55,026	233,736
East Rand Proprietary	820	25	164,000	48,261	205,000
Robinson Mine ..	250	6	52,100	27,205	115,560
Geldenhuis Mines.	420	7	71,540	23,406	99,422
Simmer & Jack..	320	6	75,100	23,292	98,938

It may be of some interest to notice that the average daily yield for the whole of the Transvaal in March was £92,637 as against £83,190 in March 1910.

There are indications that while the March gold production was a record one, the profits may not, after all, make a correspondingly good showing, as the increased production comes almost exclusively from the new Randfontein mill where the operating costs are necessarily high. Efforts have been recently made to increase the stamp-duty on the Rand, with considerable success, the new mill at the Roodepoort United Main Reef being at the top of the list with a duty per day of 17.44 tons. This mill, with ¼-in. mesh, has had a duty of over 21 tons per day. The Bantjes comes next, with a stamp-duty of 14.41 tons per day, followed by the City Deep with 13.75 tons, and Simmer Deep with 10.89 tons. Then come seven with daily duties running between 9 and 10 tons, the lowest being the old Camp d'Or mill with a duty of only four tons per day.

Mines of Eastern Oregon

Eastern Oregon is becoming active in mining affairs. In spite of adverse conditions, the legitimate miner has retained his belief in the merits of eastern Oregon mines, and it is largely due to his faith and patient toil that properties idle for years have finally reached a stage of development where all doubt as to merit has been dispelled. Then, the introduction of modern methods of mining and extraction of precious metals has enhanced the value of low-grade orebodies in the district. From 40 to 80% was formerly considered a reasonable saving, and only high-grade ores could be treated profitably. The adoption of scientific methods and the use of modern machinery now make it possible to effect a saving of 95%. Many capitalists are becoming interested in this district, but are making investments only after approved examinations by competent mining engineers. A thoroughly experienced engineer is then placed in charge of the property.

The Highland, situated on Rock creek in Baker county, is developed by adits to an average depth of 300 ft. About 5000 ft. of work has been done and a large reserve of commercial ore has been developed during the last two years. It is a concentrating ore, carrying gold and silver. Considerable shipping ore is found, and $75,000 has been received from this source during the last 18 months. It is planned to drive a 2500-ft. cross-cut whereby 800 ft. of additional stoping ground will be opened. The ore averages $20 per ton. The mine gives employment to 35 men, and Philadelphia investors are among the largest stockholders. Robert R. McCaughey is manager for the Highland Gold Mines Co., John Arthur being consulting engineer.

The Dixie Meadows Mines Co., whose property is 10 miles north of Prairie City, Grant county, employs 70 men. This mine was recently acquired by investors affiliated with L. Vogelstein & Co. of New York. It contains large bodies of silicious and sulphide ore. E. G. Hothorn stated that development alone will be done this year, and only a 10-stamp mill for testing purposes would be erected now. It is said that the future program comprises a 40-stamp mill,

and possibly a smelting plant. J. Nelson Nevius is consulting engineer, and L. A. Greenley is in charge.

The Rainbow mine, in Mormon basin, 16 miles from Durkee, has been bought by the United States S. R. & M. Co., the purchase price being $550,000, of which $200,000 has been paid. The property includes 10 claims and is developed by a vertical shaft and four levels. The orebody is 600 ft. long on the first and second levels, is about 6 ft. wide, and the ore has an average value of $19.50 per ton in gold. The ore is mostly free milling, and the mill is equipped with one 5-stamp battery and seven 2-stamp batteries. The United States company has commenced development, which is to include the sinking of a 1000-ft. vertical shaft, and providing equipment for electric power. A cyanide plant and a new mill of larger capacity will be erected in time. The mine work is in charge of A. P. Anderson, one of the engineers on the staff of the United States company, with Howard S. Lee as local manager.

The Humboldt, situated one mile west of the Rainbow, and on the same lode, is the oldest quartz location in Mormon basin; real mine development on it was begun two years ago. The mine is opened through a 200-ft. double-compartment shaft. The orebodies are continuous for 700 ft., narrowing and widening alternately, showing from 18 in. to 50 ft. of pay ore. It is estimated that 70% of the valuable metals consists of free gold; the remainder is recovered in the concentrate. The property is equipped with a 10-stamp mill and six Johnston concentrators. Short mill-runs have resulted in recovering $50,000, the saving being 90%. Work in the lowest level exposes on the hanging wall from 4 to 12 in. of high-grade ore assaying from $100 to $1500 per ton in gold. The company is preparing to open two more levels and add 10 more stamps to the mill. Equipment for electric power will be put in position at the Humboldt. A force of 30 men is usually employed, C. P. Loomis being superintendent, and John Arthur manager.

Porcupine and Its Future

The control of the Dome Mine, Ltd., at Porcupine is vested in a group, the leaders of which are E. R. Converse, W. E. Corey, J. R. De Lamar, A. Monee, and E. T. Wood, who are closely identified with the International Nickel Co. S. H. P. Pell and Robert M. Thompson are also interested, and W. S. Edwards has an eighth interest in the property. Jack Wilson, who discovered the Dome, was acting at the time for Mr. Edwards, who is a well known manufacturer of gas and electric-light fixtures in Chicago. Mr. Edwards is only one of the large number of Chicago men who have carried on exploration work in Ontario recently. When the value of the Dome mine was appreciated it was easy to interest capital on the basis of an eighth interest clear, with a collateral agreement that the mine should be equipped and a mill built this year. In order to do this, the Merrill Metallurgical Co., of San Francisco, which obtained the contract for the construction of the mill, had special machinery put in by the manufacturer, T. Shriver. The heavy presses were completed within 30 days and were then shipped into Porcupine over the ice on sleds, as it was not then known that the railroad would be completed as promptly as it will be.

At the Hollinger, which has also attracted much attention, the vein is 6 to 8 ft. wide and has been prospected to a depth of 200 ft. Part of the gold is free, and the rest is in the pyrite; a recent mill-test showed a recovery of $80 per ton. The recent rise in the price of the shares was not due to inside manipulation as alleged, but resulted from the cross-cutting of the country-rock, disclosing the fact that both foot and hanging wall are mineralized. The ore is said to be of 'good milling grade' over a zone 100 ft. wide. This probably means that it will go $3 per ton or better. It now can scarcely be doubted that Porcupine will eventually develop into one of the great low-grade districts of the world.

Electrostatic Separation at Cananea

By J. N. Houser

The Calumet & Sonora of Cananea Mining Co., operating a mine and mill 1¾ miles north of the city of Cananea, is building a Huff electrostatic mill to treat the zinc-copper middling produced by the concentrator. There are some 4000 tons of the middling on hand, which assays about 3 oz. Ag, 7% Cu, 30% Zn, 15% Fe, 3.5% Pb, and 7% insoluble, and complete tests on the Huff separators show the following results. Eighty-nine per cent of the copper is recovered in a concentrate assaying 4 oz. Ag, 16% Cu, 8% Zn, 27% Fe, 5% Pb, and 5% insoluble. Eighty-five per cent of the zinc is recovered in a concentrate assaying 54% Zn, 1% Cu, 4% Fe, and 4% insoluble.

The mill now being erected is designed for a capacity of 40 tons per 24 hours. The middling from the concentrator and stock-pile will be brought to the separating plant in 14-cu. ft. mine-cars and raised by a car elevator to the top of the bins. Feed is drawn out of the bins upon a belt-conveyor which delivers to a 3 by 18-ft. revolving dryer, in which a temperature of 750° will be maintained. The dryer discharges into a belt-elevator which raises the feed to a 10-mesh trommel, placed above a set of 20 by 12-in. rolls, which re-grind the oversize. The ore is then elevated to the top of the mill, where it is sized by shaking-screens to the following sizes, on 20 mesh, on 50, and through 50 mesh. The first Huff machines make a rough separation, and then the zinc product and copper-iron products are sent to other machines for the final cleaning.

Mining in Bulgaria

In the district about the capital city, Sofia, a very great number and variety of ores have been found, but until those who hold Government mining concessions show themselves disposed to work their claims in a sensible, practical manner in accordance with modern practice, there will be nothing done except to get out samples by which to sell stock, or perhaps from which to evolve a plan of working. On the other hand, the coal-mining industry is worked quite vigorously; for instance, the Government mine at Pernik, which is showing good results. In 1909 there were 210,993 tons of coal produced at this mine, of which up to the end of the year 198,326 tons was sold (the figures for 1910 are not yet published).

There are also in Trevna four other coal mines of importance; the Prince Boris and the Buduschte, the Lev and the Kalpazar. The coal is of good quality, but because of lack of transportation facilities, little has been produced in the last few years. The opening of the railway from Tirnovo to Borusehititza, by way of Trevno, has given them new life.

The mining laws, passed in 1891, and extended in 1906, have been again altered by the Sobranje. The new features refer principally to the limitation of the privilege to mine and exploit; the manner in which mining concessions may be obtained, and the conditions under which mining rights revert to the public domain; further, concerning the transferring of the rights to third persons, and taxing the mining enterprises, and finally the creation of a Mining Council of the Ministry of Agriculture and Commerce.

Lead and Zinc in Arkansas

Lead and zinc deposits have been known in Arkansas for many years. Lead was noted by Schoolcraft in his travels in 1819 and it has been mined in a desultory way since the settlement of the State. According to the U. S. Geological Survey, the present development dates from about 1899, when there was a great rush to the northern Arkansas field. The ores are galena, sphalerite, and smithsonite. Land for mining is ordinarily leased in 10-acre tracts at 10 per cent royalty. The Arkansas production during 1909 was valued at $57,144, an increase of $2064 over that for 1908.

Concentrates

Most of these are in reply to questions received by mail. Our readers are invited to ask questions and give information dealing with the practice of mining, milling, and smelting.

A GOOD CEMENT for iron in iron is a thick paste of powdered iron, 60 parts; sal ammoniac, 2 parts; and sulphur flowers, 1 part; mix with water and use while fresh.

HARD METAL may be drilled by using carbolic acid instead of another fatty substance as a lubricant, since the latter, by decreasing the friction, diminishes the 'biting' of the drill, whereas the carbolic acid has an etching action.

CORKS may be rendered impervious, and substituted for glass stoppers in bottles of acid, etc., by steeping in vaseline. Acid in no way affects them and chemical fumes do not cause decay, neither do they become fixed by a blow or long disuse.

SPLASH-BOARDS along washing-troughs in change-rooms are a great convenience. They should be built about 14 in. high, should slope steeply toward the trough, and should be water-tight. With them a man can stoop over and throw the water up over his neck, shoulders, and breast, without wetting his clothes.

TO CLEAN metals, especially copper, use a preparation composed of wax, 2.4 parts; oil of turpentine, 9.4 parts; acetic acid, 42 parts; citric acid, 42 parts; white soap, 42 parts. This is claimed to give perfect brilliancy very quickly that persists without soiling either the hand or the articles, and without leaving any odor of copper.

LABELS may be attached to cloth or paper by dissolving gum shellac in 95% alcohol at the rate of 1 lb. shellac to 3 pt. alcohol, and mixing with it any dry color desired. If it becomes too thick, thin with more alcohol. This works free, does not weed out, imparts brilliancy to the color, and wears well.

GLUE for articles of a metallic or mineral character is made by taking boiled linseed oil 20 parts, Flemish glue 20 parts, slacked lime 15 parts, powdered Venice turpentine 5 parts, alum 5 parts, acetic acid 5 parts. Dissolve the glue with the acetic acid, add the alum, then the slacked lime, and finally the turpentine and the boiled linseed oil. Triturate all well until it forms a homogeneous paste and keep in well-stoppered flasks. Use like any other glue.

RUST may be removed from iron or steel apparatus by application of the following solution, first removing any grease by rubbing with a clean dry cloth and then, by means of a brush, using the preparation: 100 parts stannic chloride is dissolved in 1000 parts water; this solution is added to one containing 2 parts tartaric acid dissolved in 1000 parts water, and finally 20 c.c. indigo solution, diluted with 2000 parts water, is added. After allowing the solution to act upon the stain for a few seconds, it is rubbed clean, first with a moist cloth, then with a dry one.

SIDE-DUMPING and bottom-dumping cars are used at many mines to deliver ore to mill-bins. It is usual to run the car into the top of the mill on an open track. There must be at least a walking-board along the side of the track, and often a whole floor is laid, leaving only a narrow space next to the track through which the ore can drop to the bins. An excellent arrangement in such cases is to build up of heavy boards a sloping deflector toward this slit in the floor, so as to force all the ore into the bins. Where this is not done a certain amount of shoveling is commonly necessary.

HARD iron castings may be softened by heating the object to a high temperature, covering it over with fine coal dust or some similar substance, and allowing it to cool gradually. When the articles are of small size, a number of them are packed in a crucible with substances yielding carbon to iron at a glowing heat. The crucible is then tightly closed, and placed in a stove or on an open fire. It is gradually heated and kept at a red heat for several hours, and then allowed to cool slowly. Cast-iron turnings, carbonate of soda, and unrefined sugar are recommended as substances suitable for packing in the crucible with the castings. If unrefined sugar alone is added, the quantity must not be too small. By this process the iron may be rendered extremely soft.

OLD FILES may be rendered useful by the following process: Boil them in a potash bath, brush them with a hard brush, and wipe off. Plunge for half a minute into nitric acid, and pass over a cloth stretched tightly on a flat piece of wood. The resulting effect will be that the acid remains in the grooves, and will take away the steel without attacking the top, which has been wiped dry. The operation may be repeated according to the depth to be obtained. Before using the files thus treated they should be rinsed in water and dried.

POWER COSTS along the Mother Lode are unusually low, and this is one of the secrets of cheap mining. Water-power and electricity are widely available, and where the mining company owns the water the cost may be as little as $1.50 per horse-power month. Where electricity is bought the rates are higher, but still low as compared with those elsewhere. At a particular mine where 40 stamps are operated, the contract price is $4.10 per horse-power month. To get this rate 60% of the rated horse-power of motors fed must be used constantly. Where the use is irregular a flat charge of $1.50 per horse-power month is made for current, to which is added $3.50 per horse-power month figured on meter readings. Under these conditions it is estimated that with fuel-oil delivered at $1.50 per barrel, hoisting and other irregular work may be done cheaper with steam, but that for mills electric current is the cheaper.

WATER-POWER sufficient for part but not all the load is often available for mining and milling. Where electric current is also available it may be used to advantage to supplement the water, though current is generally expensive when it is used to carry only the peak of the load. Aside from this, cutting-in and cutting-out the current requires constant watching. At the Melones mine in Calaveras county, California, W. G. Devereux uses an induction motor which is so connected with the power-shaft that current is taken only when more power is needed than the water-wheel can supply. When, on the other hand, less power is taken than the water-wheel yields, the motor becomes a generator and delivers power to the transmission line. While from the point of view of current generation such an arrangement is not the most efficient, it does have the effect of applying useful power that would otherwise go to waste, and of providing automatic control at the power-station.

TO MARK steel tools, make a rubber stamp with white letters on a black ground. Make up this ink to use with it: Ordinary rosin ½ lb., lard oil one tablespoonful, lampblack two tablespoonfuls, turpentine two tablespoonfuls. Melt the rosin, and stir in the other ingredients in the order given. When the ink is cold it should look like ordinary printers' ink. Spread a little of this ink over the pad, ink the rubber stamp as usual, and press it on the clean steel. Form a thin roll of soft putty, and make a border of putty around the stamped design as close to the lettering as possible, so that no portion of the steel inside the ring of putty is exposed but the lettering. Then pour into the putty ring the etching mixture, composed of 1 oz. nitric acid, 1 oz. muriatic acid, and 12 oz. water. Allow it to rest for only a minute, draw off the acid with a glass or rubber syringe, and soak up the last trace of acid with a moist sponge. Take off the putty, wipe off the design first with potash solution and then with turpentine, and the job is done.

Discussion

Readers of the MINING AND SCIENTIFIC PRESS are invited to use this department for the discussion of technical and other matters pertaining to mining and metallurgy. The Editor welcomes the expression of views contrary to his own, believing that careful criticism is more valuable than casual compliment. Insertion of any contribution is determined by its probable interest to the readers of this journal.

Secondary Enrichment of Gold Deposits

The Editor:

Sir—Availing myself of your invitation to take part in the discussion department, I wish to say that I have not seen in the columns of your valued journal any reference to the discovery by W. H. Emmons of the agency of manganese in the superficial alteration and secondary enrichment of gold deposits, as explained in the paper read by him before the American Institute of Mining Engineers in November 1910. I am not sure that discovery is the proper word for what Mr. Emmons states, but I do know that his idea is not to be found in any of my mineralogical books, nor in various books on the subject that I have had access to in the Bureau of Mines. An assayer in San Francisco told me that manganese had no solvent effect on gold, and a geologist told me the same. I think that the subject is both interesting and important, and should very much like to hear what some experts have to say of Mr. Emmons' theory. To show how important the subject is, I will quote from Mr. Emmons' paper: "Those deposits in the United States in which a secondary enrichment of gold is believed to have taken place are, almost without exception, manganiferous."

In an article in your issue of May 13 on 'The Bugbear of Gold' many solvents of gold are mentioned, but manganese is not among them. Of course, I understand that manganese is not the direct solvent, but is only the agent that liberates chlorine. If you publish my letter it may stir up some one to give some California ideas on the subject.

H. O. YARROW.

Bowman, California, May 11.

[Our correspondent has overlooked the fact that Mr. Emmons' first published discussion of the rôle of manganese in the secondary enrichment of gold veins was printed in the *Mining and Scientific Press*, December 1, 1909. Mr. Emmons' conclusions seem to us well founded, and the chemistry of the process has been investigated under his direction at the University of Chicago. The result of these experiments was described briefly before the Washington Geological Society by Mr. Emmons in April 1910, and more fully by Mr. Brokaw in the *Journal of Geology*. From the first source we quote as below:

"The experiments were made by A. D. Brokaw. They show that with cold dilute solutions approximating in composition the average of many mine waters, there is markedly great solvent action on gold when manganese is present. The best available data indicate that such solvent action is more than 250 times as great with solutions of manganitic salts as with solutions of cupric or ferric salts of similar concentration. Conversely, it has also been demonstrated experimentally that the precipitation of gold by ferrous sulphate is delayed if manganitic salts are present in the solution. It may be inferred from these experiments (1) that manganiferous gold ores should be more extensively leached of their gold in the upper portions of the lodes than deposits which do not carry manganese, and as a consequence that rich placers would be less likely to be associated with manganiferous than with non-manganiferous gold deposits; (2) that secondary enrichment in gold would extend to greater depths in manganiferous than in non-manganiferous lodes."

The secondary enrichment of gold veins has not attracted the attention it deserves. We published on May 20 a suggestive note on the subject by R. L. Mann, and would be glad to give space to contributions by others.—EDITOR.]

Tunnel-Driving Records

The Editor:

Sir—In your issue of April 8, you make editorial comment as follows:

"Another notable Swiss tunnel was completed on the last day of March, when, after five and one-half years work and the expenditure of twenty million dollars, the Loetschberg tunnel on the route from Milan to Berne was completed for the nine miles of its length. For speed of tunnel-driving the palm goes easily to American engineers, but for ingenious methods of coping with unusual difficulties the Swiss tunnels will long remain famous."

Having had occasion to see work in progress on the Simplon tunnel, I naturally doubted the correctness of your statement that "for speed of tunnel-driving the palm goes easily to American engineers".

Records show that the "palm" so far has gone to the Swiss engineers, and in substantiation of this statement I give the following tables taken from W. L. Saunders' paper entitled 'Driving Headings in Rock Tunnels,' delivered before the New Haven meeting of the American Institute of Mining Engineers in 1909:

AMERICAN TUNNELING RECORDS

The figures represent monthly progress:

	Feet.
Musconetcong, N. J., 1872	144
Nesquehoning, Pa., 1871	165
Hoosac, Mass, 1865-1873	184
Busk, Colo., 1890-1893	202.5
Stampede, Wash., 1886-1888	274
*Cascade, Wash., 1897-1900	301
Aspen, Wyo., 1901	306
Bitter Root Mts., 1908	340
Kellogg, Idaho, 1898	345
Raton, Colo., 1907	412
Sutro, Nev., 1869-1877	417
New Croton Aqueduct, 1887 (in one week)	127
Gunnison, Colo., 1908	449
Elizabeth Lake, Colo., 1908	466

*Another record for this tunnel is: completed tunnel, both ends, Nov. 1899, 527 feet.

EUROPEAN TUNNELING RECORDS

The highest monthly records of European tunneling show not only larger figures, but a better maintenance of approximately the maximum, month after month. In some of the cases here following, several successive monthly records are given:

Mont Cenis, 1857-1870; 297 feet.

St. Gothard, 1872-1881; 436 ft. (with a year's average of 343 ft. This is the only Alpine tunnel driven with top heading.).

Ricken, 1903—; 452, 461, 413, 358 ft. (Hand drilling entirely. Work was stopped on this tunnel nearly a year on account of fire-damp.)

Bosruck, 1902-1905; 546, 526 feet.

Karawanken, 1902-1905; 552, 544, 553 feet.

Arlberg, 1880-1883; east heading, 556, 594, 610, 613, 637 ft. (percussion drills).

Arlberg; west heading, 509, 527, 625, 641 ft. (hydraulic rotary drills).

Albula, 1900-1902; 558, 607 ft. (hydraulic rotary drills).

Tauern, 548 ft., with an average of nearly 525 feet.

Loetschberg; 555, 574, 538, 558, 551, 592 feet.

Simplon, 1900-1905; north heading, 682.2 feet.

Simplon; south heading, 685.5 ft. (This is the world's record.)

Anyone interested in this who has not read Mr. Saunders' paper should find the opportunity of doing so, as it treats the subject very thoroughly. Mr. Saunders has also offered much food for thought to the American engineer in an article entitled 'Shallow Against Deep Holes in Headings' in the April issue of *Compressed Air Magazine*. He gives some of the reasons for the superior results obtained

by the Swiss engineers, and I would respectfully suggest that you give space in your pages to this article.

H. L. TERWILLIGER.

San Francisco, May 10.

[Our correspondent is entirely right in this matter, as an examination of our various accounts of tunnel records will show. The item on which he comments was due to one of those slips that occasionally happen and which was overlooked till too late to correct. It has served an excellent purpose, however, in calling out this interesting comment from Mr. Terwilliger.—EDITOR.]

Surface Indications of Ore-Shoots

The Editor:

Sir—I wish to here thank Mr. F. L. Ransome for his interesting and valuable contribution to the discussion of this subject, published in your issue of May 20. I fully agree with him that conditions involved are complex, and I am not surprised that Mr. Ransome has been able to mention a number of mines where my theory appears not to apply. The sketches offered by him are of interest, as at first glance they all seem to throw doubt upon the correctness of my hypothesis. However, I think that the sketch, Fig. 1, p. 697, assuredly indicates that less stoping has been done beneath the gulches (at the surface) than elsewhere in those mines. In his reference to this property, Mr. Ransome speaks of the probability of the Sullivan ore-shoot pitching northwest under Mild gulch. It may do so, and probably does, but the southeasterly limitations of stoping operations, as shown in the sketch, in the Bunker Hill mine do not suggest that, in the Bunker Hill ground, the ore-shoot is continuous and equally valuable in the direction of the Sullivan shoot. Even if the latter does pitch northwest under Mild gulch, it looks, from an inspection of the sketch, as though there were an interval between the Sullivan and Bunker Hill shoots in which the vein is probably less valuable than the average run of ore of the mine. Fig. 2, illustrating a longitudinal section of the Elkton mine in Cripple Creek district, Colorado, does not show that as much stoping has been done under the depression on the left of the sketch, as has been done under the hill, without doubt there are good reasons for this also, though they are not obvious.

In Fig. 3, showing the workings of the Helena-Frisco mine, in the Coeur d'Alene district, if the dotted lines define the limitations of profitable ore, surely the blanks mostly occur (at the surface) beneath the gulches. The sketch of the Mary McKinney mine, in the Cripple Creek district, appears to contradict my hypothesis. I am not familiar with the mine and evidently was misinformed. The sketch, Fig. 4, does not show the existing condition in sufficient detail to warrant further discussion here. Fig. 5, which shows the workings of the Little Mattie, distinctly seems to disprove my theory, particularly at the Newton and General Thomas shafts, but at the Wisconsin-Corry City mine, as shown in Fig. 6, although stoping has been extensively carried on beneath Cherokee gulch (at depth), the sketch does not indicate that the ore at the surface was sufficiently valuable to warrant stoping. Possibly the problems of mine drainage had something to do with this. A study of the sketch, however, suggests the probability that the ore-shoots in this mine are quite flat, trending to the left, and that there is a poorer zone, several hundred feet in length, between the shoot worked under Cherokee gulch and that on the left under Wisconsin hill, and that this poor zone comes to the surface under Cherokee gulch. The lower stopes in the Wisconsin ground have evidently been opened from long drifts run out from the Corry City shaft, and apparently these drifts were all run from 500 to 800 ft. beyond the stopes adjacent to the shaft without any stoping having been done, which, to say the least, is unusual where the ore through which the drifts pass is worth stoping. Likewise, in the Seven-Thirty workings, as shown in Fig. 7, stopes have been opened from drifts driven east and west from the shaft, while only a little stoping has been done thus far beneath the gulch, except near the surface. This last example seems the most conclusive of all those offered by Mr. Ransome to show that my hypothesis is based upon unsound premises, unless the stopes in the Little Mattie, on the right-hand side of Fig. 5, be excepted. Those on the left in that sketch may be considered as either in favor of or against the theory.

To me it seems that Mr. Ransome, like some others, has misunderstood me. What I endeavored to make clear was, that in my experience shoots of ore rarely crossed gulches or depressions *at the surface*. I make no contention that ore is not to be found or to be expected in depth beneath gulches, but that an ore-shoot in its course along the vein close to the surface, upon reaching a gulch or depression, usually comes to an end, or will be found to have suffered a loss of value even though the vein itself continue otherwise without interruption; for it is not, apparently, absolutely essential that a fault occur to interrupt the continuity of value of the ore. I have attempted no further explanation of the theory, contenting myself with merely stating the facts as I have observed them. I have simply said that (generally) gulches or natural depressions crossing the strike of a lode or vein are the physical expression of disturbance beneath the surface. Mr. Ransome, in his contribution, gives a number of reasons for the occurrence of gulches and depressions. My observation of the occurrences under discussion are by no means confined to the Mother Lode of California, but extend to mines in many States and in foreign lands as well, and when it is thoroughly understood that my hypothesis embraces conditions at the surface or near it only, and not necessarily in depth, I think Mr. Ransome, and perhaps some others, as well, will be willing to admit that the condition I have described is much more common than has generally been supposed. Again, I wish it understood that I do not include in this ore deposits occurring in sedimentary strata—limestone, sandstone, and shale, in the form of sheets, whether as impregnations, or replacement deposits.

In considering this hypothesis, the cause of the gulch or depression should be determined. It is extremely doubtful if any gulch resulting from superimposed erosion, or one formed by a glacier, would come within the category of gulches as here intended. That is, one due wholly to geological disturbance beneath the surface. While it is evident that my theory is not of universal application, the interruption of the continuity of pay-shoots in veins from the causes I have mentioned is of such frequent occurrence as to give the theory much more than passing interest, and, as I have already said, I think that upon investigation my theory will be found to apply with much more frequency than has been generally supposed.

WILLIAM H. STORMS.

Berkeley, California, May 22.

Queensland Gold Yield

The output of gold in Queensland during February was 27,085 oz. fine, of the value of £115,050, being a decrease, when compared with that for the month of February last year, of 7186 oz. in quantity and £30,524 in value. The decrease is attributable to reduced outputs at Charters Towers, where there was a falling off amounting to over 5000 oz.; at Gympie, where the decrease was about 500 oz.; at Mount Morgan, from which a reduction of 1860 oz. is reported; and at Ravenswood, where the falling off was 788 oz. Cloncurry records a return of over 1000 oz., obtained from copper ores, as against nothing for the corresponding month of 1910; the Etheridge shows a small increase; and the Rockhampton fields have an improvement amounting to 466 oz. The output for the first two months of the year was 51,268 oz., of the value of £217,773, or a decrease, as compared with the corresponding period of 1910, of 12,815 oz. and £54,434 respectively. The calls made by gold-mining companies for the month of February amounted to £10,043, and the dividends declared to £6750.

Special Correspondence

KALGOORLIE, WESTERN AUSTRALIA

Drilling Results. — Bullfinch Quiet. — Additions to Geological Survey. — The Chaffinch Flutter. — Annual Meeting of Chamber of Mines.

In my last notes mention was made of the drilling results in the Great Boulder at 2800 ft. The Horse-Shoe people decided to test their own property at this depth, so an arrangement was made with the Boulder company to drill from the Edwards shaft at 2800 ft. Twenty-six feet from the eastern boundary, and 460 ft. from the north boundary, a lode 27 ft. wide, averaging $18 per ton, was cut. This is the old No. 4, or boundary lode, which was in Horse-Shoe ground at 800 ft., and since then has been thrown east and west by faults until it is again their property. This is a loss to the Boulder, but the Horse-Shoe wanted something to liven up shareholders. The latter's main shaft is down only 2100 ft., so it will take nearly a year to reach the lode cut. The Ivanhoe is cross-cutting at 2420 ft., and will sink to 2570 ft. at once. In the Lancefield, the lode has been cut 205 ft. east of the No. 7 level; so far it is 8 ft. wide, worth $10.80 per ton.

The Associated is opening out at 2200 ft., and preparing for the installation of skips. The Bullfinch is quiet, and people take little notice of reported rich finds in the district. In the parent mine the ore appears to be lower in value than usual. The treatment of rich ore is to be discontinued after the present month. The hoisting machinery is erected, and sinking will be resumed. Shares have dropped a great deal, and now stand at $5, about par, as compared with $15 some three months ago.

The Western Australian Government has lately made several additions to the staff of the Geological Survey, and most of the new members are to study the Yilgarn field. Of course, in this country, work can proceed all the year round. Much attention is being directed to the Ora Banda field, but rain is badly wanted. The Associated Northern and Oroya Exploration are working their options. The Chaffinch mine, which was the cause of the Bullfinch boom smash, has been prominently before the public again over the conspiracy case, in which three well known Eastern mining men were prosecuted by the Government, for defrauding the public. As predicted by many, they were released. Some peculiar methods of speculation were brought to light; and those who gave evidence for the Crown were worse than those prosecuted. It was simply a case of bulling and bearing scrip by men who knew the game; but without doubt it was a disgraceful affair. As a reminder of the boom last year, two town blocks at Bullfinch which were sold for $2500, when put up for auction recently failed to get any bids at all.

The annual meeting of the Chamber of Mines was held last month, and R. Hamilton, the president, discussed the more important points in connection with mining. During the past year 2,884,298 tons (long) was treated in Western Australia for gold, valued at $30,200,000; a shrinkage of $3,270,000. The East Coolgardie (Kalgoorlie) and East Murchison fields were responsible for 78% of the decrease. The chief developments in the outside mines were reviewed, not forgetting the recent drilling results at Kalgoorlie. The labor troubles, and the awards of the Arbitration Court were commented upon; also, the Government action in procuring reports on explosives in mines, and miners' phthisis; and legislation and its effect on mining generally.

For over a year, the Chamber of Mines has been preparing for publication 'West Australian Mining Practice', as written by Mr. Cleland, now manager of the Perseverance. The work is now published, and is a valuable book of reference for mining methods in this State, especially in Kalgoorlie. The book is well supplied with maps, plans, and pictures. Some five years ago, the metallurgical practice on our principal mines was written for the Chamber by R. Allen. Now we have a second and revised edition of the work by Gerard Williams. This is being prepared for publication at an early date. This pair of books should be of interest and value to American engineers. In the February issue of the Chamber of Mines Report is a full description, with detailed drawings of the vacuum treatment of slime as practised at the Oroya Exploration and Lake View Consols re-treatment plants, T. B. Stevens and W. R. Degenhardt being leading exponents of this treatment here.

JOHANNESBURG, TRANSVAAL

Changes in the Miners' Phthisis Bill. — Equitable Arrangement. — Basis of Fund. — Amount Paid. — Native Labor Statistics.

The Minister of Mines in the Union Parliament has proposed changes in the miners' phthisis bill that completely alter its character. When first introduced it was proposed to divide its burden for the first two years only between the mine-owners and the Government, but the most crucial amendment now proposed is to compel the miners to pay one-fourth of the amount contributed by the owners, while the Government has to pay one-half of the sum awarded to the miner as compensation. It will be recollected that at the time of the introduction of the bill it was pointed out with considerable force on the part of the mine-owners that the burden of such a proposal would be severely felt by the mining industry, which already pays, in one shape or another, the bulk of the taxes, and the warning thus given seems to have had effect, for the whole bill has been reconstructed and brought more into harmony with the wishes of the mine-owners. Naturally the Labor Party in the House has condemned the proposal to make the miners contribute, the result of which will allow the amendments to be fully considered. It is generally admitted that miners' phthisis can be avoided if proper steps are taken to prevent it, and one cause of it is the neglect of the miner who refuses to take even the steps provided for his protection by the mining regulations. Under these circumstances it seems only fair that the miner should contribute. It is generally admitted that good ventilation is essential for the prevention of phthisis in addition to the watering arrangements. Until lately artificial ventilation was practically unknown to the Rand, although at the present it is being extensively adopted. The lax manner in which the Government enforces the mining regulations with regard to ventilation and the prevention of dust is sufficient to make it also liable, and the new proposals by which it is provided that the Government, mine-owners, and miners should all pay the damages caused by their joint neglect cannot be otherwise than considered just. Then, again, the establishment of a fund to which all parties will contribute, and the placing of its administration solely under the control of a board, instead of leaving the miners to sue the mine-owners for compensation, must be considered a distinct improvement upon the former proposal, whereby the bulk of the benefits would probably be spent on law costs. The basis of the fund will be a monthly contribution from the mine-owners of £1 for each rock-driller, and 10s. for each and every other white employee underground, of which one-fourth will be deducted from the pay of the miner. The Government will pay one-half the sum awarded as compensation, while the Minister of Mines reserves the power to call upon the miner to increase his contribution if necessary. A maximum amount of compensation of £250 for phthisis and £500 for both phthisis and tuberculosis combined is proposed, but not only the amount, but likewise the method of payment, whether in the shape of a lump sum or pension, is proposed to be left to the discretion of the board. The Minister of Mines will draw up a list of the mines in which the dust is considered liable to cause miners' phthisis, and on publication in the *Gazette*, will become liable for the payments provided. Natives are provided for by making miners' phthisis the same as a personal injury under the Native Laborers' Regulation Act.

The Chamber of Mines' returns for the month of March also contained the welcome announcement that the number of native unskilled laborers for the mines was still increasing. In March the gain was 3250, and constituted another record, as the total number employed in mining during March was 312,011, as against the previous record of 1910 amounting to 206,680. The gold mines employed 193,457, another record number, the number employed during the corresponding month of last year being 178,345. Despite this increase in the number of natives coming to work in the mines, the demand is far from being satisfied, and it is doubtful whether the mines will ever be able to obtain all the unskilled native labor they require.

LONDON

APPOINTMENT OF COAL MINE INSPECTORS.—TERMS OF APPOINTMENT.—RULING AS TO WHAT IS A MINERAL.

For some years coal miners in Great Britain have been asking for the appointment of inspectors drawn from their own ranks. There were two reasons for this demand. In the first place, the present Government Inspectors of Mines are high officials, and as such are suspected of being invariably in sympathy with the employers and owners; and, second, these high officials are not sufficiently in touch with the mechanical details of operation, which appear small to them but which may be of immense importance from the point of view of the safety of the worker. More often than not, a serious accident is caused by some apparently trivial matter. The Home Secretary has now decided to appoint thirty sub-inspectors drawn from men who have had five years continuous underground experience; two will be allotted to each of the six mining districts, with an extra one for Yorkshire, and two will devote their attention to quarries. Circulars have been issued inviting applications. The applicants will first have their general qualifications investigated by a committee of the Home Office, and those selected will be subjected to competitive examination, one examination being held in each district, thus ensuring that the men shall have thorough knowledge of local conditions. Candidates are expressly warned that political or social influence must not be invoked; to present an endorsement from a Member of Parliament would be fatal. The subjects covered in the examination will be such as will prove the candidate's knowledge of ordinary routine practice, and his ability to write an intelligible report. The salary is to be £150 per year, increasing £5 yearly to £200. The scheme has not been sufficiently elaborated for it to be possible for the Home Office to give an exact outline of the duties of these new inspectors. The mine-owners and their friends are inclined to be sarcastically sceptical as to the value of the services of these working-men inspectors, and they call the creation of this new class of official a sop to the Labor party. They allege that a competent pit-man will not find the post attractive, for he can earn as much in four days, and the absence of any limit to his hours of labor and responsibility will form an unpleasant feature of the work.

During the last three years I have recorded several lawsuits undertaken to determine what is a mineral according to the meaning of the Railway Consolidation Act of 1845. The Act said that the railways only had surface rights, and did not own the 'minerals' below. These lawsuits are necessary to determine the status of each mineral, and they all eventually go to the highest court, the House of Lords. Generally speaking, a 'mineral' is held to be any constituent of the earth's crust that has a special value. China-clay has been adjudged to come within this category, but, on the other hand, stone suitable for building purposes has not. The most recent case relates to fire-clay, and the House of Lords has decided that this substance is undoubtedly a mineral within the meaning of the Act. The Caledonian Railway is owner of surface lands, and the Glenboig Union Fire Clay Co. works the seams of fire-clay underneath. It was held that fire-clay was of notable value and was the basis of a special industry, therefore the Railway Company's claim was quite untenable.

JARBIDGE, NEVADA

WORK ON THE CLARK-FLETCHER LEASE.—THE TRUE FISSURE G. M. CO.—PROGRESS ON THE PAVLAK.—NEW VEIN ON THE RELIANCE.—A DISCOVERY ON THE WEST SIDE.—TELEPHONE AND A BANK.

The season is backward this year, and this has had a tendency to retard prospecting, but where work is going on the results are very satisfactory. On the Clark-Fletcher lease on the North Star ground two shifts have been working all winter. The vein is opened on two levels to a depth of 150 ft. and is 8 to 12 ft. wide. The value of the ore is estimated at $17 per ton, corresponding to $300,000 of ore blocked out. There are many places where the vein is rich. A 60-ton mill is now on the way to the mine and will be erected as rapidly as possible.

The True Fissure Gold Mining Co. also has good ore in its mine on Jumbo peak, and is now building a road to the millsite at the foot of the falls on Fall creek. This is an ideal site for a mill, with good water-power near; it is two miles from the mine. The mine is on the main Crater vein, and the surface of its Third Peak claim makes a good showing. The development work this winter has shown the regularity of the vein, and has opened up a large orebody. The adit is now in 180 ft. and shows good ore all the way. The width of the vein at the month of the adit is 2 ft., and at the face it is 4½ ft. wide. The value of the ore has also shown a steady increase from $12 at

SCENE IN JARBIDGE DISTRICT, NEVADA.

the mouth of the adit to $60 per ton at the face. The depth at the face is about 90 ft., which gives a good back of ore to stope from.

The Pavlak mill is making good progress, but as it is a large one it is probable that both of the preceding mills will be in operation before this is finished. The cross-cut from the first drift to the north from the adit is in a large body of quartz. The conditions along the Pavlak vein can be said to be very promising. Theodore Parks has purchased an interest in the lease on the North Star vein with George A. Fisher and has found a good body of high-grade milling ore. This ore is changing somewhat and now resembles that in the Bourne vein, where Clark and Fletcher have a large orebody.

On the opposite side of Bourne gulch Lige Fletcher is opening another vein on the Reliance claim of the North Star Co. R. S. Silver is associated with him in this new lease, which is on a parallel vein about 300 ft. east of the North Star vein. They have traced the vein for a distance of several hundred feet. In one place where they propose to start development work, they have stripped the vein, which is 8 to 12 ft. wide. Another new find made at some distance from any previous one tends to prove the extent of the mineralized area. This was made by A. E. Bettles, near the head of Bear creek on the Mohawk claims, and, from the little work so far done it promises to be a very

important find. Samples from along the vein give assays of $4 to $16 per ton and an average sample of 5 ft. of the vein from one of their prospect holes gave returns of $7.20 per ton. This property is over three miles southwest of the town and on the west side of the Jarbidge river. This will greatly stimulate activity on the west side and along the Bear creek section. The Jarbidge Nevada Co. is already at work near the mouth of Bear creek, the Ham-And Co. is opening a vein on Bear creek ridge one-half mile south of Jarbidge, Nevada; some good float has been found on the Overalls group, another mile south, and now the Mohawk find, still farther south, and all on the west side, is promising for this portion of the camp.

The Mohawk claims are just west of the Yosemite claims, and join on the south the Big Four group, which belongs to the Buhl Jarbidge Co. The new wagon-road from Deeth crosses this ground just before reaching the Bear creek summit. The claims are well covered with timber, but are near the head of the water supply. Forty men are at work on the new road from Deeth; it is being built with a 12-ft. road-bed. The poles are being set for the telephone line into Jarbidge and it will be finished as soon as possible. As soon as the line is open a bank will be established in Jarbidge.

FAIRBANKS, ALASKA

Reports of Activity in Quartz Development on Tanana Tributaries.—Two Dredges to Be Operated.

The miners of Cleary creek are excited over recent work in the cross-cut being driven on Wolf creek by A. W. Balzimer, in which high-grade gold ore was found at 350 ft. from the portal. Balzimer and partners are driving both ways on the vein from where it was intersected by the cross-cut. After cross-cutting 120 ft., Utigard and Nerhland, of Chatham creek, have opened the lode for which they were driving. It is 4 ft. wide and contains good ore. Sinking continues on the Golden-Sherrard lease at the head of Cleary creek. After sinking through barren rock, ore was found in a 5-ft. vein at 112 ft., which is believed to run about $100 per ton. A boiler and hoist will be provided. Stoping is being carried on at the Tolovana Mining Co.'s property on Willow creek. A mill will be built on the claim this summer. Work will be commenced on the lower shaft of the Friedrich lode. The shaft will first be timbered, a 30-hp. plant set up, a tramway built to Vault creek, and a mill erected. Sinking will commence as soon as the plant is ready. The timber for the mill on the Rhoads-Hall claims has been shipped from town. It is intended to have the building ready by the time the stamps arrive from San Francisco on the first boat. August Hess is driving on the 80-ft. level from his Fairbanks creek 120-ft. shaft, which will be put in readiness for further development. A hoisting plant will be put in and a small mill may be built this summer. There is enough ore exposed to warrant the expenditure.

Hoel Bros., Johnson, and Witmer, who recently sold their Vault creek holdings, have a 20-hp. plant at the head of Treasure creek, where they have some quartz prospects. Learning by previous experience that windlass work has narrow limits, they are going to start right. Before proceeding with further development work, L. M. Drury and associates will sample the properties bought from Hoel Bros. & Co. Hirshberger and Zimmerman are working on their Skoogy gulch lode with gratifying results. Good ore has been found in the bottom of the 50-ft. shaft, and driving is in progress at that depth to determine the width of the shoot and to better ventilate the mine. The vein varies from 4 to 5 ft. thick, the pay-shoot showing from 1 to 2 ft. quartz. The walls are well defined, and the quartz, being free from the other vein matter, can be stripped with little loss. A bonding and leasing company is being formed by F. S. Gordon among local capitalists. The capital stock is put at $200,000, and if $10,000 is pledged, W. B. Vanderlip, of London, will be placed in charge to pass upon leases and to develop them to the point where big capital can be interested. The $10,000 was practically all subscribed in two days.

Two dredges will be operated in the camp this summer by the dredging company reorganized by G. G. Lemons and W. W. Powell, the English company organized by the former having taken up the options on Fairbanks, Twin, and Pedro creeks. The attorney for the company states that there is nothing to hinder the consummation of the deal, as the company is composed of some of the richest men in England.

SILVERTON, COLORADO

The Silver Lake Lease.—Production at the Iowa Tiger.—W. B. Lowe Failure.—New Equipment for the Silver Lake.—Proposed Consolidation.—Litigation Over the Old Hundred.—New Liability Law.

The San Juan district is experiencing a late spring this year and new operations are delayed nearly a month. Much of the work planned has now been started, and arrangements have been completed for the rest to start as soon as the roads are clear of snow. The most important development of the month is the consummation of negotiations for the Silver Lake lease, which has now been signed. The lessees are Messrs. Goudy, Maris, Barry, and Fox, all experienced operators in this district. Work started on May 20 with the repair of the power and tram lines, and underground operations will be pushed as soon as supplies can be taken to the mine. Under the lease the Garfield Smelting Co. operates the tram and mill, and the lessees the mine. The minimum amount agreed upon is 50 tons daily, and the lessees expect to be producing 100 tons daily within 90 days. Should this property meet expectations and be restored to the list of active shippers, it will add more than any other item to the feeling of confidence that is gradually returning to this old district. The Gold King is working steadily, and the mill is treating 250 tons of crude ore per day, resulting in a production of 55 tons of concentrate. The company at present employs 100 men. The Iowa Tiger Leasing Co. has opened up several new ore-bodies during the past month, and the concentrate shows high value. Two cars sent out last week assayed: Au, 1.7 oz.; Ag, 11 oz.; Pb, 37%; Cu, 2%. The mill is treating 100 tons per day and for the past month shipments of concentrate totaled 400 tons. The Iowa Gold Mining & Milling Co., owner of the Iowa and Tiger mines, paid a dividend of ½% on May 15, or a total of $8333. For the two years operation under lessees, royalty payments have amounted to $60,000. The mine is in excellent condition and should continue production for some time to come. The ore contract with the Ohio & Colorado Smelting Co. has been renewed at a slightly better figure than the previous contract. The District Court is now in session, and the affairs of the Kittimac, Peerless San Juan, and W. B. Lowe companies are being adjusted. The W. B. Lowe company is not represented by counsel, and the creditors, whose claims total $40,000, have agreed on a division of the company's property, which consists of the Arpad mine, the Contention mill, and a bond and lease on the Yukon mine. The company spent nearly $200,000 in developing these mines, and the failure seems entirely due to reckless and extravagant management. The Sunnyside, at Eureka, continues its steady production, and no changes of note have taken place. The Silver Ledge is driving a raise from the sixth level to the fifth, and the opening exposes excellent ore. The raise produced about 100 lb. of high-grade gray-copper ore, but no more has been discovered. Five cars of new machinery for the mill are in the Silverton yards, and will be taken to the property when the railroad has been cleared of snow. The mill will be started sometime in June and will handle 200 tons per day. The mine produces a lead-zinc ore with a talc gangue, the percentages of lead and zinc being about equal. The mill at present has crushers, rolls, Chilean mills, Richards classifier, Callow tanks, and Wilfley tables. To these will be added one set of rolls, trommels, jigs, classifiers, and a set of Callow

tanks. This addition is expected to raise the capacity and percentage of saving, which at present varies between 67 and 72%. The Hercules is being sampled, and future operations will depend upon the results obtained. Should operations be resumed, Tom Kane, former manager of this property, will again assume the active management. The Highland Mary mine is for sale and an attempt is being made to consolidate it with the Shenandoah and Trilby properties. Among the smaller properties that are operating and that will make some shipments during the summer are the Columbus, Gold Bug, Esmeralda, Kansas City, Emma, Shenandoah, Pride of the West, and Kankakee. The Old Hundred mine is involved in litigation, and the owner is attempting to wrest control from the lessee. Local merchants and laborers have large claims against the lessee and affairs are in a very tangled state. The Colorado legislature, during its recent session, passed a law known as the lien liability law, which holds the owner of a mining property liable for debts incurred by lessees. This bill was proposed by Senator Joyce and Representative Slattery of this district and has already caused wide discussion. It will be far-reaching in its effects, and practically compels mining companies to require ample bonds of lessees to protect the companies against debts. It is generally believed by mining men of this district that it will prove beneficial, as it may put an end to 'wild-cat' operations under cover of bonds and leases. This form of operation has been one of the greatest curses of the San Juan, and it is hoped that properties will now be conducted by responsible operators and not by irresponsible, incompetent, and extravagant lessees, with resulting failure, leaving large debts to burden the community.

NEW YORK

REORGANIZATION OF UNITED COPPER.—BUTTE-BALLAKLAVA.—SALE OF CORDOVA COPPER CO.—CLOSING DOWN OF MONTGOMERY-SHOSHONE.—GROWING INTEREST IN PORCUPINE.—REA CONSOLIDATED.—MINING EXCITEMENT AT TORONTO.

It is understood that there is to be a reorganization of the United Copper Co. The public and the shareholders alike have never been able to secure any kind of a statement from the Heinze management regarding the company's operations or assets. There is some talk of a call upon the shareholders for $1 per share, but as the stock is issued fully paid, it will be necessary to organize a new company to do this. The annual meeting will be held the first week in June, but it is not expected that any light will be shed upon United Copper's operations during the past year. To protect itself against any flank movements, the Butte-Ballaklava management has organized an iron-clad pool, and the majority of its 250,000 shares of stock has been deposited in a bank at Duluth. The statement is made that outside interests have been endeavoring to gain control of the company, using the suits brought against the company as ammunition in their campaign. The Butte-Ballaklava has built something of a back-fire by instituting a suit against the Anaconda to recover $1,376,095, being the estimated value of ore wrongfully extracted from the Butte-Ballaklava ground. The Inspiration Copper Co. has acquired full title to the holdings of the Cordova Copper Co., which adjoin the Inspiration at Miami, Arizona. The price reported to have been paid for the minority interests is $76,000.

It is expected that the curtain will be lowered for the last time on the operations of the Montgomery-Shoshone when the annual meeting is held in the latter part of the current week. It is practically decided to close down the property and dismantle the big plant that was once looked upon as one of the principal producers in Nevada. The company will realize something from the sale of its mill, but will close its existence heavily in debt to Mr. Schwab. The Granby mines in British Columbia have been forced to shut down by reason of the strike of the coal miners. Some 500 men are thrown out of employment at the Granby property, and the smelter at Grand Forks will be closed down in a day or two. It is said that no work will be begun until the coal strike is out of the way.

Though there has been some temporary increase in interest in copper shares and in the announcement that in spite of prevailing conditions Utah Copper is to increase its output after August 1, when the much talked of curtailment agreement will expire by limitation, still the chief centre of interest in New York is in the Canadian goldfields. The endorsement given by well known mining engineers is beginning to have weight with the public, and the belief is growing that Porcupine will develop several large mines. There is a decided trend of opinion to the theory that good ore will be found to exist at depth. It is this question that has so far been the stumbling block in the way of progress. The fire which occurred recently has had no effect on prices, or on activity. The greatest loss was sustained by Timmins Brothers, the 30-stamp mill which had been erected and equipped for the Hollinger having been destroyed. Orders have already been placed by wire to duplicate this equipment, consisting of the mill and a cyanide plant, the latter having been just completed when the fire occurred.

GRANBY SMELTER, GRANBY FORKS, B. C.

A large part of the interest in Porcupine during the past week or ten days has been centring in the Rea Consolidated, in which the Consolidated Gold Fields of South Africa had at one time a large interest, but for some reason saw fit to sell out. The property is now controlled by the same interests that control the Golden Cycle of Cripple Creek; John T. Milliken of St. Louis, Frank G. Logan, of Logan & Bryan, and their friends. Work at 200 to 250 ft. depth in the Rea is said to have shown such good ore as to make the property one of the sure mines of the camp.

Toronto has become the centre of mining deals, real and imaginary, and there is an army of promoters and boomers fanning the flame of excitement in the hope of inducing the public to let its enthusiasm run away with its judgment, so that paper promotions may look like real mine development. The way of this class of gentry is, however, getting harder to travel all the time. E. N. Foss, governor of Massachusetts, has signed the bill making it a crime, punishable by a fine of $5000 or ten years imprisonment, or both, to make or cause to be made public any false statements regarding the merits of the stock in any corporation, or of the financial condition of any corporation.

Some important bills passed by the legislature of Colorado also treat upon the mining industry. The most important of these is the bill providing that mines shall be taxed upon their net returns, not upon the gross production. The question of how to assess non-producing properties is a difficult one; it was finally decided to materially reduce the present local rates. How to assess mine improvements is also a puzzle, the only equitable arrangement is some simple and easily applied rule that can be made uniform in its imposition. The Colorado legislature also made smelting and sampling companies public-utility corporations. How this will work out in practice is yet to be seen.

General Mining News

ALASKA

Juneau District

The report of the Alaska United Gold M. Co. for the month ended April 15, 1911, is as follows: Ready Bullion 120-stamp mill: Ore crushed, 17,799 tons; concentrate saved, 420 tons; estimated gross value of free gold recovered, $21,212; value of concentrate, $16,714. Total realizable value, $37,548; operating expenses, $30,508; net operating profit, $7039. Construction expense, $1260; yield of ore, $2.13 per ton. The 700-Ft. Claim 100-stamp mill: Ore crushed, 17,595 tons; concentrate saved, 413 tons; gross value of free gold, $18,887; concentrate, $15,687. Total realizable value, $34,256; operating expenses, $28,002; net operating profit, $6254; construction, $5803. Yield of ore milled, $1.96 per ton. Development on Ready Bullion claim, 359 ft.; on 700-Ft. Claim, 494 ft. Stock of ore broken, 721 tons in former, and 52 tons in latter.

Prince William Sound

The Valdez M. Co. has driven 120 ft. along the course of its lode, and from this adit cross-cuts 20 ft. apart have been driven through the vein, demonstrating that it has a width varying from 7 to 11 ft. It is claimed the ore assays about $100 per ton. The face of the adit is 130 ft. below the cropping. The intention is to extend the adit, and drive another level, starting it 400 ft. lower on the mountain side. Interest in the Cliff mine has been increased by the recent discovery of a body of ore, not previously opened, which proves to be on the main vein. A clean-up at the Cliff on May 9 amounted to $8500. The Blue Ribbon Gold M. Co. has given a 5-years lease of its six claims on Mineral creek to Daniel Johannson and G. E. Erickson, of Nevada, the lessees to pay a royalty of 20% of proceeds after the pay-roll has been met. The lessees also have an option to purchase the mine at $200,000 if taken within a year, but at a higher price if the option is exercised within any one of the subsequent years of the lease.

It is announced at Cordova that the Copper River & Northwestern Railway Co. is to have a survey made this season for an extension of its line from mile 191 a distance of 60 miles northeasterly into the White River region, this route being through a mineral region. The Alaska Road Commission announces that $20,000 will be spent this year in so improving the trail between Chitina and Willow creek as to make it passable for wagons and automobiles.

Seward Peninsula

The Wild Goose Mining & Trading Co. is to operate its dredge on upper Ophir creek, near Council, this season, the work to be in charge of Gilbert Russell. The dredge was built last year and was operated satisfactorily for 10 days in October. It has a close-connected line of 58 buckets, each of 3½-cu. ft. capacity, the power for operating being supplied by a 125-hp. gasoline engine. The rated capacity of the dredge is 2000 cu. yd. per day.

ARIZONA

Mohave County

The C. O. D. mine and mill are being made ready to operate again. The intention is to mill the ore on the dump and that which is exposed in the stopes. The property is 15 miles out from Kingman, near Mineral Park.

Pima County

The Plumed Knight claims, 18 miles south of Tucson, have been purchased of L. D. Chillson by the Pioneer Smelting Co., the second payment having been made recently according to the terms of a lease and bond signed last January. This is but one of several properties which this company is acquiring. A smelting plant is to be built eventually. Development on the Golden Age group of claims, 64 miles southwest of Tucson, has resulted in exposing a vein of ore containing wulfenite, or molybdate of lead. Development on other similiar deposits leads to the belief that gold ore underlies the wulfenite. The Golden Age operators have on the ground the equipment for a mill in which surface ores are to be treated.

Pinal County

The two units of the Ray Con. mill, which are in operation, are turning out a concentrate containing 71% of the assay value of the ore treated. This percentage of saving is said to be reached even when the mill is being run at the maximum capacity of 2400 tons per day for the two units. While the smelter of the Ray Con. is being constructed the concentrate is being shipped to the El Paso smelter. The Ray mill and smelter are both at Hayden. David Cole, formerly with the Cananea Consolidated, is now manager for the Ray company, with George O. Bradley as superintendent of construction.

CALIFORNIA

Amador County

The operating profits of the Central Eureka mine for April amounted to $5000. The Fremont Con. M. Co., the property of which is between Drytown and Amador City, pays a monthly dividend of 2c. per share, amounting to $4000. Arthur W. Goodall and Wales Palmer are manager and mine superintendent, respectively. R. S. Rainsford, in charge of the Argonaut mine, close to Jackson, has purchased new hoisting machinery, which will be put in position this month. It is stated that the vein, where opened at the 3400-ft. level, is 20 ft. wide, containing ore of good grade.

Butte County

The Natomas Consolidated is operating two dredges in Oroville district, and has a third dredge under construction for work in the same locality. The new one will have 15-cu. ft. buckets.

Inyo County

(Special Correspondence.)—The report of the Skidoo Mines Co., for April, showed that 1026 tons of ore was milled, from which there was recovered $14,254 by amalgamation, and $3282 by cyanide treatment. The costs of operating were $7734; development expense, $1068. Net profits for the month, $8734.

Skidoo, May 25.

The Randsburg *Miner* notes the sale of the Arondo mine, situated in Argus mountains, in the southwestern part of Inyo county, to A. B. Rogers and associates of Los Angeles, the purchasers now being in possession of the property, with Charles E. Anderson in charge of the work. The equipment includes a small mill for cyanide treatment.

Nevada County

The 20-stamp mill at the Pittsburg mine at Nevada City is running on ore taken from the stopes between the 1000 and 1100-ft. levels. The deepest workings in ore consist of drifts on the vein at the 1300-ft. level. The vein was opened at this depth by driving a 40-ft. cross-cut from the 1300-ft. station. Raises are to be driven on the vein from the 1300 to the 1100-ft. level. The stoping ground between those levels is expected to supply a big tonnage of ore. Mark B. Kerr, managing director, is in charge of the work. The Fairview mine is now under the management of Arthur W. Hoge, who is identified with the Montana mine, at Grass Valley, and the Downey at Jones bar.

Sacramento County

The Natomas Consolidated of California is operating its Natoma dredge No. 8 on American river, in the vicinity of Folsom. It is handling about 500 cu. yd. of material per hour, digging in most difficult ground, consisting of cemented gravel and heavy clay; the digging extends considerably into the false bedrock of volcanic ash. Dredge No. 9, now nearly completed, is to be started in operation this month on Rebel hill, one mile from dredge No. 8. Both dredges have 15-cu. ft. buckets, and dig to a depth of 55 ft. below water-line. This company has placed with the Yuba Construction Co., of Marysville, an order for the building of Natoma dredge No. 10, which is to have a steel

hull, 150 by 50 ft., and 10 ft. in depth. It is to be equipped with a chain of 15-cu. ft. buckets, and will be operated on Humbug hill, near Folsom. The cost of this dredge will be close to $275,000. It is the first one with a steel hull to be built for work in California. The Yuba Construction Co., which designed and built all the dredges mentioned, constructed two steel-hull boats for the Yukon Gold Co., for its work at Dawson.

San Bernardino County

The Bob Young and other mining properties, situated 14 miles from Barnwell, have been sold to a company of Philadelphia people at $150,000, of which $75,000 is said to have been paid in cash. It is claimed the Bob Young has 7000 ft. of development work.

Shasta County

(Special Correspondence.)—The Western Dredging Co. has arranged to operate a dredge this season on the Sacramento river 2½ miles above Redding. The dredge is of the Dubois suction type. The Mammoth Copper Co, is operating three furnaces, and recent improvements in collecting fumes are expected to make it possible to continue through the summer. The difficulty in trying to cool the smoke sufficiently to avoid injury to the woolen bags during the passage of the smoke has been apparently overcome. The company has a force of about 100 men at work in the Quartz Hill mine, Old Diggings district, where silicious gold ore has been opened. The Noble Electric Steel Co. is arranging for three new furnaces. Within three months the company expects to be producing pig iron on a large scale. In the meantime operations continue at the iron mines in the Pit river canyon, while the chrome deposits are also receiving attention. The electric smelter is built at Heroult on the Sacramento Valley & Eastern railway, a short distance from Redding. The officials of the Balaklala Copper Co. have been cited to appear before Judge Van Fleet, June 19, in the U. S. District Court at San Francisco, to answer to the charge of the Farmers' Protective Association that the decree of the court relative to the smelter fumes is not being obeyed by the company. It is understood that the company will maintain that the smoke from its Coram plant is not causing any damage to crops and that the decree of the court has been complied with.

Redding, May 28.

Sierra County

(Special Correspondence.)—There is some mining activity in the vicinity of Sierra City. It is reported that a vein has been opened in the Sacred Mound mine. The ore recently discovered is said to be richer than any previously found. Operations are also in progress in the Bullion or Colombo mines, as well as in the Swastika. The old Sierra Buttes mine, formerly operated by the Sierra Buttes Mining Co. of London, which also owned the Plumas Eureka mines at Johnsville, Plumas county, has ten additional stamps in operation on a good grade of ore. In addition to these, the Keystone and San Luis are operating on a small scale. This season promises to be favorable, the unusual fall of snow in the Sierras guaranteeing an adequate water supply for the next six months.

Sierra City, May 27.

The Rio Antigua M. Co. of Los Angeles has obtained a renewal of the bond under which it has performed a great deal of work on the South fork placer property in the vicinity of Forest. It is said that $50,000 has been expended by this company on the property. Work is to be resumed this month. The Standard mine, in Sailor ravine, owned by R. E. Blevins and Jason Frye, is to be equipped with a 5-stamp mill. They have ore on the dump and in the stopes sufficient to keep 5 stamps crushing for some time.

Trinity County

The Payne ranch, in the vicinity of Trinity Center, considered good dredging ground, has been sold by G. W. Payne and others to a company formed at San Francisco, in which Payne is included. W. L. Christy, one of the eight stockholders, is said to have prospected the ground two years ago. A dredge, having 7-cu. ft. buckets, that formerly was operated in Siskiyou county, is to be moved to the Payne property.

COLORADO

Thirty-six members of the senior class of the Colorado School of Mines, Golden, accompanied by six of the professors of that institution, visited and inspected mines, mills, smelters, and power plants in Colorado, Utah, and Montana last month, and did some underground and field geological work. They made a study of the New Monarch, Wolftone, and Silver Cord mines, and the Yak tunnel, at Leadville; the Daly-Judge and Daly West at Park City; the mines of the Utah Copper Co. and Utah Consolidated in Bingham district; the St. Lawrence, High Ore, Diamond, Belmont, Anaconda, Never Sweat, and Butte & Superior mines at Butte.

Clear Creek County

The Conqueror mine, situated at Empire, is to be reopened and operated this season under direction of George Schneider. The small concentrating mill is to be put in operation. The 5-ft. vein tapped by an adit in the Josephine, 1400 ft. from the portal, is said to contain ore assaying 65% lead and 35 oz. silver per ton. The Argentine Central railroad, extending from Georgetown up toward the pass, is probably open for traffic by now, and ore shipments from the Santiago mine to the Golden smelter doubtless have commenced.

Fremont County

(Special Correspondence.)—The new tailing mill, built at the Union plant of the United States Reduction & Refining Co., at Florence, was finished and put in operation in April. It was built to treat the stuff in the tailing dump from the main plant, this material being pulverized by tube-mills in which cyanide solution is used. Following this the pulp is passed over blankets, thence to large tanks containing Dorr thickeners. Merrill presses are used in precipitating with zinc dust. This mill was built under direction of J. Q. MacDonald, manager of the Union plant.

Florence, May 27.

Hinsdale County

The Lake City *Times* publishes an account of the starting of the Rankin plant, and states that the first ore treated contained silver, 4% sulphur, 10% lead, 5% zinc, 1% copper, and about 80% silica, the cost of treatment having been 75c. per ton. It is claimed the extraction reaches over 90 per cent.

Lake County (Leadville)

The Leadville District M. & M. Co. is operating a wet-concentration mill, treating about 50 tons of ore per day. The American Zinc Extraction Co. is operating a roaster and magnetic separators, and is shipping about 100 tons per day of zinc sulphide concentrate.

San Miguel County

The Primos Chemical Co. has acquired about 2000 acres of land situated between Fall and Bear creeks, on the south side of the San Miguel river, in the vicinity of Newmire, the tract being within the vanadium belt. This company has under lease the mill of the Vanadium Alloys Co., and is the only concern reducing vanadium ores in Colorado at the present time. The product is bought by the General Vanadium Co. and shipped to Liverpool. The Crucible Steel M. & M. Co., of Pennsylvania, through its agents, J. B. Johnson and R. H. McMillan, has purchased a number of claims on the Vanadium belt, including the Harmon from Tom Bradley, the Gopher from Bradley and Finnegan, the Lone Tree, Jennie Lind, Iowa, Mammoth, and Jumbo from I. B. Imes.

Teller County (Cripple Creek)

The Gold Dollar mines, on Beacon hill, produced 82 carloads of ore during April, and 60 to 80 tons per day have been hoisted and shipped from the Mabel M. and Husted

shafts of this group during May. The Mohawk M. Co. shipped from the Favorite mine, on Bull hill, two cars of ore that sampled $23.40 per ton. The Favorite belongs to the Stratton estate. A mill for cyanide treatment is being erected at the Jo Dandy mine, on Raven hill.

The Mine Rescue Association of Cripple Creek has been formed, the officers of which are as follows: President, Phillip H. Argall, of Stratton's Independence; vice-president, D. D. Woodruff, secretary of the Mine Owners & Operators Association; secretary, Fred Jones, engineer at Portland mine; committee to solicit subscriptions, F. L. Smale, manager at Portland, Dan McCarthy, manager at the Granite mine, and Phillip H. Argall. A rescue station will be established at Cripple Creek, and one at Victor, both of which are to be equipped with appliances required by the U. S. Bureau of Mines.

It is probable that the necessary money to extend the Roosevelt drainage tunnel will be subscribed. The plan is to use diamond-drills in finding other water channels, after which they will be tapped by driving, thus increasing the flow of water from the tunnel, now about 6000 gal. per minute. By this work the water-level in the mines will be lowered more rapidly, and the orebodies now below that level will be made accessible.

IDAHO

Idaho County

The Salmon River M. Co., J. R. Painter, manager, has a large area of placer ground at Eakin bar, on the Salmon river, the camp being 14 miles south of Dixie. Equipment for hydraulic mining and for a hydro-electric power-plant has been shipped from Salmon to Eakin bar, down Snake river, in barges, a distance of 150 miles. Ten barges were brought into use.

Lemhi County

The Pittsburg-Idaho company, owning and operating the Gilmore lead-silver mine, at Gilmore, has five patented claims, employs 65 men, and the property has been developed by a 400-ft. shaft, 3160 ft. of adits, 105 ft. of winzes, 550 ft. of raises, and 1225 ft. of cross-cuts. The total ore shipments amount to 12,122 tons, from the sale of which $203,252 was received. There was a cessation of ore shipments for a few weeks, while some new equipment was being put in position, but they were resumed last month. Over 2000 tons per month are to be marketed at the Salt Lake smelters. J. E. Walker is superintendent.

Owyhee County

The Banner M. Co. is employing about 30 men, and is reported to have put its mill in operation last week. The ore blocked out in the mine is sufficient to supply the mill at full capacity for six months. There is a surface tramway, 1100 ft. long, extending from mill to mine. The property is situated a mile south of Silver City. The mill is equipped with four Nissen stamps, settling-tanks, and concentrating-tables, and the concentrate saved is ground in 6-ft. amalgamating pans for recovering the gold and silver.

Shoshone County

The four principal lead-smelting companies are in keen competition for the purchase of the lead-silver ores and concentrate of the Coeur d'Alene district. This competition, however, is limited by the fact that some of the largest operators are bound by contracts with the A. S. & R. Co., made a few years ago. It is understood that mine operators not held by such contracts are getting a reduced treatment rate. The Salida smelter, and that of the United States company in Utah, receive a fair tonnage of Coeur d'Alene ores, and a new competitor in the district is the International S. & R. Co., which is stocking up with ore at its Tooele plant, pending the building of its lead furnaces. An interesting rumor concerning the lead-mining industry is that lead furnaces are to be built at the big Anaconda copper plant. The existence of competition among the lead-smelting companies is having a stimulating effect on mining in northern Idaho.

MICHIGAN

Houghton County

The Mayflower M. Co., having an area of mineral ground surrounded by the Kearsarge, Old Colony, and Wolverine mines, has sunk a 1300-ft. drill-hole to explore the amygdaloid lode that was penetrated at 1200 ft. on another part of the group, but no ore has been found thus far by the last drilling. Sinking is to be continued. The hopes of this exploration work are based upon what has been discovered on the Old Colony and other adjoining properties.

The Mohawk operations for April showed a recovery of 16.18 lb. of refined copper per ton of ore, which is a gain of 2 lb. over that of March. During that month there was 71,868 tons hoisted, and 63,993 tons stamped.

NEVADA

Churchill County

Work on the Nevada Hills mill is progressing satisfactorily. The steel frame is up, and the covering of corrugated iron, with an asbestos lining, is being put on. The machinery is being put in position, and the 150-hp. double-drum electric hoist for the new shaft was to have been delivered at the mine last week. An electric-driven pump has been put in place in the old workings; and a cross-cut is to be driven from the 570-ft. level to tap the orebody that was opened on the 470-ft. level. The new 3-compartment shaft, now at a depth of 300 ft., is to be sunk to 650 ft., before cross-cuts are driven to the ore. Connections will be made between the old workings and the new shaft, as all ore from both vein systems will be hoisted through the latter. The Nevada Hills mine is at Fairview, the nearest railroad town being Fallon, 36 miles to the northwest.

Esmeralda County

(Special Correspondence.)—At the regular quarterly meeting of the board of directors of the Goldfield Consol-

CLERMONT SHAFT, GOLDFIELD CONSOLIDATED.

idated Mines Co., at Goldfield, May 25, there was declared the regular dividend of 30c. per share, and an extra dividend of 20c. per share, payable July 31, to stockholders who are of record June 30, 1911.

Goldfield, May 25.

(Special Correspondence.)—At the Florence Goldfield mine a station has been cut at the 700-ft. level, and lateral development is in progress on two levels below the 500-ft. Mill-heads have shown a decided improvement with the introduction of ore from the large body opened in the Reilly shoot at the northern extremity of the Florence claim, and the mill is treating 130 tons daily. No concentrate has been shipped recently, as the company's plant now treats mill products as well as the high-grade ore. On the 700-ft. level the south drift will be extended to explore the main Florence and Little Florence veins; these veins formerly yielded high-grade ore to lessees. The large andesite dike, south of Florence hill, will be penetrated in this level in the hope of finding the southern extension of the ore.

Goldfield, May 24.

Eureka County

The Buckhorn Mines Co., owned by George Wingfield and associates, has developed the property by about 12,000 ft. of work. Further improvements are awaiting the rebuilding of the Eureka & Palisade railroad. Fred J. Siebert has charge of the development. At present the property is reached by team or automobile from Beowawe.

Humboldt County

John T. Reid, G. G. Cunningham, and others of Lovelock, are preparing to ship nitrate of soda to California, where it is in demand as a fertilizer. The Lovelock *Tribune* asserts that nitrate shipments from the deposits of that part of the Humboldt valley are likely to increase.

Lyon County

The Mason Valley Mines Co. has given to the A. Leschen & Sons Rope Co., of St. Louis, the contract to erect an aerial tramway from the shipping bins on the Nevada Copper Belt railroad, at Mason, to the No. 4 adit of the Mason Valley mine, the distance being between 5000 and 6000 ft. The tramway is to be ready to operate by Sept. 15. The Mason Valley company is to purchase and set up a new air-compressor at the portal of No. 4 adit. Mason is the new town on the railroad, on the opposite side of Walker river from Yerington.

Nye County

The Tonopah-Belmont Development Co., owner of the Belmont mine, at Tonopah, has received bids and estimates on equipment for a new mill to be erected at the mine. The old mill is situated at Millers, 10 miles from the mine, and the company's plans contemplate eliminating the expense of this haulage of ore. The most important expense to meet under the new arrangement will be to provide for a water-supply. Frederic Bradshaw is the company's manager.

(Special Correspondence.)—The Tonopah Liberty M. Co., operating at Liberty, 18 miles north of Tonopah, recently sent out five bars of bullion, the result of a 10-days run of the mill. The shipment was valued at $10,000. Most of the ore treated is extracted in course of development. About 25 men are employed.

Tonopah, May 27.

W. B. and F. A. Milliken have a force of miners at work developing the Indiana claims at Pioneer. A shaft has been sunk to a depth of 400 ft., and now lateral work in ore is in progress from the 265-ft. station; and a crosscut is being driven to the vein at 400 ft. About 50 tons of ore of milling grade has been hoisted. Some ore shipments are to be made, and it is possible that a mill will be built.

Storey County (Virginia City)

The report of Whitman Symmes, superintendent for the Mexican G. & S. M. Co., for the week ended May 27, notes the cleaning out of the old drain tunnel connecting the Union shaft with the site for the mill which is to be built. On the 2300-ft. level there was hoisted 57 mine-cars of ore, assaying $7.33 per ton, from the north drift off the east cross-cut No. 2, in driving 12 ft. The south drift from the east cross-cut No. 2 was extended 17 ft., and from it 75 cars of ore was taken, averaging $12.21 per ton. Work on the 2400-ft. level consisted of driving 25 ft. on north drift No. 2, starting in the west cross-cut from the north drift, in the course of which there was mined 68 cars of ore averaging $16.50 per ton. On the 2500-ft. level, work was done on the third and fourth floors of the stope at the end of the north drift, from which 94 cars of ore of an average value of $70 per ton was mined. Three railroad cars of first-grade ore were shipped to the smelter.

The report of T. F. McCormick, superintendent of the Con.-Virginia mine, for the week ended May 27, gives account of work on the fourth and fifth floors in the stope above the 1750-ft. level, where there was mined 145 tons of ore averaging $10.90 per ton. On the 2450-ft. level the west cross-cut, started in the south drift, 280 ft. in from the mouth, was advanced 15 ft., making a total length of 47 ft. Work on the 2550-ft. level consisted of driving 21 ft. on the west cross-cut, from the southwest drift that was started from the north boundary of the mine. There was shipped 130 tons of ore to the Comstock tunnel mill at Sutro.

Work in the Ophir mine for the same week was mostly on the second, fourth, eighth, ninth, and tenth floors in the stopes above the 2100-ft. level, and from these workings there was extracted 262 tons of ore, assaying $44.94 per ton. This work was in the west cross-cut, started in the main northeast drift 200 ft. north from the south boundary of the mine. The ore shipped to the Kinkead mill amounted to 341 tons; one railroad car of concentrate was shipped to the Selby smelter.

White Pine County

The Kinsley Development Co., mining in the northeastern part of this county, shipped 26 tons of ore to a Salt Lake smelter which sampled 22 oz. silver and $1.42 gold per ton, 21% lead, 40% iron, 11% silica, 1% sulphur, 1% zinc. A carload of copper was more recently shipped from another part of the same property. The camp is nearly west of the Deep Creek district, in Tooele county, Utah.

NEW MEXICO

Grant County

The Western Belle mines, Pinos Altos district, are being operated with a force of 60 men, by McKinney, Corrigan & Hutchinson. The properties include the Hearst and Gillette. The 500-ft. shaft on the former was retimbered last spring, and the shaft on the latter has reached a depth of 800 ft. The lateral development from these shafts is mostly in ground previously unexplored, a body of high-grade ore having been opened on the 400-ft. level of the Hearst mine.

The Chino Copper Co., it is estimated, has 45,000,000 tons of ore developed, 70% of which can be mined by the steam-shovel method. The ore assays about 2.3% copper. The properties are at Santa Rita.

Socorro County

(Special Correspondence.)—The oil consumption for power purposes at the mill of the Deadwood mines, Mogollon district, is said to be less than 11c. per horse-power day, and since not to exceed 70 hp. is required to handle 50 tons daily in this mill, the fuel cost to crush, stamp, and treat a ton of ore is less than 16c. To this must be added cost of labor, depreciation, and other items in arriving at the total power-cost which is under 50c. per ton. The mine has been unwatered to the second level; ore is being supplied to the mill from this and the first levels. The large accumulation of water in the lower workings will be permitted to stand until the water-supply, from springs two miles up the canyon, is tested during the normally dry months of May and June, and will be drawn upon for ore-treatment if necessary.

Mogollon, May 30.

OREGON

Josephine County

The Waldo Con. Gold M. Co., having 4353 acres of placer ground in the vicinity of Waldo, and controlling the water rights on the east fork of the Illinois river, operates on an extensive scale, with modern equipment. These holdings comprise the various groups which were consolidated, including the Osgood, Logan, Deep Gravel, Freye Gulch, and Frainey. The operations consist of hydraulic work with giants, drift mining from shafts sunk to bedrock, and with hydraulic elevators. A 1-mile tunnel is to be driven from the head of Butcher gulch to the Deep Gravel mine, to be used as an outlet race for carrying away the tailing from the Logan mine, thus making the hydraulic elevator unnecessary at this property. It is stated by the Grants Pass *Courier* that a dredge is to be built this season for operating on the Deep Gravel mine. The operations of the company are under direction of Frank M. Leland.

The Oriole mine is opened by adits No. 1, 2, 3, and 4, which, with the cross-cuts, drifts, and winzes, amount to one mile of development. No. 4 is the main working level,

and this attains a depth of 600 ft. on the vein. The ore is to be hauled to the mill over a surface tramway by gravity. The grade of the selected ore is demonstrated by four shipments made to the smelter at Tacoma, the net returns from which showed about $200 per ton.

The Oscar Creek Con. M. Co. has acquired 250 acres of placer ground on Oscar creek, 10 miles south of Grants Pass. The group is made up of a number of smaller holdings that formerly were worked by individuals. The principals in the company are A. H. Gunnel, L. L. Jewell, and Charles Burkhalter, all of Grants Pass. The intention is to provide equipment to operate on a larger scale.

The properties of the United Copper-Gold Mines Co., formerly controlled by O. H. Thomas, F. E. Newberry, O. S. Blanchard, and Ralph Looney, have been taken over by South Dakota men, comprising W. L. Low, G. C. Westby, James Greig, and George Williamson. Mr. Low formerly operated in British Columbia, and Mr. Westby is a metallurgist, who formerly was in Nevada. The holdings purchased consist of quartz claims on Pickett creek, 7 miles west of Merlin, and a group of 8 claims on Illinois river, 12 miles northwest of Selma. The first work to be performed will be on the latter group, where a vein of copper ore was developed by former operators.

UTAH

Beaver County

(Special Correspondence.)—South Utah Mines & Smelters has issued a report on April production which shows a decrease in tonnage as compared with March, but a higher production of metal. The figures are: Tons ore, 21,743; tons concentrate, 1969; pounds copper, 300,137; ounces gold, 145; ounces silver, 2690. March figures were: Tons ore, 23,972; tons concentrate, 2301; pounds copper, 300,007; ounces gold, 141; ounces silver, 2583. The average tonnage treated in April was 720, which has been increased during May to about 800.

Newhouse, May 27.

Juab County

The Southern Eureka group of 80 acres, close to Mammoth, which was partly developed by a 500-ft. shaft, is to be further developed through a deep shaft on the Opex. Among those interested in it are S. D. Nicholson and C. T. Limberg, of Leadville, and J. H. McChrystal of Eureka, who are arranging to have work commenced. E. R. Higginson, having a lease on a block of ground in the Black Jack mine, has been mining on a stringer of gold ore, a carload shipment of which sampled 5 oz. gold per ton, and this was accompanied by some silver. V. Whiting, also a lessee on the Black Jack, is making regular shipments of iron ore, on which he realizes a small profit.

Salt Lake County

The Utah Apex development during the last five months has resulted in opening a body of lead ore approximately 50 ft. wide, and driving thereon has demonstrated the length, thus far, to be 400 ft. This orebody was opened by driving from the main haulage-level. The operators of the property are shipping 125 to 150 tons of ore daily from the drifts and stopes of the new workings. While running high in lead, this ore contains an excess of iron.

WASHINGTON

Ferry County

(Special Correspondence.)—The Belcher mine is employing 20 men, with W. M. Anderson as superintendent, and is shipping from 50 to 70 tons of ore per day to the Granby smelter, under a contract to deliver 12,000 tons. The ore contains an average of 50% iron and 35% sulphur. Five Leyner drills are in use, driven by a compressor at the Spuro mine, 6000 ft. distant. The No. 3 adit-level is 750 ft. above the Belcher mountain railway track, and the ore is delivered from the portal of the adit by an 1875-ft. gravity tramway. The ore is drawn from the 200-ft. and intermediate levels, where the vein is 60 ft. wide, the stoping being from wall to wall. A raise has been driven from No. 3 level to the intermediate. The mine has in sight, and partly blocked out, about 100,000 tons of iron carbonate and an equal tonnage of sulphide ore. The ore contains low value in gold and traces of copper. After the mine had been idle over a year, percolating water dropping on the floor of the No. 2 adit-level precipitated sulphate of copper. Copper-bearing ore was formerly shipped from the No. 3 level by J. L. Harper, the former manager, whose predictions regarding the Belcher mine are now being realized.

The Great Northern Railway Co. has put into effect a freight rate of $4 per ton on ore from Republic to the Washoe smelter, Anaconda, Mont. The Granby company being unwilling to receive Republic ore during the coke shortage, Mr. Harper, of the Republic Mines Corporation, arranged with the Washoe smelter people for the shipment of ore from the Republic mines in which he is interested.

Republic, May 25.

King County

The Seattle-Cascade Mining Co., after having developed a mining property in the vicinity of Berlin, has purchased equipment for a concentrating mill, the foundation for which has been laid.

Okanogan County

(Special Correspondence.)—The property of the Double Header M. Co. is situated at Nespelem, 2½ miles from the Columbia river, making easy transportation by boat to Wenatchee. Development has resulted in exposing silver ore in two veins. A large percentage of the ore is of good milling grade, while a portion of it assays over $100 per ton. A 2-compartment shaft was sunk 80 ft., drifts from which were extended to both veins. It is the intention to sink 100 ft. deeper. As soon as the mine is well developed a mill is to be built. The work is in charge of George McQuinn, of Seattle.

Nespelem, May 11.

Stevens County

(Special Correspondence.)—The Oriole M. Co. has two carloads of ore ready to ship from its mine at Metaline. It is made up of two classes of ore—one in which gold is of principal value, and another which consists mainly of lead. The mine has been opened by a cross-cut to the ore, on which there has been several hundred feet of driving and winze work. A second cross-cut is being driven whereby the vein is to be opened 200 ft. deeper. Joseph Lancaster is engineer in charge of the work.

Metaline, May 6.

MEXICO

The Pearson oil interests are now furnishing fuel oil to the Mexican railway, operating between Mexico City and Veracruz. A contract to furnish fuel oil was entered into by the Pearsons a few years ago, but their failure to develop sufficient supplies made it impossible for them to fill it, and the failure proved expensive. Recent developments in Veracruz have given the Pearsons a big supply of oil, and the contract has been renewed.

Chihuahua

(Special Correspondence.)—The March operations of La Republica Mining Co., as reported by J. Gordon Hardy, consulting engineer, of El Paso, Texas, are summarized as follows: Ore milled, 1224 tons; gross production, ₱76,710.99; operating charges, ₱46,834.79; construction expenses, ₱3369.84. The mine is at Sanz, reached by way of Ocampo.

Ocampo, May 2.

San Luis Potosi

The Benito Juarez mine, situated ten miles south of Salinas, was raided by a body of bandits recently, who forced those in charge to close down the mine and stop the pumps. As a consequence the mine workings were flooded with water, entailing heavy damages. Americans and one Englishman, connected with this and other mines, were robbed of their money and stores, and subjected to rough treatment. The Benito Juarez is owned by a company for which A. B. Carpenter is engineer in charge.

Company Reports

TENNESSEE COPPER CO.

The Tennessee Copper Co., operating in Ducktown district, with offices at Copperhill, employs 1000 to 1200 men. Its gross earnings for 1910 were $547,157, an increase of $119,502 over those of the previous year. The net earnings amounted to $445,387, being $105,982 in excess of those of 1909. The production of copper for the year was 12,429,009 lb., which is 1,500,000 lb. less than the output of the last year; the principal increase in profits was due to the manufacture and sale of sulphuric acid. The cost of copper production for 1910 was 10.6c. per pound; the dividends paid amounted to $300,000. The ore available in the mine on December 31 was estimated at 4,563,671 tons, which is said to be greater than has been shown at any former date. It is estimated that the profits from the operation of the acid plant during 1911 will reach $500,000.

NEW YORK & HONDURAS ROSARIO MINING CO.

This company, with properties at San Juancito, Honduras, in its thirty-first annual report for the year ended November 17, 1910, gives the following table of production, extraction, and costs for the year:

PRODUCTION

Ounces silver produced	1,289,173.87
Ounces gold produced	102,610.82
Ounces silver produced per ton	35.19
Ounces gold produced per ton	0.289
U. S. value of total	$857,008.59
Production per ton	$23.39
Pesos value of total at 170%	2,313,923.19
Production per ton, pesos	63.163
Total tons crushed during year 1909-1910	36,634.55

EXTRACTION

	Percentages of Extraction.
Silver	86.17
Gold	89.68
Total	87.73

COSTS

	Labor		Supply	
	Total.	Per ton.	Total.	Per ton.
	₱	₱	₱	₱
Mine	525,948.78	14.36	177,672.38	4.85
Tramway	37,034.37	1.02	17,993.49	0.49
Mill	75,015.35	2.05	258,346.03	7.05
Surface improvement	169,687.85	4.62	22,967.70	0.63
Total	807,686.35	22.05	476,979.60	13.02

TOTAL

	Total.	Per ton.
	₱	₱
Mine	703,621.16	19.21
Tramway	55,027.86	1.50
Mill	333,361.38	9.10
Surface improvement	192,655.55	5.25
Total	1,284,665.95	35.06

Thirteen veins are being worked, the most important being the San Miguel and the ore reserve is estimated at 107,575 tons (containing an average of 23.7% waste) of an average gross value of $25.30 per ton, or a gross value of $2,776,437. The operating profit for the year ended September 30, 1910, was $349,476. During the year six dividends were paid, amounting to $105,000, leaving a balance on hand, October 1, 1910, of $1,429,150. The amount of capital stock is $1,500,000, and the surplus is given as above. The bullion production since 1882 is given as $15,530,574. One hundred and seventy dividends have been paid, amounting to $2,970,000 in all.

Book Reviews

Any of the books noticed in these columns are for sale by, or can be procured from, the MINING AND SCIENTIFIC PRESS.

QUALITATIVE CHEMICAL ANALYSIS OF INORGANIC SUBSTANCES. By O. F. Tower. Pp. 84. P. Blakiston's Son & Co., Philadelphia, 1911. For sale by the *Mining and Scientific Press*. Price, $1.

This is a student's text-book and pre-supposes considerable familiarity with general chemical principles. It is brief, well arranged, and clear.

WINDMILLS AND WIND MOTORS. By F. E. Powell. Pp. 78. Pocket size. Ill. Spon & Chamberlain, New York, 1910. For sale by the *Mining and Scientific Press*. Price, 50 cents.

This is a simple treatise on how to build and run wind engines. It discusses principles briefly, and gives detailed drawings showing how to construct small mills. Considering the long use of windmills and the wide territory in which they can be used, it is surprising that so few works in this field are available. Wind-power is readily available at many isolated mines where a small amount of power would be of great service, and is more reliable than is often supposed. To engineers finding themselves in such a place this little book will be particularly useful.

DREDGING OF GOLD PLACERS. By J. E. Hodgson. Pp. 65. Ill. Sir Isaac Pitman & Sons, Ltd., London, 1911. For sale by the *Mining and Scientific Press*. Price, $2.

This, the latest addition to the growing literature of dredging, is based upon experience principally in the Ashanti fields, with extensive observation elsewhere and wide reading. Mr. Hodgson gives many practical suggestions, and the book is quite worth reading. It is more incidental than comprehensive in treatment and lacks any adequate description of the dredges themselves, comparative tables of performance and costs, wholly ignores methods of hand-drilling, and is weak in its treatment of American dredging practice. It is, however, frank, and generally accurate, and will be of value to American engineers in giving them side-lights on foreign conditions and work.

H. F. B.

THE MINES DIRECTORY. Vol. 1, 1910. Pp. 610. Pub. by The Mines Directory Co., Salt Lake, Utah, 1911. For sale by the *Mining and Scientific Press*. Price, flexible back, $7.50; cloth, $5.

This is a directory of the metal mining companies of the Western States, including Arizona, California, Colorado, Idaho, Montana, Nevada, and Utah. In addition, a limited number of companies operating elsewhere are included, as are also tables of statistics and a summary of mining laws. The directory is the most valuable part of the book. While inaccuracies and omissions will doubtless be found, the book will none the less be extremely useful and corrections can be made in future editions. We hope every user of the book will supply the publishers with additional data, so that in time a comprehensive and accurate annual may be available.

OIL AND PETROLEUM MANUAL, 1911. By Walter R. Skinner. Pp. 164. Published by the author, London, and for sale by the *Mining and Scientific Press*. Price, $2.

The second annual issue of this handbook prepared by Walter R. Skinner, is now available. It contains full particulars of nearly 500 companies, in addition to the names and addresses of (1082) directors, (262) secretaries, (113) consulting engineers, managers, and agents. The particulars given regarding each company include the directors and other officials, date established, situation of property, purchase consideration, royalties payable, number of wells sunk, output, and description of work in progress, capital, if offered to the public, calls, dividends, and financial position as disclosed by accounts, also latest price of shares. The book is a companion volume to the well known 'Mining Manual,' also published by Mr. Skinner.

Personal

Professional men are invited to send news of their engagements and travels. Such news is interesting to friends.

W. H. Weed is at Porcupine.

W. H. Aldridge is in the East.

Sumner S. Smith is at Pittsburg.

George S. Rice sails on June 17 for Europe.

O. B. Perry was in San Francisco last week.

Arthur G. Blake has gone to Nome, Alaska.

Harry Johnson is studying the Oklahoma oilfields.

L. D. Ricketts was at the Miami copper mine May 26.

Silas L. Gillan is at Globe, Arizona, for the Land Office.

H. F. Julian sailed on the *Mauretania* May 24 for London.

Chester B. Naremore is now with the Valeeitos Oil Company.

S. W. Mudd has been visiting the Chino and Ray copper mines.

R. M. Haskell has returned from Triunfo, Baja California.

M. K. and J. H. Rodgers, of Seattle, were in San Francisco, May 29.

Dietz & Keedy, of Boston, have recently made examinations in Maine.

J. Nelson Nevius has returned to Los Angeles from southern Utah.

James W. Malcolmson, of Kansas City, was recently at Ketchikan, Alaska.

T. Walter Beam, of Denver, visited Republic, Washington, last week.

E. L. Dufourcq was in San Francisco and has gone to Shasta county, California.

F. H. Probert, who has been in New York and Chicago, is returning to Los Angeles.

Alexander Leggat has gone to Alaska to report on copper prospects to the west of Cook Inlet.

Courtenay De Kalb is at Tucson, Arizona; will be in Los Angeles June 10, and then in Mexico City.

H. Cushing Smith has accepted the management of the Wettlaufer-Lorain silver mines, in the Cobalt district.

J. F. Callbreath is making a trip through southern Alaska, expecting to visit Juneau, Cordova, and Valdez.

D. M. Riordan and J. B. Keating, of the Bully Hill Copper M. & S. Co., recently visited the properties of that company in Shasta county, California.

M. H. Kuryla, formerly in charge of milling operations for the Esperanza Mining Co., is now with the Merrill Metallurgical Co. at the new Santa Gertrudis mill, Pachuca, Mexico.

Obituary

William McHale, one of the best-known old-time prospectors and mining men in the West, died recently at Florence, Arizona. Mr. McHale was a native of Pennsylvania, served in the Civil War, and has spent his time since then on the plains and mountains of the West. He has made several fortunes, and at 64 years of age he was tramping the hills in preference to enjoying the luxuries which he had the money to buy. He was the owner of mining property in Utah, Arizona, Nevada, and California.

Charles D. Lane, who died at the age of 72 years in his home at Palo Alto, last week, was long a prominent figure in mining circles on the Pacific Coast. Born in 1840, in Missouri, he drifted into mining on the Coast, and, with Hayward and Hobart, developed the Utica mine at Angel's Camp, and more recently was prominent in the development of the Seward Peninsula and the construction of the railroad from Nome to Anvil creek.

Decisions Relating to Mining

Specially reported for the Mining and Scientific Press.

Taxation of Oil—Interstate Commerce

Oil pumped from a pipe-line from one State to a point in another, is a subject of interstate commerce and is therefore exempt from local taxation.

Prairie Oil & Gas Co. *v.* Ehrhardt, (Illinois) 91 Northeastern, 680.

Location of Mining Claim—Effect of Excess

A placer-mining claim located in good faith is not wholly void merely because it exceeds twenty acres. In such case it is void only as to the excess, and this may be rejected from any portion the owner may select, and until he has been advised of the excess and has had a reasonable time to make his selection, his possession extends to the entire claim, and a third person who makes a location of any part of such claim is a trespasser and his location is a nullity and is void for any purpose.

Jones *v.* Wild Goose Mining & Trading Co., 177 Federal, 95. March 1910.

Taking Ore Without Consent—Measure of Damages

The measure of damages for unlawfully taking ore from a mine, but which taking is done in good faith under the belief that such ore belonged to the person taking the same, is the value of such ore as it was in the mine before mined or undisturbed. As applied to the taking of oil, the measure of damages for taking of oil from land through mistake as to its ownership is the value of such oil at the surface or in tank less the cost of pumping and tanking it, and not the usual royalties for producing oil.

Bender *v.* Brooks, (Texas) 127 Southwestern, 168. April 1910.

Conveyance of Land—Reservation of Oil

A deed conveying certain land excepted and reserved out of and from the grant at all time thereafter and forever unto the grantor, his heirs and assigns, one-tenth of all the gas and oil that might be obtained by the grantee, his heirs and assigns, from the land granted, the same to be delivered on the land to the grantor or his agents, free of expense, except the furnishing of barrels or other means of transportation. In an action for an accounting, the effect of this reservation was to reserve in such grantor, his heirs and assigns, to be delivered as stipulated, a royalty of one-tenth of all the oil produced, possessing the same quality of estate as royalty reserved in an ordinary lease for oil and gas purposes.

Jackson *v.* Dulaney, (West Virginia) 67 Southeastern, 794. March 1910.

Failure to Contribute to Assessment Work—Right of Forfeiture

The publication of notice to a part owner of a mining claim to contribute to the cost of doing assessment work thereon for the previous year under penalty of forfeiture of his interest under the statute, is a waiver of a prior personal notice to the same effect, and the delinquent may make his contribution at any time within 90 days from such notice by publication. A part owner of a mining claim who holds an option to purchase the interest of his co-owner has a right to pay or tender the contribution of such co-owner to the cost of the assessment work to avoid a forfeiture; and a failure to object to such tender on the ground of want of authority of the agent when made is a waiver of the right to make such an objection. The rule is that one who does assessment work on an association place or mining claim for which he is paid by one of the part owners has no right to enforce a forfeiture of the interest of another part owner for failure to contribute.

Kniekerboeker *v.* Halla, 177 Federal 172. Feb. 1910.

Market Reports

LOCAL METAL PRICES.

San Francisco, June 1.

Antimony	12—12¾c	Quicksilver (flask)	46.50
Electrolytic Copper	14—15¼c	Tin	45—46½c
Pig Lead	4.75—5.70c	Spelter	7—7¾c

Zinc dust, 1400 lb. casks, per 100 lb., small lots $9.50—9.75; large $7.50—6.50

METAL PRICES.

By wire from New York.

Average daily prices in cents per pound.

Date.	Electrolytic Copper.	Lead.	Spelter.	Silver, per oz.
May 25	12.10	4.36	5.34	53¼
" 26	12.10	4.36	5.34	53¼
" 27	12.10	4.36	5.34	53¼
" 28	Sunday.	No market.		
" 29	12.10	4.36	5.34	53⅛
" 30	Holiday.	No market.		
" 31	12.10	4.36	5.34	53¼

ANGLO-AMERICAN SHARES.

Cabled from London.

	May 25. £ s. d.	May 31. £ s. d.	
Camp Bird	1 11 6	1 10 9	ex div.
El Oro	1 4 3	1 4 3	
Esperanza	1 10 3	1 10 0	
Dolores	1 5 0	1 5 0	
Oroville Dredging	0 6 9	0 6 9	
Mexico Mines	8 0 0	8 0 0	
Tomboy	0 15 0	0 15 0	

(By courtesy of W. P. Bonbright & Co., 24 Broad St., N. Y.

MINING STOCK QUOTATIONS—NEW YORK.

(By wire from Catlin & Powell Co., New York.)

	Closing prices, May 31.		Closing prices May 31.
Amalgamated Copper	$ 64⅞	La Rose	$ 4⅜
A. S. & R. Co.	78¾	Mason Valley	9⅞
Braden Copper	4⅜	Miami Copper	20
B. C. Copper Co.	6¼	Mines Co. of America	6¼
Butte Coalition	19⅝	Nevada Con	18⅞
Chino	23⅞	Nevada Utah	¾
Davis Daly	1⅜	Nipissing	10½
Doble	3⅛	Ohio Copper	1⅝
Dolores	5½	Ray Central	1⅜
First National	1¾	Ray Con	17⅛
Foley O'Brien	1⅜	South Utah	⅞
Giroux	6¾	Superior & Pittsburg	16⅜
Goldfield Con	6	Tenn. Copper	38¼
Greene-Cananea	6⅞	Trinity	4¼
Guanajuato Con	⅜	Tuolumne Copper	4½
Hollinger	12½	United Copper	3⅜
Inspiration	8⅜	Utah Copper	47
Kerr Lake	6¼	Yukon Gold	4

COPPER SHARES—BOSTON.

	Closing prices, June 1.		Closing prices June 1.
Adventure	$ 6½	Mohawk	$ 45
Allouez	31	North Butte	35¼
Atlantic	5½	Old Dominion	44⅜
Calumet & Arizona	58⅜	Osceola	104
Calumet & Hecla	465	Parrot	12⅛
Centennial	12½	Santa Fe	1¼
Copper Range	62	Shannon	11
Daly West	5	Superior & Pittsburg	16⅝
Franklin	11½	Tamarack	86
Granby	35	Trinity	4¼
Greene Cananea, ctf.	6⅞	Utah Con.	16
Isle-Royale	16	Victoria	1⅝
La Salle	3½	Winona	8
Mass Copper	5¼	Wolverine	111

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

COMSTOCKS

San Francisco, May 31.

Alpha	$ .07	Justice	$ .14
Alta	.07	Mexican	3.70
Andes	.21	Occidental	.65
Belcher	.85	Ophir	2.07
Brunswick Chollar	.20	Overman	.41
Brunswick Potosi	.20	Potosi	.34
Bullion	.15	Savage	.31
Chollar	.20	Scorpion	.29
Con. Virginia	1.15	Seg. Belcher	.19
Crown Point	.70	Sierra Nevada	.56
Gould & Curry	.25	Union	1.67
Hale & Norcross	.26	Utah	.13
Julia	.35	Yellow Jacket	.50

(By courtesy of San Francisco Stock Exchange.)

SOUTHERN NEVADA

San Francisco, June 1.

Atlanta	$ .10	Mayflower	$ .05
Belmont	6.25	Midway	.20
Booth	.08	Montana Tonopah	.83
Combination Fraction	.07	Nevada Hills	3.15
Florence	1.30	Pittsburg Silver Peak	.55
Goldfield Con	6.05	Round Mountain	.56
Gold Kewenas	.04	Silver Pick	.06
Jim Butler	.25	Tonopah Extension	.97
Jumbo Extension	.29	Tonopah of Nevada	5.63
MacNamara	.11	West End	.50

(By courtesy of San Francisco Stock Exchange.)

OIL SHARES

San Francisco, May 31.

Associated Oil	$50.75	Palmer	$ 1.37
Bay City (New Stock)	.70	Palmer Union	.48
Brookshire	1.22	Peerless	4.00
Caribou (New Stock)	1.00	Premier	.63
Claremont	1.15	Producers	2.50
Coalinga National	.20	Republic	.50
Con. Midway	.12	Sauer Dough	1.40
Cresceus	.20	Silver Tip	1.05
De Luxe	1.10	S. & F. McKittrick	13.00
Empire	1.50	S. W & B.	.22
Enos	.52	Sunset Monarch	.62
Maricopa National	.26	Turner	1.15
Monte Cristo	2.00	United Oil	1.00
Nevada Midway	.16	Wolverine	.40
Occidental	.15	W. K. Oil	2.90
Pacific States Petroleum	.26	Yellowstone	.15

(By courtesy of San Francisco Stock Exchange.)

Current Prices For Chemicals

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

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

	Min.	Max.
Acid, sulphuric, com'l, 66°, drums, 100 lb.	$0.80	$1.00
Acid, sulphuric, com'l, 66°, carboy, 100 lb.	1.00	1.50
Acid, sulphuric, C.P., 9-lb. bottle, bbl., lb.	0.13	0.18
Acid, sulphuric, C.P., bulk, carboy, lb.	0.09½	0.12
Acid, muriatic, com'l, carboy, 100 lb.	1.60	2.00
Acid, muriatic, C.P., 6-lb. bottle, bbl., lb.	0.15	0.20
Acid, muriatic, C.P., bulk, carboy, lb.	0.10½	0.16
Acid, nitric, com'l, carboy, 100 lb.	5.25	6.50
Acid, nitric, C.P., 7-lb. bottle, bbl., lb.	0.16	0.22
Acid, nitric, C.P., bulk, carboy, lb.	0.12½	0.16
Argols, ground, bbl., lb.	0.20	0.25
Borax, cryst. and conc., bags, 100 lb.	2.75	3.85
Borax, powdered, bbl., 100 lb.	3.00	4.00
Borax glass, gd., 30 mesh, cases, 100 lb., tin lined	10.00	13.00
Bone ash, 60 to 80 mesh, bbl., 100 lb.	4.50	5.50
Bromine, 1-lb. bottle, lb.	0.55	0.65
Candles, adamantine, 12 oz., 40 sets to case.	3.50	4.15
Candles, adamantine, 14 oz., 40 sets to case.	4.00	4.55
Candles, Stearic, 12 oz., 40 sets to case.	4.95	5.50
Candles, Stearic, 14 oz., 40 sets to case.	4.65	5.20
Clay, domestic fire, sack, 100 lb.	1.50	2.00
Cyanide, 98 to 100%, 100-lb. case, lb.	0.20¾	0.24¾
Cyanide, 98 to 100%, 200-lb. case, lb.	0.20	0.24
Cyanide, 127-129%, 100 lb. case, lb.	0.27½	0.28½
Cyanide, 127-129%, 200-lb. case, lb.	0.26¾	0.27½
Lead acetate, brown, broken casks, 100 lb.	8.75	9.00
Lead acetate, white, broken casks, 100 lb.	10.00	10.25
Lead acetate, white, crystals, 100 lb.	11.75	12.25
Lead, C.P., test., gran., 100 lb.	13.00	15.00
Lead, C.P., sheet, 100 lb.	15.00	18.00
Litharge, C.P., silver free, 100 lb.	10.50	13.00
Litharge, com'l, 100 lb.	7.50	9.00
Manganese ox., blk., dom. in bags, ton.	20.00	25.00
Manganese ox., blk., Caucasian, in casks, ton. (85% MnO_2—¾% Fe)	45.00	50.00
Nitre, double ref'd, small cryst., bbl., 100 lb.	7.00	8.00
Nitre, double ref'd, granular, bbl., 100 lb.	6.50	7.50
Nitre, double ref'd, powdered, bbl., 100 lb.	7.25	18.00
Potassium bicarbonate, cryst., 100 lb.	12.00	15.00
Potassium carbonate, calcined, 100 lb.	15.00	18.00
Potassium permanganate, drum, lb.	0.11	0.12½
Silica, powdered, bags, lb.	0.03	0.05
Soda, carbonate (ash), bbl., 100 lb.	1.50	1.75
Soda, bicarbonate, bbl., 100 lb.	2.00	2.50
Soda, caustic, ground, 98%, bbl., 100 lb.	3.15	3.50
Soda, caustic, solid, 98%, bbl., 100 lb.	2.65	2.85
Zinc shavings, 800 fine, bbl., 100 lb.	10.50	11.50
Zinc sheet, No. 9—18 by 84, drum, 100 lb.	9.25	10.25

Current Prices for Ores and Minerals

(Corrected monthly by Atkins, Kroll & Co.)

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

	Min.	Max.
Antimony ore, 50%, per ton	*$20.00	$25.00
Arsenic, white, refined, per lb	0.01¾	0.02¼
Arsenic, red, refined, per lb	0.06¾	0.07¼
Asbestos, according to length and quality of fibre, per ton	100.00	350.00
Asbestos, lower grades, per ton	10.00	100.00
Asphaltum, refined, per ton	15.00	20.00
Barium carbonate, precipitated, per ton	42.50	45.00
Barium chloride, commercial, per ton	42.50	47.50
Barium sulphate (barytes), prepared, ton	20.00	30.00
Bismuth ore, 10% upward, per ton	*75.00	upward
Chrome ore, according to quality, per ton	10.00	12.50
China clay, per ton	15.00	20.00
Cobalt metal, refined, f.o.b. London, per lb	2.50	
Coke, foundry, per 2240 lb	15.00	17.50
Diamonds:		
Borts, according to size and quality, per carat	2.00	15.00
Carbons, according to size and quality, per carat	75.00	100.00
Feldspar, per ton	5.00	25.00
Firebrick:		
Bauxite, per M	175.00	
Magnesite, per M	190.00	275.00
Silica, per M	42.50	47.50
Flint pebbles for tube-mills, per 2240 lb	15.00	25.00
Fluorspar, per ton	10.00	15.00
Fullers earth, according to quality, per ton	20.00	30.00
Gilsonite, per ton	35.00	40.00
Graphite:		
Amorphous, per lb	0.01	0.02½
Crystalline, per lb	0.04	0.13
Gypsum, per ton	7.50	10.00
Infusorial earth, per ton	10.00	15.00
Magnesite, crude, per ton	7.50	10.00
Magnesite, dead calcined, per ton	22.50	27.50
Magnesite, brick (see firebrick).		
Manganese ore, oxide, crude, per ton	10.00	25.00
Manganese, prepared, according to quality, per ton	40.00	120.00
Mica, according to size and quality, per lb	0.05	0.30
Molybdenite, 95% MoS_2, per ton	400.00	500.00
Monazite sand (5% thoria), per ton	150.00	200.00
Nickel metal, refined, per lb	0.45	0.60
Ochre, extra strength, levigated, per 100 lb	2.25	3.25
Platinum, native, crude, per oz	25.00	30.00
Scheelite (see tungsten ore).		
Sulphur, crude, per ton	15.00	25.00
Talc, prepared, according to quality, per ton	20.00	50.00
Tin ore, 60%, per ton	450.00	475.00
Tungsten ore, 65%, per ton	487.00	520.00
Vanadium ore, 15%, per ton	200.00	250.00
Wolframite (see tungsten ore).		
Zinc ore, 50% up, per ton	*15.00	20.00

Commercial Paragraphs

H. D. McLeod, of Cleveland, Ohio, is now connected with the Seattle Machine Works, where he is having the McLeod concentrating table built.

The Mine & Smelter Supply Co. announces the appointment of William D. Gordon, late of South Africa, as local manager of its branch house at El Paso, Texas.

Abbe Engineering Co. has moved to larger quarters at 220 Broadway, New York, and the increased space will enable it to exhibit a number of additional mills in the showroom.

W. M. White, formerly of the I. P. Morris Co. of Philadelphia, has become associated with Allis-Chalmers Co. as manager and chief engineer of their hydraulic turbine department.

The Way's Pocket Smelter Co. of South Pasadena, Cal., reports that the sale of its pocket smelter outfits, as well as its whole line of miners' supplies, has greatly increased during the past month.

The Redwood Manufacturers Co., has moved its tank and cyanide plant equipment department from its factory at Black Diamond, Cal., to room 916 Balboa building, San Francisco, Cal., adjoining the wooden pipe department which has been at this address for some time.

Meese & Gottfried Co. of San Francisco, Seattle, Portland, and Los Angeles, are giving away a convenient pocket catalogue of 300 pages, covering their line of transmission, elevating, and conveying machinery. It is a compact and valuable reference book for engineers.

Woodin & Little, San Francisco, are distributing their catalogue No. 35, covering pumping machinery of all kinds, gasoline engines, and windmills. This company is one of the pioneer houses of the Pacific Coast and, as in the past, their catalogue is replete with excellent illustrations and complete information, with dimensions of their machinery.

The New York Metal Hose Co., 42 Broadway, New York, is producing a flexible metal hose up to 12 inches internal diameter for use with high-pressure steam, petroleum, and gasoline, or for suction hose in phosphate mines, rock drills, water, and compressed air, and all purposes where a flexible connection is desired. They claim this hose will stand any reasonable amount of heat and the action of oil. The U. S. Navy uses it for charging torpedoes for a pressure of 4000 pounds per square inch. For steam use the ends or the entire length is covered with asbestos and cotton fabric to permit handling.

Falkenburg & Laucks, of Seattle, Wash. have built an ore-testing plant at an expenditure of nearly $6000, in which they have good facilities for making tests of ore in carload or smaller lots, by amalgamation, concentration, and cyanidation. The plant occupies two floors of a building 36 by 74 ft., and the equipment comprises a 7 by 8 crusher, a battery of one 1300-lb. Nissen stamp, amalgamating plates, Wilfley and McLeod tables, tube-mill, Callow tanks, one Pachuca agitating tank, and sampling devices. It also contains a rotary kiln for cement testing, and a Reihle 2000-lb. machine for testing steel. The plant is on the tide-flat, has railroad shipping facilities, and is close to the water channel that connects with the bay.

F. E. Marcy, formerly district manager for Allis-Chalmers Co. at Salt Lake, has become associated with The Mine & Smelter Supply Co. as manager of its business at Salt Lake. During the last six years Mr. Marcy, while acting as manager for the Allis-Chalmers Co., has been closely in touch with the metallurgical development of this country, and has designed some of the largest equipment, among which may be mentioned McDougall furnaces for the Garfield Smelting Co., converter equipment for the First National Copper Co., copper converters for the Canadian Copper Co., copper converters for the United States S. R. & M. Co., at Kennett, Cal., and McDougall furnace equipment for the Steptoe Valley S. & M. Company.

The Williams Patent Crusher & Pulverizer Co. of St. Louis, Missouri, is sending out the following notice: "The United States Circuit Court of Appeals at Philadelphia rendered its final decision in the suit that we brought against the Pennsylvania Crusher Co. some time ago for infringement of our patent, No. 843,729, for improvements in dumping cages for crushers and pulverizers. This decision of the Court of Appeals handed down in the March term, 1911, concludes 'the record will be remanded with instructions to the Circuit Court to enter a decree reversing the former one adjudging claims 1 and 2 of the patent in suit to be valid and infringed and awarding to the complainant an injunction with the usual accounting and costs of suit.'

"Under the law, a user of an infringing machine is liable for his acts of infringements. The maker and seller of the infringing machine in question has been found to have infringed our patent, No. 843,729, and the Court of Appeals, in addition, has found the infringed claims of said patent to be valid.

"It is our intention to protect our rights as secured to us by the above patent and numerous other patents which have been granted on improvements we have made in crushing and pulverizing machinery, and the public is warned against buying crushing and pulverizing machines which infringe any of our 87 patents."

MINING AND SCIENTIFIC PRESS

"Science has no enemy save the ignorant."

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EDITORIAL

CANADIAN RECIPROCITY now holds the attention of Congress, and the issue is still in doubt.

SHARES in many American corporations have been listed on the Paris Bourse and London Exchange recently, a late addition being American Smelting & Refining Company.

THE first of the postal savings bank bonds will be issued soon. These will be in denominations of $20, $50, and $100, bearing 2½ per cent interest, and undoubtedly will prove popular.

THE March record in the work of excavation in the Culebra cut was a notable one. Handling material of which 70 per cent was solid rock requiring blasting, the 50 steam-shovels averaged 1430 cubic yards per day, at a direct cost of 37.65 cents per yard, and a total cost of 51 cents per yard.

OFFICIALS of the American Mining Congress are now jubilant at having secured from President Taft a promise to attend the forthcoming meeting in Chicago, beginning September 25. Mr. Walter L. Fisher, Secretary of the Interior, is also expected to attend, and the meeting promises to be a most interesting one.

WELCOME NEWS to the graduates and undergraduates of the Massachusetts Institute of Technology is that T. C. Du Pont has given a half million dollars to be used toward the purchase of the new site which has so long been needed. A further grant of $100,000 a year for ten years from the State gives needed aid toward the solution of the problem of expansion.

THE problems arising out of the amalgamation of Asiatic, Ethiopic, and Caucasic races in the Hawaiian Islands have recently been discussed by Mr. J. L. Kelly in the *Westminster Review*. These are only a few of the questions growing out of the changes which have taken place in the countries bordering on the Pacific in recent years, and next week we expect to discuss some of them at greater length.

WE PRESENT this week the concluding article of Mr. J. W. Hutchinson's series descriptive of the work of the Goldfield Consolidated mill. The great productiveness of this mine has made it such a source of interest that the noteworthy metallurgical work done there has been somewhat overshadowed. The thanks of the profession are due to Mr. Hutchinson, as is evidenced by the great amount of interest and commendation which his articles have evoked.

SAMPLING and assay methods vary greatly from place to place and there is a lack of uniformity that is provocative of much friction and misunderstanding. The U. S. Bureau of Mines is planning an investigation of the methods of cargo sampling of ores and metallurgical products and as a first step, Mr. J. A. Holmes, the director, has been conferring with a number of engineers engaged in commercial sampling.

CABLE rates from the United States to Brazil have been lowered by the Postal Telegraph Cable Company. This is an excellent method of stimulating trade between the two countries. It is interesting to note, however, that the messages cross and re-cross the Atlantic going "via Azores."

THAT the United States battleship *Delaware* will be the largest warship present at the naval review held in connection with the coronation ceremonies of King George V, is surprising news to many Americans, who are more often accustomed to hear our navy spoken of in terms the reverse of laudatory, and illustrates that though our Nation is negotiating general treaties of arbitration, it is not unprepared for war.

THE decision of the Supreme Court in the Tobacco case, which was handed down last week, extends and strengthens the results achieved by the preceding decision. In brief, the monopoly now existing must be dissolved and competitive conditions restored. There must be real and complete disintegration. How this is to be secured is yet to be determined. One result is sure, there is now no uncertainty as to what the law will allow, and plans for the future can now be made.

INCREASED consumption of copper would relieve the present difficulties of copper producers. Mr. Alfred C. Lane points out in a letter to the *Boston Transcript* that a considerable increase could easily be brought about if architects would use copper more extensively for roofing. That they do not do so is due partly to lack of information and partly to the fact that the price of sheet copper has not gone down in the same ratio as has the price of wire. A little intelligent attention to the matter would seem worth while.

THE BUREAU OF MINES has just sent forth No. 1 of a series of 'Technical Papers,' a discussion of 'The Sampling of Coal in the Mine' by the Director, J. A. Holmes. The value of information is immensely increased if it is presented promptly. A hastily prepared plan of campaign before the battle, is of incalculably more value than a scholarly analysis of it a year later, and in thus presenting at the earliest feasible moment the results of investigations by the Bureau of Mines, the greatest effectiveness will be secured and the greatest good subserved.

THE POSTOFFICE DEPARTMENT, in a preliminary announcement, predicts that the accounts for the year ending on June 30, next, will show a surplus of receipts over expenditures of more than a million dollars, and the Postmaster General has returned to the Treasury $3,000,000, which was set aside from the public fund to make good the usual deficit in the operation of that department. Second-class rates have not been raised, the rural free delivery service is still in operation, and we have postal savings banks. Mr. Hitchcock has therefore demonstrated one thing that the department needs; the introduction of business methods of administration.

CLIMATE has an effect on trade, as is interestingly illustrated by the growing use of metal ceilings and storefronts in Hongkong. Almost all the buildings erected there by foreigners have steel beams, and the Chinese are beginning to use them as well. The white ant destroys wooden beams and the woodwork of ceilings to such a degree that steel is preferred, even where labor and plaster are both cheap. The objection to steel is the humidity of the climate, causing deterioration due to rust. Consequently even building hardware is made almost entirely of brass, which, when locally manufactured, is cheap but of inferior quality.

A PROFIT-SHARING SYSTEM for the more than a half million employees of the National Electric Light Association was proposed at its recent convention, as well as plans for insurance and saving funds for employees.

INSTEAD of always trying to 'hustle the East' it would often be well to learn of her wisdom. About twenty-five years ago, when one of China's most faithful officials was warden of the Eastern Marches, and Taotai at Fenghuangcheng in Manchuria, he decreed that all hillsides which could not be permanently used as farm land and pay taxes, must revert to the Government, unless the nominal owners planted them with trees. Then regular title deeds would be given, with all rights secured, and the planted hills would be free of all tax for a number of generations. In consequence the hills were soon covered with fir, silkworm oak, and other trees. The villagers have plenty of fuel from the undergrowth, and the valleys are growing richer harvests. Japan might do well to follow this example, in her government of Korea. The Koreans have used wood as fuel exclusively and for centuries they have felled the forests and have even dug up the roots, so that now in rainy seasons the soil offers no resistance, and every year the area of agricultural land decreases.

A Defense of Prejudice

Recently there have appeared, in contemporary journals, notices of a book bearing a title similar to that above. We have not read the book—no defender of prejudice would ever stop to read a book before expressing an opinion of it—but to us the idea appears excellent. Prejudice is commonly reckoned as a vice, but, to paraphrase Stevenson, the wise man may well hesitate to draw the line between vice and virtue. We dare affirm that if such a line can be drawn, prejudice will be found on both sides of it. In so far as prejudice is a vice it is not an ugly one. To believe that the antagonist is a poor sort of fellow with no redeeming feature; that the other side of the case has not a single good argument to sustain it; that any other method than the one advocated will result in disaster, is a vice, but a full-blooded, human kind of vice, that is easily forgiven. And the belief that our country is the best place in the world to live, our city in some degree the best in the country, our employment the most useful and honorable, and our own people the best there are, is a virtuous prejudice out of which fidelity and devotion grow. It is curious that the philosophers, Epictetus, and all the rest, have held before us as an ideal the calm judicial temperament that in real life often proves cold and unattractive. Many of the most useful, best loved, and best hated men of the ages have bristled with prejudices; and the man who claims to be free of prejudice usually has a prejudiced view of his own excellences. If he is honest with himself every man is a defender of prejudice.

Institute Changes

At a joint meeting of the Council and Board of Directors of the American Institute of Mining Engineers, in New York last month, a set of regulations for the formation of local sections of the Institute was adopted and the applications from San Francisco and New York for permission to form local sections were granted. The most important features of the regulations governing local sections are that they must consist of at least twenty-five members, and that all the members of the Institute who reside within the territory of the section shall be members of the section, which shall include no others. The Institute may contribute toward the support of its branches and papers presented before the sections shall be the property of the Institute.

The formation of sections is a most commendable innovation. In agriculture it is customary to carefully cut away all the shoots about the base of the main stem of a plant, so that the strength of the roots may be concentrated into a larger growth of the single stem. But the agricultural analogy does not hold when applied to scientific societies. A better analogy is with politics, where each local organization serves as a stimulus to greater interest in national questions, and it can not be doubted that the influence exerted by local branches of the parent society will be for the good of both.

The suggested change of name of the Institute to include metallurgy should receive careful consideration. At the time of the founding of the Institute metallurgy was so little developed compared with the present that it was naturally not included in the name chosen. At the then recently formed Columbia School of Mines metallurgy was taught by Thomas Egleston, who was also professor of mineralogy. Now in our schools, metallurgy constitutes a separate department, often a separate course, and its literature is more voluminous than that of mining. Logically mining and metallurgy should be treated separately, since the one is based upon physics and the other upon chemistry. But an old and well known firm does not change its name every time a new partner is taken into the business, for obvious reasons; reasons that may well apply to the case of our Institute. From the fact that metallurgy by nature lends itself more easily to scientific experiments and discussions, it has always received its due share of space in the *Transactions*, and it may well be questioned whether it is now worth while to signalize in the proposed manner a change that has been the slow growth of years.

National Problems

In his able and thoughtful discussion of the rights and duties of the individual, State, and Nation, in the use and conservation of mineral resources, Mr. J. A. Holmes has touched on many things that can with great profit be given serious consideration by our readers. That the needs of the Nation will increase much faster than the rate of increase of population can scarcely be over-emphasized. The ordinary citizen of today not only has, but demands, utilities and conveniences that were undreamed of by his great-grandfather. The daily wage of a laborer now enables him to command the services of railroads and tramways, steamships, telegraphs, telephones, electric and gas light and power, printing presses, and a host of other industries that spring directly from the loins of mineral production, in a way that would have appeared incredible even a generation ago. Take a concrete example. In so high a type of civilization as the Chinese people enjoyed before the introduction of foreign devices, a few decades since, the needs of the people made necessary a production of not more than one pound of iron per capita per year. The present needs of the American people make necessary, for domestic consumption, a yearly per capita production of approximately 675 pounds of iron. No more striking illustration of the relative utilities and conveniences now available to the average citizen of the two countries could be desired. How much the needs of our population are likely to further increase is difficult to say. This much is certain from past experience; we cannot hope to decrease our needs, but we are assuredly decreasing our present reserves. This does not mean that it is necessary to be despondent over the future. Great additional reserves can be added to those existing by improvements in methods that will make available what is now useless. The skill of man has always been adequate to his needs, and it is not too much to believe that it will continue to be. The problems need, rather, adequate prevision. Our national life now moves with such express speed that its leaders must scan the future closely, just as an engineer keeps keen watch ahead, so that he may shut off steam and apply the brakes long before an obstacle is reached. The history of civilization is a history of achievement by mankind of what had been deemed impossible. With sufficient thought for the morrow it is safe to believe that our future is well assured.

A feature of the address which is likely to draw forth discussion is the suggestion that unlimited combination may be permitted, and that it might be feasible to allow coal to be mined and sold by a single corporation under national supervision as in Germany. The temper of the American people is not such as to readily allow the introduction here of methods of government that chafe even in Germany, and the problems which such a suggestion give rise to are many and perplexing. In engineering problems we have data to guide our action; we can, as Ostwald says, prophesy. If we construct a dam in a gorge we know from experience what will result, we know how strong to make the dam, how to construct the canals and conduits, how much water to distribute to the different tracts; we can even prophesy with reasonable accuracy the total cost of the work and the probable yearly profit from the enterprise. But when, for example, the Supreme Court orders the dissolution of a great corporation which has enjoyed a monopoly of the production of a necessary commodity, or when it is proposed to combine into a single corporation all the producers of a useful metal, no one can prophesy as to the cost and results of these undertakings. No one knows, no one can know, what would have been the history of the development of the petroleum industry had it been left in the hands of numerous independent producers. The scientific way to find out would be to go back and make the experiment under otherwise identical conditions. Obviously this is impossible. We can not apply the scientific method as yet to industrial conditions, enthusiasts to the contrary notwithstanding. So in proposing sweeping industrial changes we can not prophesy, we can only guess. In the experience of the engineer, guessing is always risky and often dangerous.

Among the features of Mr. Holmes' argument that should meet with unqualified approval another must be mentioned. Not many years ago the elective system was introduced into college curricula with great acclaim. Now the experience of years shows that the undergraduate is not, after all, the best judge of his own needs, and means have been provided to afford him guidance and to prevent his too complete disregard of what the experience of others has gone to show. Only the naked savage can enjoy perfect liberty. With increase of civilization comes increasing restraint, necessary to secure the greatest good to the greatest number. It is natural that the individual should chafe at restraint; it is none the less necessary that he be placed under it. The recent statements by E. H. Gary before the Congressional Investigation Committee are of great interest in this connection. He emphasized the importance of protecting the people against imposition by great combinations of wealth, and stated his belief that enforced publicity and governmental control of corporations, even to the extent of governmental control of prices, is both necessary and desirable. An enlightened individualism will in the end secure the greatest aggregate good, but we must guard against an excess of individualism and a deficiency of enlightenment. The basis upon which Mr. Holmes founds his argument for a stricter observance of duty by individual, State, and Nation is a sure one, and the mining profession may confidently expect from the Bureau of Mines influence that is potent and achievement that is noteworthy in the development and use of our mineral wealth.

Individual, State, and National Rights in Mineral Resources

By J. A. Holmes

*The very abundance and cheapness of American resources has developed a habit of waste which is a great menace to our future welfare. The waste of the past and present, and the rapidly increasing needs of the present and immediate future, entail on us a still greater obligation to strive for the highest possible efficiency in the future mining and use of our mineral resources. All unscientific or inefficient use of resources is waste, and the most important factor in the movement for the rational conservation of our resources is the fact that the seemingly necessary waste of today may become the avoidable waste of tomorrow.

One of the facts which is to our national discredit in comparison with other countries is that the statistics of men employed in mining operations in the United States, show that the percentage killed in our mines is three times as great as that in most other mining countries. I am glad to be able to report that, whereas, during the three years from 1905 to 1908, the death rate in our mines increased not less than 30%, during the three years that followed this, the death rate has decreased nearly 30%. There is still great need of improvement. In our mines during the past ten years, more than 30,000 men have been killed, and more than 100,000 have been injured; and many of those injured have been maimed for life, through the lack of prompt and suitable treatment. But the movement for better conditions is under way. The operators and the miners are co-operating with the State inspectors and National Bureau of Mines in a determined effort to make American mines as safe as those in any other country. Miners in every part of the country are being instructed in the methods of preventing mine disasters, and of rescuing the injured, and of caring for the injured so they can be properly treated by the physicians. Government rescue cars with trained experts are traversing the mining camps in every part of the country, and every effort for the betterment of conditions that is being made by the Federal and State Governments is finding hearty response and co-operation on the part of the operators and miners.

Investigations into the causes of mining accidents by the Federal Government, the enactment of better mining laws among the several States, increasing activity on the part of State mining inspectors; best of all, greater safety precautions on the part of the operators and miners, and the development of a strong, earnest spirit of co-operation between the mine owner and the mine workers, all give promise of a serious, general effort to make mining in the United States safer and more creditable from a humanitarian as well as from a business standpoint.

Let us, therefore, consider briefly some of the rights and duties of the individual, the State, and the Nation in utilizing our mineral resources. In the past the individual has been the factor of incalculable value in the development of the world's resources. As an explorer he has discovered new countries; as a prospector he has discovered the new deposits of mineral wealth; as a miner he has developed these resources, and made them valuable for use in the industries and arts. And when the undertaking has proved too large for a single individual, he has associated with himself other individuals, and the corporation thus organized has carried the work forward.

In the aggregate, probably, for every dollar taken out of the ground by the explorer, the prospector, and the miner, a dollar or more than a dollar has been expended by them. Nevertheless, the lure of gold has led them forward as explorers, prospectors, and miners; and the hope of profit has carried them forward despite all discouragements and failures. Nor have the benefits resulting from their work been limited to mining operations. They have paved the way; they have been followed by the farmer and the manufacturer, and thus they have not only opened up, but they have developed countries and continents.

But if the individual has accomplished so much through his efforts, then why should the public today become dissatisfied with the arrangement and ask to have new laws enacted; new regulations adopted concerning the relations of the individual and the public. It is because the individual has been wasteful in his methods. He has claimed the right of supreme ownership of the mineral resources which he discovered, even though these resources may have required millions of years for their creation; they may be indispensable to the public welfare; they may be the only supply available for this purpose within reasonable reach; and the individual claimant has done nothing toward their creation or their inherent value; and his claim to ownership may be only that based on discovery or purchase for a paltry sum from some other person who made the discovery, and who was willing to dispose of his supposed birthright for a mess of pottage. He claims the right to mine those resources as he chooses, even if his methods involve enormous waste. He declines to recognize the claim of the public that the people are the supreme owners of these resources, and that the individual holds them in trust for development with profit to himself, but keeping the permanent welfare of the people steadily in view.

The life of the individual is admittedly short. His plans and ambitions relate to temporary purposes and present profits. Generations of individuals come and go; the State alone is perpetual; and the State must safeguard its own future. In the past the chief idea of the State has been, and naturally so, to encourage individual effort; and with this in view, it has explored and published reports on its material resources. Material development has always been and must continue to be, an important basis of the State's growth. This present development of resources is the motive that has generally led to the establishment of State geological surveys and State mining schools; and great good has resulted from the efforts of the State along these lines. The exploration of hidden or unknown resources in different parts of the State and their advertisement to the world through publications and geological reports has brought in new capital and additional settlers; has led to a wise use of home capital and labor, and has otherwise brought growth and prosperity to the State. However, this is usually related to the present development, without special reference to the future.

In carrying out its new purpose and new duty, the State must not only encourage present development, but must safeguard its future progress. This does not mean that the State should check development by endeavoring to save for the future what the citizens of today need for their own use. It means that the citizen of today, in the use of this material, while he has the right to use what he needs, has no right to waste or misuse that which he does not now need, but which his children and his children's children will need hereafter. He has neither created nor can he add to these resources, nor can he replace them by others when the present supply has been exhausted. He can and should, therefore, mine, prepare, and use these resources with the least possible waste, and with the greatest possible efficiency. It is the duty of the State to see that this is done.

And the State has a right to safeguard its own future, or, as the Supreme Court of the United States has recently expressed it, "The State as guardian of the public welfare possesses the constitutional right to insist that its natural advantages shall remain unimpaired by its citizens." In the developing and carrying out of this purpose, it is necessary and proper that the State should employ its own engineers, chemists, and geologists; that it should establish and support its own mining schools, with a view to training its citizens how to mine and utilize resources with greatest efficiency and least waste.

*Portion of Commencement address, Missouri School of Mines, May 26.

The geologist and the engineer in the employ of private capital must primarily regard present profit. Any other policy on his part has usually resulted in his seeking other employment. But the geologist and engineer in the employ of the State must give primary consideration to the public welfare, and the public welfare requires that, while in the development and use of material resources present profit cannot be neglected and must not be made impossible, a way must be found of using these essential resources with minimum waste; in order that, while not preventing profit today, the resources not needed today may be saved for the needs of tomorrow. The needs of neither the individual, the State, nor the Nation will be curtailed; on the other hand, these needs will in the future increase with the extent and the variety of our industries; they will increase even more rapidly than our population.

Furthermore, the present generation has both the power and the right to use these resources, in so far as it will use them efficiently. It has the right to use as much of these resources as it actually needs, but in each State, as in each country, there is but the one supply of mineral resources, and when this one supply is gone, there is no other supply to take its place, except the supply that may be brought in from other countries and for which due tribute must be paid. Whether we consider the resources of a great State like Missouri, or of the United States as a whole, there can be no doubt as to the fact that, measured in terms of the life of the State, or of the Nation, we shall, while the State and the Nation are yet in their infancy, exhaust the existing supply of these resources, unless we use them in the future less wastefully than we have been doing in the past.

At the same time, we may as well understand that the individuals of this generation will not mine, extract, or use mineral resources in such a manner as to entail financial loss on themselves in order that the supply may be left for the use of future generations. There will be no mineral industries without profit to those who engage in them. Any consideration of the doctrine of conservation of resources for the benefit of future generations must give equal consideration to the doctrine of reasonable compensation for those who have capital to invest. Investors are entitled to a reasonable return on their capital, and a man who has labor to invest is entitled to profit from it; but neither private gain nor public greed should be allowed to destroy a nation's liberty, or those resources essential to a nation's life. In considering the rights and the duties of the Nation in the development and use of its mineral resources, we need not, at this time, discuss the constitutional relations between the States and the Federal Government. I grew up in a State where the men spent much of their time discussing the relative rights of the States and the Federal Government. It is high time to give more thought to questions of duty, rather than questions of rights. The great purpose which we should now keep in view is that of the permanent welfare of the people of this country. Constitutions are made by and for the people, not the people for the constitution. "What are constitutions, anyhow, among friends?"

For convenience in administrative affairs, our forefathers, in framing the constitution, assigned certain local duties and rights to the several States, and to the Federal Government certain other duties and rights pertaining to interstate, national, and international functions. The police supervision of mining and metallurgical operations undoubtedly comes within the province and function of the State; but the products of the mine make up more than half the interstate commerce of the country; they now constitute a large, and will hereafter constitute a much larger, part of our international commerce; and neither the interstate nor the international commerce can be carried on without them. They are inseparably associated with the general welfare—whatever that means—of all the people. The coal and other raw products of certain States are essential factors to the convenience and comfort of the people in many other States. They are also essential to the manufacturing enterprises in all the States. The phosphates produced in three States are essential elements in fertilizers, now considered necessary for crops in all parts of the country. The coal and the steel from certain States are indispensable factors in the transportation of our mails and in the movement of our army and navy, and other national functions.

The Federal Government, therefore, has both its rights and duties to perform; and the important question is not how we can avoid the conflict of rights between the Federal and State governments, but how each can do its duty in behalf of the wise development of mineral resources, and this without delay or unnecessary duplication of effort. Whatever may be said of the duties of the Federal Government in behalf of agricultural industries, may be said with equal and even greater force concerning its duties and its efforts in behalf of mining industries. In agriculture we have, recurring crops coming with the returning seasons. Of our mineral resources we have but this one supply.

There are many needed inquiries and investigations which, if conducted by each of the several States, would lead to large, unnecessary duplication in cost and effort. These may be conducted by the Federal Government for the benefit of the people in all the States. There is a large amount of educational work which the Federal Government should do in behalf of the mining industry along lines similar to educational efforts in behalf of agriculture. At every point where the mining industry touches the interstate and international commerce, the guiding and helpful hand of the general Government should be applied. National and State governments should co-operate to help the individual in the proper development of mineral resources and should be careful not to hinder his efforts, except when these efforts are not in accord with best public interests.

From time to time it has happened that drastic State legislation has for the time being seriously crippled—and unnecessarily so—certain branches of industry; and today the proper development of mining industries is hampered in many respects because of the lack of uniformity in legislation in the different States. Furthermore, both State and National legislation may retard the proper development of mining by preventing the needed co-operation among individuals with a view to reasonable increase in the price of mineral products—an increase in price necessary to the introduction of such mining methods as will safeguard the lives of the miners and prevent the waste of essential resources. In all these efforts for the betterment of the mining industry, there should be hearty co-operation between the Federal Government dealing with the broad general problems of value to the entire country, the States dealing with problems more or less local to themselves, and the private corporations dealing with still more local or individual problems. Thus we shall have greatest efficiency, and largest results, at least cost.

I see no objection to any combinations of persons or capital or holdings or mineral properties for operative purposes. Experience and reason both indicate that such combinations may make for stability of business, for economy and efficiency in production, for lessening the loss of life, and lessening the waste of resources. I even commend for earnest consideration in this country the German system by which nearly all of the coal produced in that country is sold under a single syndicate dealing direct with the purchaser and consumer, without the aid (and without the added cost) of the middle-man and his advertising agencies, this coal being sold at uniform prices which are reasonable and fair alike to the producer and the consumer, and furnish reasonable safeguards of the public interests as to the saving of life and prevention of waste. In the future mining and preparation for use of important American resources, it is not so much these questions of combinations of capital about which we need concern ourselves, as it is that of ultimate control. We must see that the people of this country exercise their supreme right and duty in requiring that these resources be utilized in such manner as will best promote the permanent welfare of the citizenship of this Nation.

Operation of the Goldfield Consolidated Mill

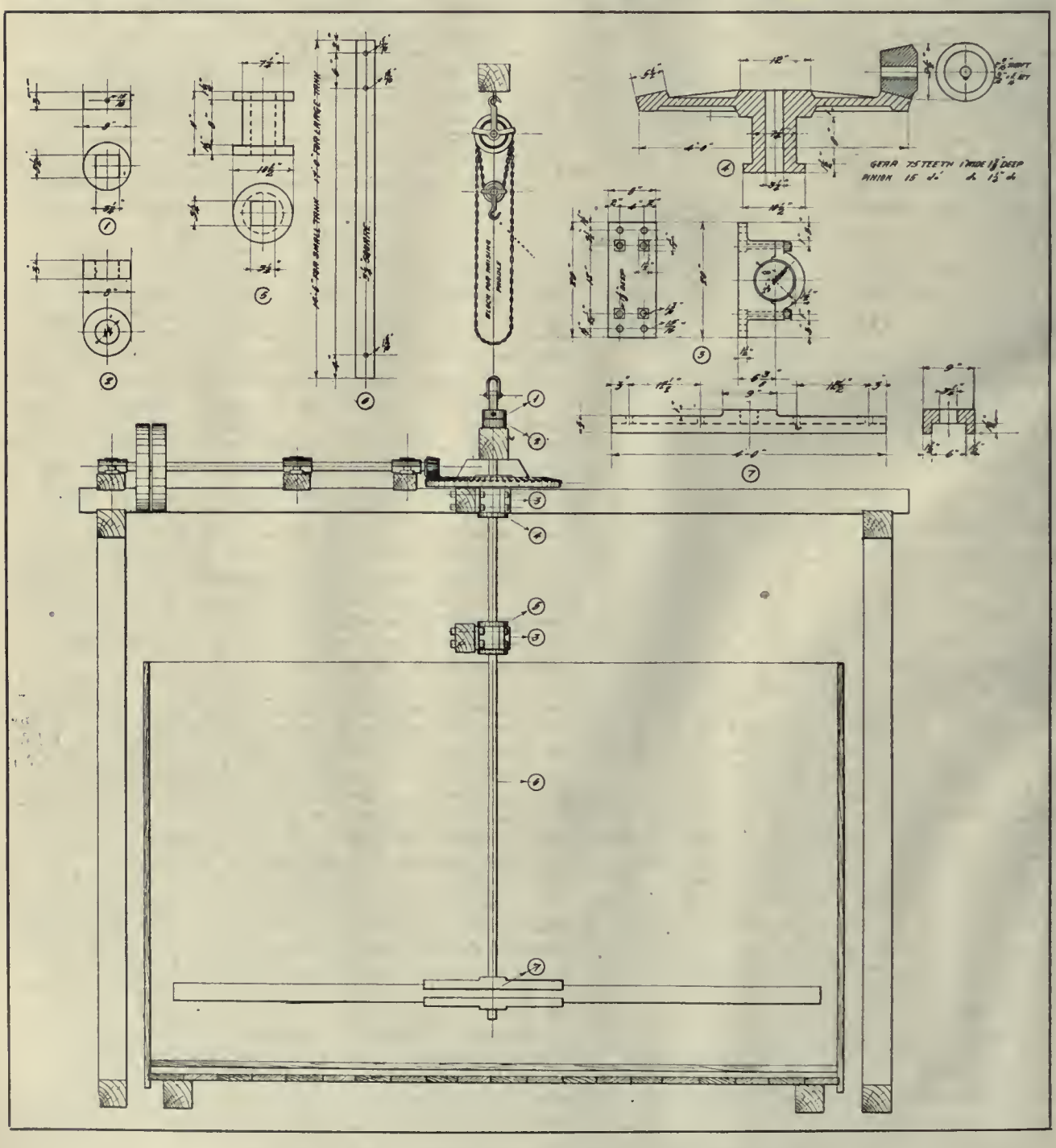
By J. W. Hutchinson

(Concluded from page 719.)

Concentrate Treatment.

Up to June 1908 very little progress had been made in evolving a process for treating the high-grade concentrate which would be produced at the mill. This product from the Combination mill of this company had been shipped to the smelters until J. H. Mackenzie assumed the management. The freight and treatment charges were so excessively high at that time that he decided to store the concentrate, pending the solution of the problem of treating it. The reports to the management by the former metallurgists of this company stated that roasting would be necessary for economical treatment, although the results of the tests made did not prove conclusively that the concentrate could be treated successfully in this way.

As can be seen from the flow-sheet on p. 686, concentration follows tube-milling. Roasting the –200-mesh concentrate, containing 30% sulphur and 20 oz. gold, to put it mildly, seems dangerous. In addition, roasting is not necessary. Much of the visible gold in the ore from this company's mines, although apparently free, is so coated that it cannot be recovered by amalgamation, and is only slowly soluble in cyanide solution. During the summer of 1908, when engaged in experimental work on the concentrate, an acid wash was applied for the purpose of removing this coating, in order to amalgamate the coarse gold if possible. It was found that this acid wash did remove the coating, and that much more gold could be recovered by amalgamating the concentrate after an acid wash had been applied. It seemed probable from this result that cyanidation of the raw concentrate would be facilitated by the same process, since it was not reasonable to suppose that only the coarser particles of gold were thus coated. Experiments were made on a laboratory scale and the results were astonishing. Approximately 90% of the gold in 20-oz. concentrate was dissolved in 8 hr. contact with a 4-lb. solution of cyanide, after a preliminary acid wash. The results were corroborated by larger tests, and were so encouraging.



ADJUSTABLE GEAR AND PINION AGITATOR, GOLDFIELD CONSOLIDATED.

the management leased the old Kinkead mill for the purpose of treating the accumulation of concentrate from the Combination mill. During the summer of 1908 approximately 300 tons was treated and yielded 94% of the gold content, at a cost which made it seem advisable to build a plant of similar type at the 100-stamp mill. It was found during experimental work, that the solutions became inert after 8 hr. contact, and that it would be necessary to remove them and re-treat the concentrate with a solution freshly precipitated and freed of reducing agents. As originally designed and operated, the process of cyanide treatment after the acid wash consisted in agitating for 8-hr. periods in Pachuca vats, passing the pulp at the end of these periods through Dorr continuous thickeners; the clear overflow passing to the precipitating department and the thickened pulp to a second Pachuca vat, where a regenerated solution was added. This arrangement proved expensive, since it necessitated pumping the concentrate each time, and was abandoned. The process in use now consists in agitating the concentrate for 8-hr. periods, and settling and decanting in the Pachucas, and is very satisfactory. During the first year's run, much difficulty was experienced in evolving a mechanical stirrer for the pulp during the acid wash and the subsequent water washes. The sketch on the preceding page gives the details of the present arrangement, which is very successful.

The concentrate from the mill gravitates through wooden launders to four 48 in. by 16 ft. amalgamating tables. The last section of these tables is covered with carpet for removing the coarser particles of gold, which do not amalgamate. The recovery by the combined process of amalgamating and carpeting amounts to approximately 35% of the value of the concentrate, or 25% of the value of the ore. Of this amount, 10% is contained in the carpet concentrate, which is briquetted with the precipitate from the cyanide plant, and supplies the necessary sulphur for matting the copper in it. The pulp from the plates runs to three 10 by 20-ft. redwood collecting and agitating vats, fitted with the above-described adjustable stirrer. When a charge is being collected, the vertical shaft is pulled up by means of the chain-block, so that there is no difficulty in starting it up. Each vat holds one day's run, amounting at present to 50 tons of dry concentrate. After the charge has been collected, the water is decanted, leaving a pulp containing approximately 50% moisture. The agitator is started up and gradually lowered until the whole charge is in motion. To this is added 66°B. sulphuric acid in the proportion of 20 lb. per ton of concentrate, and agitation continued for 8 hours. The vat is then filled with water, after which the agitator is shut off and raised, and the charge allowed to settle. The clear solution is decanted and runs to a special tank in the mill, is neutralized there, and used in the mill for crushing purposes. Two more water washes are added in like manner, equivalent to 6 parts by weight of water per ton of dry concentrate. The last water wash is decanted as closely as possible to avoid subsequent dilution of the cyanide solution, lime added in quantities to raise the alkalinity to ½ lb. in terms of CaO, the agitator started, and when the charge is in motion, 1 lb. of lead acetate per ton of concentrate is dissolved in water and added to the pulp, which is kept in motion until time to pump to the Pachucas.

It has been found most necessary here not to let the concentrate be in contact for any length of time with a weak solution of cyanide. For this reason the amount of cyanide required to bring the solution on the charge to 4.5 lb. KCN per ton, is first dissolved in the Pachuca agitator and the charge pumped into this. Exactly what effect a dilute solution of cyanide has on a heavy sulphide ore is not known here, but that the effect is deleterious has been demonstrated beyond question by the following results. In order to avoid the small mechanical loss of cyanide due to neutralizing the concentrate with milk of lime, it was decided to slack the lime with solution from the mill. This

RATED H.P.	R.P.M.	MAKE	Series N°		Ave. H.P. per 24 hr. day.	Ave. K.W. Per 24 hr. day.	Ave. K.W. hr. Per 24 hr. day.	Ave. K.W. hr. Per 730 hr. Month.	K.W. hr. Per ton Basis 20,000 Tons per Mo.	
				CRUSHING, SAMPLING, STAMPING AND REGRINDING.						
150	570	Bullock	42733	Crusher.	75.3	23.01	171.97	12530.81	0.6265	
75	680	do	40468	Elevator and Samplers.	45.6	16.40	122.23	8931.11	0.4466	
15	1130	do	32834	Distributor.	9.3	3.40	2.54	6087	1851.57	0.0926
50	680	do	42805	Stamps.	242.5	231.44	172.65	414370	126037.57	6.3019
50	680	do	42761							
50	680	do	42756							
50	680	do	42735							
50	680	do	42755							
260	570	do	50932	Tube Mills.	387.6	356.73	266.12	6386.89	194268.04	9.7134
200	570	do	50887							
40	850	do	42783	Mill-Water Pumps.	66.0	48.40	36.11	866.55	26357.67	1.3179
40	850	do	42823							
				CONCENTRATING.						
30	850	do	40556	Deister Slimers.	44.0	41.18	30.72	737.29	22425.82	1.1213
30	850	do	40555							
				CYANIDING.						
20	1130	do	44321	Stock Pulp Mechanical Agitators.	23.6	21.00	15.67	375.98	11436.18	0.5718
10	850	do	41559	Excess Pulp do. do.	12.8	6.18	4.61	110.65	3365.52	0.1683
30	850	do	40554	Pulp Pumps Excess to Stock Tanks.	35.0	10.02	7.47	179.40	5456.68	0.2728
30	850	do	40701	Circulating Pumps Pachuca Agitators.	49.0	26.80	19.99	479.83	14594.74	0.7297
30	850	do	44425	Circulating Pump Butters Filters.	15.6	6.90	5.15	123.54	3757.60	0.1879
15	850	do	44131	Vacuum Pumps do. do.	15.0	9.34	6.97	167.22	5086.35	0.2543
15	850	do	44203							
20	850	do	40576	Clarifying Presses Pump	24.5	22.01	16.42	394.07	11986.24	0.5993
20	1130	do	44336	Circulating Pumps Wash Water.	28.5	19.43	14.49	347.88	10581.20	0.5291
30	1130	do	44442							
15	850	do	44136	Pumps Gold Solution to Merrill Presses.	25.6	22.07	16.46	395.14	12018.87	0.6009
15	850	do	44139							
7.5	1200	General Electric	104021	Lime Crusher.	2.2	2.00	1.49	35.81	1089.16	0.0544
75	684	Westinghouse	50446	Oil Heater.	14.8	5.00	3.73	89.52	2722.90	0.1361
75	720	General Electric	108658	Air Compressors.	140.0	107.00	79.82	1915.73	58270.06	2.9135
15	850	Westinghouse	410418	Tramway.	12.0	0.13	0.10	2.33	70.81	0.0035
				CONCENTRATE TREATMENT.						
50	850	Bullock	30419	Agitators.	30.0	18.20	13.58	325.85	9911.36	0.4956
20	1200	General Electric	174100	Kelly Press.	19.0	5.23	3.90	93.64	2848.17	0.1424
20	1130	Bullock	44353	Pachucas.	54.5	78.3	58.4	1401.9	42640.7	0.2132
20	850	do	40605							
				REFINING.						
10	1130	Bullock	42074	Agitators, Johnson Presses, Slag Crusher.	5.5	2.80	2.09	50.13	1524.82	0.0762
2	1800	General Electric	135530	Acid Wash Pump.	1.7	0.30	0.22	5.37	163.37	0.0082
3	1800	do	126500	Fumes Collector.	1.3	0.65	0.49	11.64	353.98	0.0177
				GENERAL.						
10	1130	Bullock	40593	Machine Shop.	12.0	1.20	0.90	21.48	653.50	0.0327
3	1800	General Electric	P.116180	Carpenter Shop.	4.0	0.30	0.22	5.37	163.37	0.0082
				Lighting.	78.0	46.02	34.33	823.94	25061.56	1.2531
1630.5	Total Installed Horse Power in Motors.				1454.9	1060.97	791.48	18995.61	577783.10	28.8891

18.4989 K.W. hr. Per Ton for CRUSHING, SAMPLING, STAMPING AND REGRINDING.

1.1213 K.W. hr. Per Ton for CONCENTRATING.

5.5631 K.W. hr. Per Ton for CYANIDING

2.3097 K.W. hr. Per Ton for CONCENTRATE TREATMENT.

0.1021 K.W. hr. Per Ton for REFINING

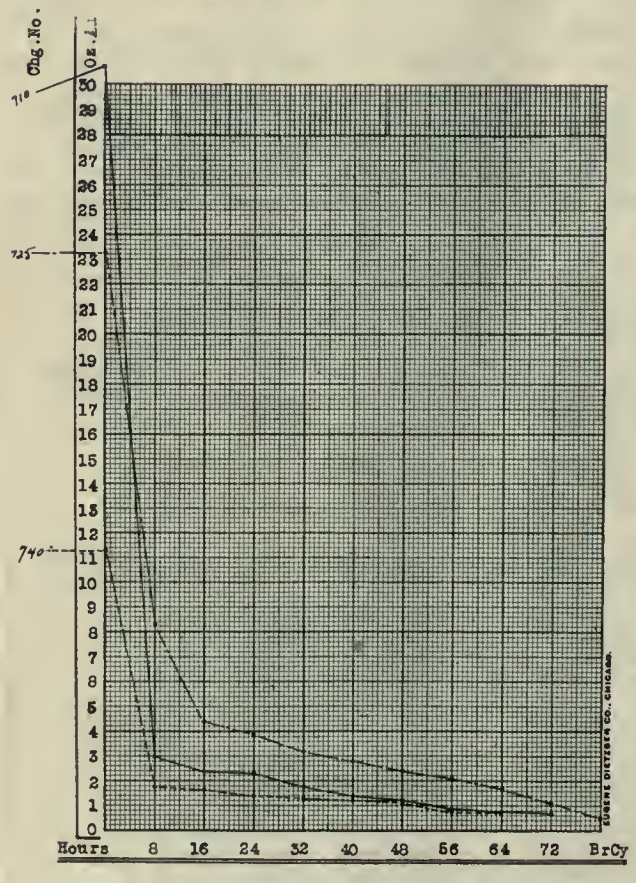
4.2940 K.W. hr. Per Ton for SHOPS & LIGHTING.

POWER ANALYSIS BY TONNAGE, GOLDFIELD CONSOLIDATED MILL.

was done, and titration of the solution in the neutralizing tank showed a content of from 0.2 to 0.3 lb. KCN per ton. This practice was continued for nearly two weeks, with the result that the assay value in the tailing was doubled. Immediately on discontinuing the KCN solution in the neutralizing tank, the extraction came up to normal. This has been tried on different charges since, with the same result each time.

The same effects have been noted when treating a heavy silver sulphide ore which had been crushed in water, and then transferred to the strong solution in the agitators. When this same ore was crushed in the mill solution, and allowed to stand in the dewatering tanks in dilute cyanide solution, before being transferred to the agitators, the extraction was materially reduced and the strength of the solution used for agitating had to be increased in order to approximate the same results obtained by cyanidation after crushing in water. It is not to be understood that crushing silver sulphide in water is believed to be the most economical plan for low-grade ores, but the instance is cited to show that contact with a weak solution of cyanide is deleterious to the treatment of concentrate and ores containing large quantities of sulphides. At the end of the fourth hour, in alternate periods, peroxide of sodium is added to the charge, which increases the activity of the solution and reduces the time of treatment. One-tenth pound lead acetate per ton of dry concentrate is added to each solution at the beginning of the period.

The accompanying chart, showing the extraction graphically by periods, is representative of the various conditions



EXTRACTION CHART, GOLDFIELD CONSOLIDATED.

and grades of concentrate. For two years the extraction of gold from the pulp in the Pachuca agitators has averaged 93%, and the total extraction by amalgamating, carpeting, and cyaniding has averaged 95.23 per cent.

A Kelly filter-press (type B) containing 400 sq. ft. of filter surface is used for filtering the concentrate. It was found necessary to set this machine at a much greater inclination than is required for ordinary slime, since the heavy pulp has a tendency to pack in the bottom of the cylinder, which prevents the carriage from running out freely. The labor of one operator and two trammers is required to filter and dispose of 50 tons of concentrate in 8 hours. On this material the capacity of the Kelly press is equivalent to 750 lb. concentrate and 1200 lb. solution per square foot of filter per day of 24 hours.

The cost of cyaniding the concentrate is as follows:

Labor	$0.93
Supplies	4.44
Power	0.48
Total	$5.85

SUMMARY OF RECOVERY AND COST

Recovery:	1911. %	1910. %	1909. %
By amalgamation	17.55	15.38	10.60
By concentration	53.93	56.86	49.20
By cyanidation	22.56	22.03	32.80
Total	94.04	94.27	92.60

Cost per ton milled:	1911. %	1910. %	1909. %
Crushing-conveying	0.040	0.071	0.053
Sampling	....	0.003	0.021
Stamping	0.134	0.174	0.195
Elevating-separating	0.022	0.023	0.021
Chilean milling	0.097	0.095	....
Tube milling	0.177	0.187	0.206
Concentrating	0.057	0.059	0.062
Amalgamating	0.025	0.033	0.058
Neutralizing	0.045	0.046	0.046
Settling	0.053	0.055	0.055
Agitating	0.604	0.561	0.503
Experimental	0.102	....	....
Filtering-discharging	0.068	0.084	0.093
Assaying	0.046	0.045	0.063
Precipitating	0.074	0.110	0.120
Refining	0.098	0.183	0.203
Water service	0.098	0.112	0.110
Surface and plant	0.007	0.011	0.015
Steam heating	0.056	0.032	0.023
Watchmen	0.042	0.049	0.031
Storehouse and office	0.022	0.028	0.027
Stable	0.004	0.004	0.005
Lighting	0.021	0.018	0.019
Superintendence	0.062	0.067	0.082
General expense	0.012	0.012	0.009
Mill tools	0.002	0.003	0.005
Mechanical department	0.001	0.004	0.008
Electrical department	0.034	0.026	0.007
Return water service	0.010	....	....
Fire loss (machine shop)	....	0.026	....
Mill total	2.013	2.131	2.040
Concentrate plant total	0.381	0.312	0.276
Total, mill and conc. plant	2.394	2.433	2.316
*Mill operation	1.859	1.828	1.820
*Mill repairs	0.154	0.283	0.220
*Concentration plant operation	0.371	0.298	0.256
*Concentration plant repairs	0.010	0.014	0.020

*Included in the above but given for additional information.

On the preceding page is given a chart of the power-load analysis by tonnage which is sufficiently self-explanatory. This is the chart mentioned upon page 617, where the cost of the average power load, 1.73 hp. per ton milled, is given as 32c. per ton.

A RED AND WHITE SOLUTION for writing on blue-prints may be made by a crystal of potassium oxalate, about the size of a pea, in an ink-bottle full of water. This solution will give white lines on blue-prints; other potash solutions are yellowish. If this shows a tendency to run, owing to its too great strength, add more water and thicken slightly with mucilage. Mix this with red or any other colored ink, about half and half, and writing may be done on blue-prints, in colors corresponding to the inks used.

Amalgamation on the Rand

By W. R. Dowling

*It is found that the present increased use of tube-mills for re-crushing enables so coarse a screen to be used in the stamp-mill that amalgamation of battery pulp becomes an impossibility owing to the scouring action of the coarse pulp upon the mill-plates. This necessarily leads to the removal of the plates from the stamp-mill in such cases, and a consideration of the following possible alternatives represented graphically in the corresponding diagrams:

A. Amalgamation of the tube-mill pulp by one set of plates, and the overflow final pulp by another set, as at the Randfontein Central and Knight Central.

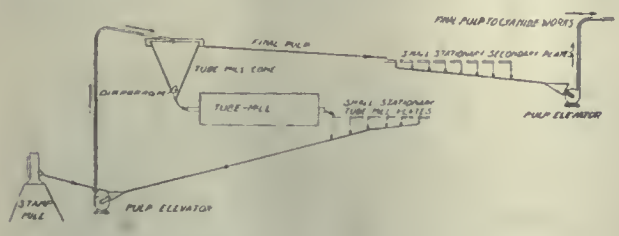
B. Amalgamation of the tube-mill pulp only, as at the Simmer & Jack, Simmer Deep-Jupiter, and the various South Randfontein mills.

C. Amalgamation of the mixed pulp after re-grinding of the coarse portion by tube-mills, as at recently erected plants.

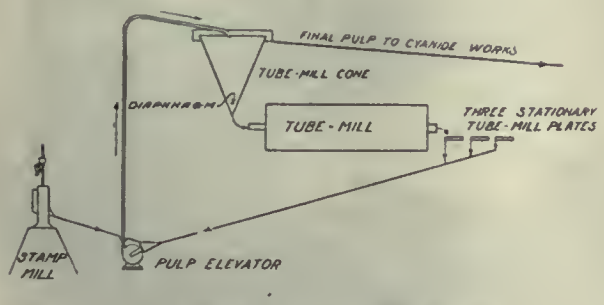
After the failure of various efforts to eliminate tube-mill plates, it may now be accepted that there is general agreement among metallurgists as to the advisability of amalgamating the tube-mill pulp, since otherwise considerable concentration of coarse gold by the classification of both stamp and tube-mill pulp takes place in the tube-mill circuit. Tube-mill pulp has only to be examined for metallic iron from the wear of shoes and dies and from other sources to illustrate how heavy particles will persist in the circuit till crushed or abraded fine enough to overflow the classifiers.

With efficient tube-mill classification, all but the finest gold released by the stamps is brought into the tube-mill circuit and recovered on the plates, together with that released by crushing in the tube-mills. This being the case, the problem narrows itself down to determining whether it is necessary or advisable to amalgamate the final pulp, leaving the crushing plant as an overflow of the tube-mill classifiers. The considerations which enter into this problem are the extra capital outlay and buildings, the capital locked up as amalgam as setting to the plates, the increased area of amalgamated surface to guard, the consumption of mercury, the labor of dressing, and the additional elevation of pulp necessitated by its fall during this amalgamation process. Even if mercury traps are used at the foot of amalgamated plates outside the tube-mill circuit for the pulp overflowing the tube-mill classifiers, it is possible for fairly coarse mercury and amalgam to escape to the cyanide plant.

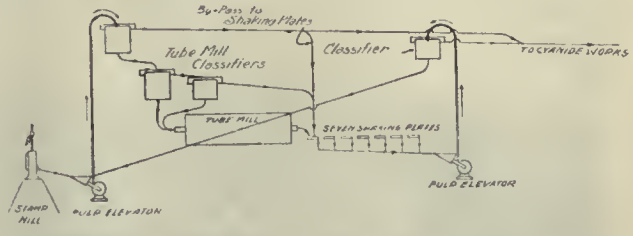
On reference to the sketches, it will be noted that alternatives A and C have two elevations of the total pulp, plus the tube-mill pulp, whereas B has only one elevation of the total pulp, plus the tube-mill pulp. Alternative B therefore does not involve any extra charge for re-elevation, and remains the same as in the usual present-day practice, as represented in sketch D. Unless increased recovery counterbalances these disadvantages, it is preferable to omit this additional operation. The use of very coarse battery screening naturally reduces the amount of metallic gold set free in the stamp-mill, and where the bulk of the crushing is done by the tube-mills, the quantity of very fine gold which might reach and overflow the tube-mill cones is correspondingly reduced, as such gold is retained on the tube-mill plates before the elevation of the tube-mill pulp. Even where the coarseness of crushing in the stamp-mill does not preclude the use of plates there, their elimination, when conditions permit, is followed by the various advantages above mentioned, and the rendering available as immediate profit the gold on the plates, which would otherwise not be realized until the end of the life of the mine. Plates thus taken out of the stamp-mill may carry from £50 to £300 worth of gold per plate, according to their condition, and in the aggregate this may render some £20,000 worth of gold immediately available in the case of a large mill. The elimination of the final pulp plates, however, can only be considered safe where good tube-mill classification obtains, and an equally efficient cyanide treatment follows. In the cyanide plant clean separation of sand from slime is essential, such as is possible with large diaphragm cones and continuous sand collection, producing on the one hand freely leachable sand, and on the other a large percentage of slime free from coarse sand. With tube-mill classifiers liable to choking of small underflow outlets and consequent overflow of coarse sand and gold to the cyanide plant, and with slimy semi-permeable sand charges, the wisdom of allowing any fine amalgamable gold to escape from the crushing plant is doubtful, in spite of the economies above mentioned. In the case of the Simmer & Jack mill, where there are plates in the tube-mill circuit only, though the cyanide residue remains normal, the amalgam recovery dropped from 64 to 55% on a 6¾-dwt. ore, owing to the fact that the fine sand and slime overflowing the classifiers is not amalgamated at all. If necessary, and as shown later in the case of the Simmer Deep plant, finer crushing and larger relative tube-mill cone area could be employed to increase the percentage of gold recovery by amalgamation. While the collected sand is slightly enriched by some very fine free gold, there is no difficulty in dissolving this and obtain-



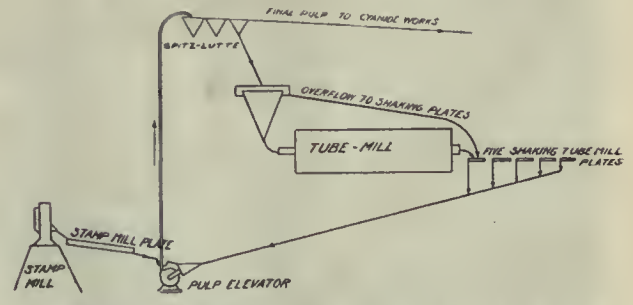
A. RANDFONTEIN CENTRAL ARRANGEMENT.



B. SIMMER & JACK ARRANGEMENT.



C. RECENT ARRANGEMENT. SEVEN PLATES FOR TOTAL PULP.



D. COMMON ARRAGEMENT. ONE PLATE FOR 5 STAMPS AND 5 PLATES FOR 1 TUBE-MILL.

*Abstract from the *Journal* of the Chemical, Metallurgical, and Mining Society of South Africa.

ing a complete recovery. The popular theory that only 85% of this gold is recovered by cyaniding, instead of 100% by amalgamation, has not so far been borne out either in the laboratory by residue assays or regular panning of residues. Any fine metallic gold overflowing the tube-mill cones is necessarily smaller and more easily dissolved than the average of partly-encased particles in sand which are dissolved by cyanide. The amount of fine metallic gold overflowing the tube-mill cones is much affected by the number and area of the latter. Where a large ratio of tube-mills to stamps exists, such gold, more often than not, can not be detected in the final pulp by panning, or in the sand before treatment. This is the case at the Simmer Deep plant, where, before the removal of the stamp-mill plates, the total plates in operation numbered 82, equivalent to 5276 sq. ft., of amalgamating area, and the amalgamation recovery was 56.8% of the ore value. After the removal of all the stamp-mill plates and the reduction of those in the tube-mill circuit to 30 stationary plates, presenting an area of 1700 sq. ft., the amalgamation recovery was 57.7%, and the value of sand and slime before and after treatment has not increased. The total extraction by amalgamation and cyaniding was 93.4% before and 93.5% after removal of the stamp-mill plates. There was slightly finer crushing of the ore in the latter case, there being 77.6% of −90 mesh (0.006 in.) product in the final pulp before removal of the mill-plates, and 81.0% of −90 mesh (0.006 in.) product after the removal. Where the ratio is lower, as at the Simmer & Jack, a trace of very fine gold can be detected by panning the final pulp and collected sand, though the assay value of the sand residue remains normal. The slime is also enriched, though this may be offset by better washing, due to the lower percentage of moisture on settlement of well-classified slime, containing a higher percentage of fine (−200 mesh) sand. For instance, assuming that 1.5 and 1.8-dwt. slimes are treated, settling to 42.5 and 35% moisture respectively, by two 4 : 1 washes in both cases, of which the first wash only is precipitated down to 0.01 dwt. per ton of solution. With 0.08 dwt. undissolved gold in the first residue and 0.10 dwt. in the second, the total extraction will be 90.4% (0.114 dwt. total residue) from the 1.5-dwt. slime, and 92.2% (0.14 dwt. total residue) from the 1.8-dwt. slime. Where Butters or other vacuum filters are used, the value of the original slime should be immaterial, as, providing the dissolving of the gold is satisfactory, the residue should contain little more than the trivial amount encased. It is to be hoped that detailed results and working costs of the recent work in this direction at the Crown Mines will before long be laid before our Society.

The author is indebted to F. A. G. Maxwell for much information on regular work at the Randfontein Mines, where plates are eliminated from the stamp-mill, and hopes that he will bring forward his results as a discussion to this paper. In the meantime, it may be said that during 1908, in the four 100-stamp sections of South Randfontein, when there were amalgamated plates both in the stamp-mill and the tube-mill circuit, the average amalgamation recovery was 54.46%, and the total recovery 92.06%, whereas in 1910, when there were plates in the tube-mill circuit only, the amalgamation recovery was 48.60% and the total recovery 92.94 per cent.

As mentioned in a note lately presented by the author to this Society, it has generally been considered necessary for the satisfactory amalgamation of the large volumes of thick tube-mill pulp that the plates should shake. Tracing back the history of this belief to the pioneer work done by J. R. Williams on the Glen Deep in 1904, it seems that in order to prevent the banking of sand on the stationary plates installed with 10% grade, it was found necessary to mount the plates on shaking vanner frames. Not only has the shake been subsequently adopted by all the mines without question, but the number of plates has gradually increased from the two originally installed to five and even six later. When the Knights Deep had five tube-mills, equivalent in cubic capacity of shell to 3.91 standard tube-mills of 22 by 5½ ft., sixteen shaking plates 10½ by 4¾ ft. were in operation. As there was no convenient space for more plates when another tube-mill was erected, it was decided to make the sixteen plates serve. The number has now been reduced to fourteen. The ratios are:

For 3.91 tube-mills 16 plates = 4.09 plates per tube-mill.
For 4.91 tube-mills 16 plates = 3.26 plates per tube-mill.
For 4.91 tube-mills 14 plates = 2.55 plates per tube-mill.

The amalgamation recovery was just as efficient with the smaller ratio as with the larger.

A TYPICAL SCENE ON THE RAND.

In the course of the experiment mentioned in my note, and after having thoroughly tested the stationary five-plate system, initiated originally by F. A. G. Maxwell at Randfontein, it was decided, on W. A. Caldecott's suggestion, to perform the whole amalgamation of the tube-mill pulp on two stationary plates per tube-mill. The Simmer East plant has three 22 by 5½ ft. tube-mills. The pulp of each mill has been regularly run over two plates only since December 19, 1910. The dressings have been at six-hour intervals and the scrape taken 6 in. lower than formerly. The daily scrapes have been normal, yielding the amalgam called for. The two plates of one of the mills were steamed at the beginning of the run and again at the end of the month's run to determine whether the yield from this source was affected in any way. The previous practice in this plant was to steam one-third of the total plates each month, so that each plate ran for three months before steaming. It was found that one month's run of the two plates yielded more amalgam when multiplied by three, than the average of the three months of five shaking plates previous to starting the non-shaking experiments. However, to be on the safe side, it was assumed that the plates would not accumulate steam amalgam at the same rate during the second and third months, and it was decided to multiply by only two and a half. This calculation gave a figure for steam amalgam just about equal to the average of the three months of five shaking plates. Adding this to the daily scrape and other sources the recovery is fairly arrived at, and works out at 21.54% of the screen value and 34.17% of the tailing value, compared with 21.80 and 34.04% of the previous five-shaking-plate period.

To ensure successful and economical work the ratio of water to solid should be reduced to a minimum, as not only does this decrease the velocity of the stream over the plate, but the cost for re-elevation is also less. The volume of pulp of 400 tons of sand per tube-mill plus 480 tons of water, allows about 10,000 cu. ft. of pulp per 24 hours for each of the two plates, or about the same as passes over the plate of a 5-stamp battery with a 9-ton duty per stamp, and a 6.5 to 1 ratio of water to ore in the screen pulp. The tube-mill circuit is the only part of the crushing plant where a thick amalgamable pulp is available without the installation and operation of special classifiers for the purpose. Distribution of the stream across the full width of the plate is also of considerable importance, and may be obtained by using the usual box at the head of the plate perforated with about ¾-in. holes along the bottom of the side facing down the plate. These holes should be of such capacity that the pulp attains some head in the box. In the event of any of the holes becoming temporarily choked, a further row of holes an inch or two higher up the front side of the box will serve to carry over the stream, and still maintain a fairly good distribution. The fall given to the stationary plates is 18%. This is the fall arrived at by Mr. Maxwell and since adopted here. With a fall of 18% it is found that the minimum percentage of water in the sand is 55%, and it appears that should it be desired to reduce the fall, the moisture would have to be increased, fall and water ratio being convertible terms within limits. The point to be reached in water ratio and fall is that just short of banking of the sand on the plate. Even with a low water ratio the rush of pulp over two plates appears to the eye to be too great, but this is not really so. As long as the velocity of the pulp stream is such that particles in suspension may come into contact with the plate and not be carried on mechanically without touching the plate, the gold will be caught. It might be considered that pulp carrying only 55% of moisture is too thick to allow the gold to sink through and reach the plate. As, however, amalgamation has been proved efficient with this ratio, it would not appear to be the case. In this connection, it might be mentioned that in pan amalgamation the pulp is kept very thick, although in plate amalgamation a fluid pulp was heretofore considered necessary for good recovery. On a stationary plate there is a tendency for the gold to amalgamate farther down the plate than when shaking; there is hence a liability for the scraping to yield less amalgam and the steaming more with stationary plates as compared with shaking plates. In connection with the satisfactory results obtained in the operation of the two-stationary plate method, much credit is due to the practical skill and progressive attitude of A. J. Herald, the Knights Deep mill foreman, and to his assistant, Peter Wilson.

The removal of plates from the stamp-mill has had the good result of introducing on these fields the separate plate-house. The Homestake mine and the Waihi set the example many years ago, but the Witswatersrand has been very slow in following the lead and accepting the suggestion made before this Society in 1903 by H. R. S. Wilkes. The arguments advanced by some mill-men that a plate attached to each battery makes for good recovery due to better distribution of the pulp by the stamps over the width of the plate, and that even vibration assists, lack confirmation. It appears to me that this method is just one of the many practices taken over from other countries without investigation. Tube-mill plates have now been running long enough to prove that most efficient amalgamation can be performed with a pulp sub-divided from a launder and distributed over the width of the plate from a box pierced with holes. Tube-mill pulp carries heavier particels and contains less water than other mill pulp, and is therefore a more difficult pulp to distribute. The advantages of a separate plate-house are increased running time, since stamps need not be stopped for plate dressing, and greater attention to the crushing machinery by the attendants, thus increasing the crushing capacity. Again, better amalgamation should be obtained by the greater attention to the work by specially chosen and trained men. The whole operation is confined to a smaller area and lends itself to closer supervision so that the risk of loss by pilfering may be reduced to a minimum.

In connection with the matter of the method of conveying pulp the author considers that sufficient importance is not attached to launders. All launders should be as smooth as possible and free from obstruction at the joints. Of all material used for the lining of launders there does not seem to be anything better than cement. This provides an ideal surface presenting least resistance to the flow of the pulp and affording very little lodgment for amalgam and still less for gold in unamalgamated pulp. On those mines here, where separate plate-houses or combined plate and cyanide extractor houses have been built, the arrangements have not gone far enough or else too far. The erection of zinc-lathes, elevator pumps, and tube-mills in the same building with the plates and the extractor boxes means the introduction of gangs of men and natives for repairs, other than those engaged on the gold recovery work. If this machinery is placed in the same building because the launders may carry gold, then the whole tube-mill plant, including circuit launders and elevators, should be included. The best plan is to include in the building only such machinery as is actually connected with recovery work, so as to limit the men entering the building to those directly engaged in the work. The accumulation of amalgam in the tube-mill launders should be reduced to a minimum and the launders should be closed to protect what does collect. Prior to the introduction of tube-milling, amalgam was to be found in the launders to the cyanide plant, and some found its way as coarse particles to the concentrate vats, entailing loss in the residue. Where efficient tube-mill classifiers are installed no amalgam is found today reaching the cyanide plant except in an impalpably fine condition, since heavy particles of amalgam pass into and are retained in the tube-mill circuit. There is always a loss of mercury in amalgamation mainly by abrasion, and where this enters the tube-mill, amalgamation of the gold liberated by crushing takes place. Where this amalgam does not reach the plates it is found in the launders between the discharge of the tube-mills and the plates. Such impalpably fine mercury or amalgam as enters the cyanide plant dissolves in the same way as gold, and, like dissolved lead salts, is either wholly or partly precipitated by soluble

sulphides in the working solution, or later in the metallic form by zinc shavings in the boxes.

Where plates are eliminated from the stamp-mill the water ratio may be considerably reduced. The clearing of a long plate, set at a fall of 9 or 10% by avoidance of any banking of sand from the pulp, has been the factor determining the water ratio in the past, and this requires six to seven parts by weight of water to one of solid using average battery screening. It has been found that in the absence of mill plates the ratio may be reduced to 4½ without serious ill effects provided the mill launders have sufficient grade to carry pulp of this consistence. A coarse screen with less water will give the same result in duty and grading as a finer screen and more water, water and screening being convertible terms within limits. The reduction of water has considerable influence on the cost of pulp elevation and of running water pumps, the reduction of weight from 6.5 to 4.5 of water to 1 of solid being equivalent to about 27%. The saving in power in a large plant is material when working on the reduced ratio, and there is likewise a smaller load on the classifiers and slime collectors. There would, however, be no saving in the consumption of water, as much the same volume is exposed to loss by evaporation, seepage in dams, and moisture in residue.

Although there is no rule for the area of amalgamating plates there is no doubt that the number and area of plates in common use is unnecessarily large and when these are placed in a separate plate-house the total area may be materially reduced. The author is of the opinion that much

TURF SHAFT, JOHANNESBURG.

of the amalgam found at the lower end of long battery plates is largely worked down by amalgamators wishing to present a uniform bright surface all over the plate. The old practice was to use plates about 15 ft. long by 5 ft. wide per battery of 5 stamps, which equals 15 sq. ft. per stamp. Where, say, one standard large tube-mill for 30 stamps is erected, and assuming that the tube-mill is equivalent to 30 stamps, five plates of 11 by 5 ft. would probably be used. The combined plate area is then:

30 stamps = 6 plates 15 × 5 ft. = 450 sq. ft. = 15 sq. ft. per stamp.

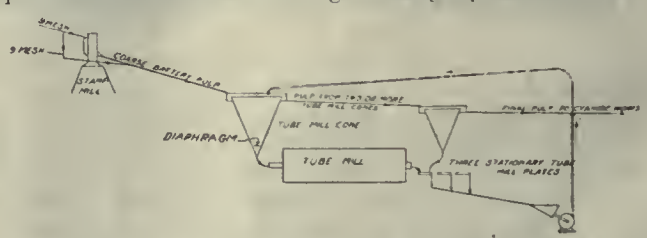
1 tube-mill = 30 stamps : 5 plates 11 × 5 ft. = 275 sq. ft. = 9 sq. ft. per stamp.

Total for 60 stamp units = 725 sq. ft. = 12 sq. ft. per stamp unit.

At the Randfontein Central the total plates erected amount to 9.6 sq. ft. per stamp unit, but it is now proposed to use only 4.8 sq. ft. per stamp unit, and there is little doubt that the latter area will be quite sufficient. In the Simmer & Jack re-arrangement the plate area is about 2 sq. ft. per stamp unit. With the high stamp duties of recent years the same plate area is doing nearly double the work it used to do in the past, and is capable of doing a great deal more. Conversely, in regard to the usual 10% fall, where this is increased more crushed material with smaller water ratio may be amalgamated with equally good results. H. W. MacFarren, in his interesting little book, says the fall of plates varies from 1½ to 3 in. per foot, and should not be less than 2 or 2½ in. A fall of 2 in. per foot is equivalent to 16.7%, and 2½ in. to 20.8%, while the average is 17.75%. Among the advantages due to reduced area of plates are reduced cost of installation and operation, and especially a reduced cost of mercury; the consumption being in proportion to the area of plate. In the Simmer & Jack plant the consumption of mercury has been reduced to one-sixth of the former figure. Where a large area is exposed in amalgamation a proportionate amount of gold is taken up to set the plates, and is not available for realization until the end of the life of the mine. The gold held by well-set plates may be taken at 1 oz. per sq. ft. of plate. A 200-stamp mill having 40 plates 15 by 5 ft. will thus absorb 3000 oz. of gold, worth £12,000. The future indicates a reduction of plate area to the point

TUBE-MILLS AND SLIME PLANT, SIMMER DEEP.

where only the gold too coarse for cyaniding will be caught by amalgamation. This has probably been reached already in the Simmer & Jack plant, which has now only 18 stationary plates in the tube-mill circuit in place of the former 64 battery plates and 30 shaking tube-mill plates. It will be noted that the Simmer East with plates in the stamp-mill has retained two stationary plates per tube-mill, whereas the Simmer & Jack and the Simmer Deep-Jupiter joint plants without plates in the stamp-mill have each retained three plates per tube-mill. The additional plate in the last two cases is a measure of safety to deal with the richer pulp and to have not less than two plates per tube-mill in action during dressing operations. Dia-



E. PROPOSED ARRANGEMENT, THREE STATIONARY TUBE-MILL PLATES.

gram E shows a proposed arrangement of crushing and amalgamating and three stationary plates per tube-mill and no plates in the stamp-mill, and with safety cones for the common streams of pulp overflowing the tube-mill classifiers.

In the manufacture of coke during 1909, more than $50,000,000 worth of by-products in the form of ammonium sulphate, creosote, pitch, and other materials were allowed to escape into the atmosphere, to do harm rather than good. The total value of the mineral products of the United States during the past year approximated $2,000,000,000. The products which were lost in either the mining or the treatment of these materials must have aggregated more than one-fourth of that, or in value more than $500,000,000.

Steamboat Mountain, B. C.

STAFF CORRESPONDENCE

Steamboat mountain is 35 miles southeast of Hope, near the headwaters of Skagit river. The international boundary is 45 mi. south of Hope, and prospecting has been extended over the surrounding district; good ore has been found from 23 miles from Hope, to the boundary and in United States territory. Some of the best discoveries have been made on Lightning creek, which follows the boundary. There is much activity in the camp and the surface indications are good, but a final estimate of the work of the camp can not be made until later in the summer when the returns for the season's work are in.

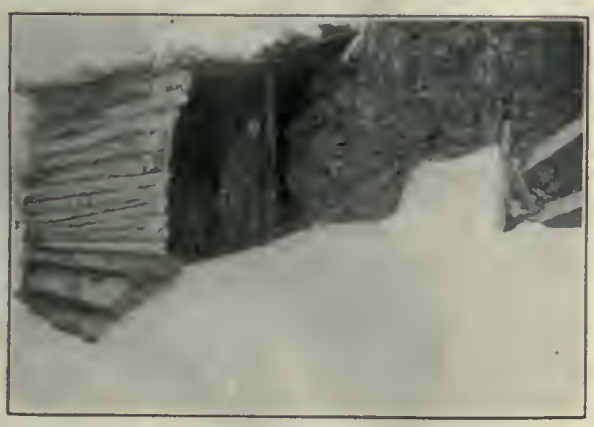
Dan Greenwalt made the first location on June 30, 1910, from Hope, but easy entry is obtained from Princeton on the east side.

At Steamboat two companies have townsites, and it is a question as to which one will get the population. Both are convenient to the locations in the district. Claims have been staked in all parts of the district, about 1000 in all. The discovery claim was at an elevation of 5400 ft., and many others are at an equal altitude on neighboring mountains. The ore generally is gold-bearing, with an average value of $15 to $30, but ten miles from Steamboat, toward Hope, a fine vein of galena has been uncovered by Frank Fritz.

Samples were brought to Vancouver two weeks ago by reputable mining men and the returns from these were extremely satisfactory. From 18 in. of the vein on the property of the Steamboat Prospecting Co. the ore ran $60; another 5 ft. went $2.80, while another sample was $537.

STEAMBOAT MOUNTAIN AND THE UPPER SKAGIT.

PACK-TRAIN LEAVING HOPE FOR STEAMBOAT.



UPPER TUNNEL, GREENWALT AND STEVENS DISCOVERY.

A PART OF THE TENT TOWN.

and brought the news into Vancouver. Interest was immediately taken in the district, and many locations were made during the autumn and winter. Many of these were on the snow, and warning was given by experienced mining men to be on the lookout for those who were offering these snow locations, in many instances made over other locations, for sale at $100 each. In Vancouver one man was offered ten of these claims for $1000. Many of these sales were effected, and it is not unlikely that litigation will follow.

Going into Steamboat the activity starts at Hope. That town has awakened after outdoing Rip Van Winkle twice over. Forty years ago it was in the throes of excitement because of the Cariboo discoveries, and now all the buildings in the place are crowded and a tent town has been established. New hotels are being erected and effort is being made to take care of the traffic. Two road-houses, one at Fourteen-Mile and the other at Twenty-Three Mile, supply the needs of travelers on the trail. The road is not the best, but will be improved this year. The best way in is from Princeton on the east side. As this latter may have been a stringer, it is not taken into calculation. Assays are now being made of the other ore brought in.

Besides the Steamboat Gold Mines, the Steamboat Wonder has good claims on Steamboat mountain, and several others are being opened up. The Steamboat Central's property is on Red mountain, and Fred Whitwell has the Yellow Jacket there also. On the west bank of the Skagit, almost opposite, Messrs. Moore and O'Neill and the Steamboat Prospecting Co. are preparing to work their claims on Luckless mountain. Down near the boundary Mr. Webb and associates, of Seattle, have a promising location and prospecting is lively.

Steamboat is the last great area of mineral ground in the southern part of British Columbia that is practically virgin ground for the prospector. All that remains now is to prove whether there is gold in the sulphide zone as well as in the rich surface oxides. The trials of a new camp are bound to come, but it is expected now that Steamboat will come through all right.

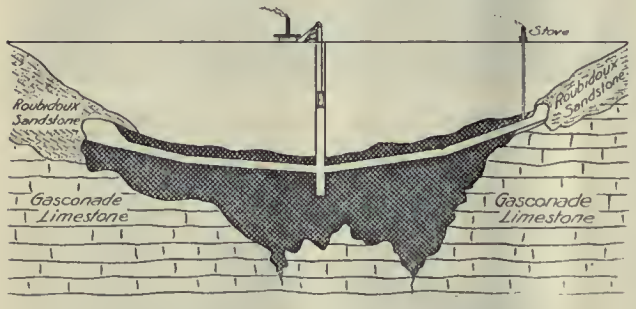
Hematite Deposits of the Ozark Uplift

By Norman L. Ohnsorg

The hematite deposits of the Ozark mountains are generally situated along the back-bone of a ridge and are characterized by a promontory on the ridge, the orebody being the cause of this irregularity. The orebodies are in sinks formed by the leaching away of the underlying Gasconade limestone and the bending down of the overlying Roubidoux sandstone into these caverns, followed by a leaching out of this sandstone and deposition of the hematite, coming from a higher ferruginous horizon. The contact, when seen near one of these sinks, of the Roubidoux sandstone and the Gasconade limestone may easily be mistaken for an unconformity, the limestone lying nearly horizontal, while the sandstone has a dip of 10° or more.

Profits of Mining

Where these deposits are close to the surface they are mined as open-cuts. The shallow deposits are practically exhausted and the deposits are now being worked as underground mines by a modification of long-wall retreating or the caving system. A shaft having been sunk in the centre of the deposit and drifts run to the extremity of the orebody at the highest level, the ore is taken out and the ground above allowed to settle; the next lower level then being worked, if the thickness of the orebody permit.



CROSS-SECTION, MISSOURI HEMATITE DEPOSIT.

In general these deposits do not permit of more than one level. The ore around the shaft is taken out last. The saving of ore by this method is very high. The old method probably saved less than half.

Extensive timbering is necessary, due to the loose texture of the overburden. Timbering is not expensive, however, as the country is heavily wooded. White oak mine timbers can be had for little more than the cost of cutting. Drilling is done entirely by hand. The cost of labor is $1.25 to $1.50 per day for underground men. As the ore consists of hard lumps in softer material, and is full of clay seams, it does not permit of the use of air-drills, and for this reason ventilation becomes quite a problem.

Combined Method of Prospecting and Ventilation

After the mine has been located the centre and general outline of the deposit is determined by plotting up the dips. The orebody is then proved by means of a churn-drill; an 8-in. hole is commonly put down, at intervals of 100 ft. or more, so placed that during the development and working of the mine these holes can be used for ventilation. The cost of drilling ranges from 80c. to $1.25 per foot, depending on the size and depth of hole.

An ordinary large sheet-iron stove, having a circular 8-in. draft opening, is used for securing ventilation. When the mines are damp or cold, which is seldom, as they have a natural drainage through the sink, pumping rarely being necessary, the stoves are placed in the mine, using the drill-hole as a flue; but in most cases these stoves are placed on top of the ground and the draft connected to the drill-hole casing, getting its air for combustion from the mine. When a good strong fire is kept in these stoves, the results are remarkably good. This same method is employed in shaft-sinking, using a canvas sleeve on the lower end of a suction pipe. The best results are obtained, however, by having the stove underground, as the draft being close to the floor takes out the heavier gases, such as carbon dioxide. Before this method of ventilation was adopted but one shift could be worked, and even then much time was lost when it was necessary to shoot during the shift.

It would seem as though there should be a large profit in mining these ores, with cheap labor, low cost of timber, and other items in proportion, but the profit is actually small, the operator receiving about $2.25 per ton f.o.b. railroad at mine, for ore carrying 58% metallic iron. Where the mines are operated on a lease, a royalty of about 25c. per ton is paid, and it takes good management to make them pay, as they are not found along the railroad. Those large enough to warrant it have their own sidings built from the main lines.

Fusions

By H. C. Pritham

Any method of running a fusion around a crucible to cool takes time and care to perform the operation, and in the subsequent digestion in hot water the fusion dissolves slowly, and if, as sometimes happens, considerable of the fusion collects in a hard mass in the bottom of the crucible, it certainly takes time and patience to get it dissolved out. With the following method all this is avoided. The crucible is almost entirely clean from the fusion and the dissolving of the bottom is very fast. The minimum of time is required to transfer the liquid fusion to the digestion in hot water. Many times in a commercial laboratory or a cement plant one has to fuse 20 or 30 samples of clay or other material in the morning, and as a rule has about four platinum crucibles to do the work in. The sooner the chemist can make a fusion and get a clean crucible back, the more time he will have to sleep that night. Moreover, the wear and tear on the platinum is much less. The sudden chilling of a crucible in cold water or the squeezing in of the sides in order to loosen a fusion is not beneficial; the platinum gets brittle and loose. Considering the present price of $43 per ounce it is necessary to take care of the crucibles.

My method is to take a shallow 5-in. evaporating dish and bend up a clay triangle so as to set in the centre of this. In the triangle put a 50 c.c. nickel crucible so that it is held solid and leaves about an inch space between the bottom of crucible and dish. Fill the dish with cold water up to the triangle, and you are ready.

When the fusion is finished raise the heat for a minute or two, remove the cover and at once pour the fusion into the nickel crucible by taking up the platinum crucible in the forceps on one edge. This can be done very quickly and easily with practice. Almost all fusion will pour out and will solidify at once. Have a casserole ready half full of hot water, pick up the nickel crucible in the forceps, tap it lightly on the desk, and dump the button into the casserole. Keep the casserole covered. The action of the hot water on the hot button will disintegrate it. Add the platinum crucible and cover, and after a few minutes take them out and rinse off. If necessary, rinse in acid into a beaker, using this acid when the fusion is made acid for evaporation. Acid should not be added, however, until the fusion is well dissolved. The button will leave the nickel crucible clean, but if desired it can be rinsed in hot water. If this is done be sure to have the crucible perfectly dry before pouring the next fusion. A little water will cause rather startling results when the hot fusion is poured in on it.

In conclusion I would call attention to the fact that a blast-lamp is not necessary for fusions, contrary to most textbooks. A good Bunsen burner will give all the heat needed except in a few iron ores. The heat should be low until the fusion is well under way. In no case should the practice of turning on a blast-lamp for fifteen minutes be allowed.—*The Chemical Engineer.*

Concentrates

Most of these are in reply to questions received by mail. Our readers are invited to ask questions and give information dealing with the practice of mining, milling, and smelting.

GLASS may be cemented to iron by melting 1 oz. wax and 5 oz. rosin on a water bath, and adding, with constant stirring, 1 oz. venetian red, previously well dried. The mixture should be stirred until nearly cool, so as to prevent the venetian red from settling to the bottom.

RUST is removed from instruments by laying them over night in a saturated solution of chloride of tin. The rust spots will disappear through reduction. Upon withdrawal from the solution the instruments are rinsed in water, placed in a hot soda-soap solution, and dried. Cleaning with absolute alcohol and polishing chalk may follow.

INKS for marking articles of glass, glass slips for microscopy, reagent flasks, etc., are as follows: in black, sodium silicate one to two parts, liquid india ink one part; for white, sodium silicate three to four parts, chinese white one part. Instead of chinese white a sufficient amount of the so-called permanent white (barium sulphate) may be used.

A SOLUTION for water-jackets on gas engines that will not freeze at any temperature above 20° below zero (F.) may be made by combining 100 parts water, by weight, with 75 parts carbonate potash and 50 parts of glycerine. This solution is non-corrosive and will remain perfectly liquid at all temperatures above its congealing point.

SCREW connections may be made tight by using powdered shellac dissolved in 10% ammonia. The mucilaginous mass is painted over the screw threads, after they have been thoroughly cleaned, and the fitting is screwed home. The ammonia soon volatilizes, leaving behind a mass which hardens quickly, makes a tight joint, and is impervious to hot and cold water.

SHEET MICA properly dressed, varying in sizes from 1½ in. diam. upward, has an average value of 24c. per pound. Scrap mica, which includes all sizes below 1½ in. diam., sells for about $14 per ton on the Pacific Coast. Buyers require this material in a finished state, and it is a serious question whether there is sufficient demand to justify the erection of a plant.

LABELS may be attached to glass bottles by using water glass (sodium or potassium silicate). Care should be taken to spread this product on the glass, not on the paper, and then to apply the paper dry, which should be done immediately. When the solution is dry, the paper cannot be detached. The silicate should be somewhat diluted. It is spread on the glass with a rag or a small sponge.

FLAKE GRAPHITE commands very good prices if the material is properly dressed and sized. Crude amorphous graphite is used in limited quantities, and it is a question whether there is sufficient demand on the Pacific Coast to keep one fair-sized mine in operation. Most of the miners of amorphous graphite are forced into the manufacture of pencils, etc., to get rid of their output.

THE FOLLOWING PREPARATION will remove rust when already present, and prevent its coming, if the article is well greased with it. Melt 5 parts crude vaseline on a water bath, and mix 5 parts finely levigated powdered pumice stone into a uniform mass. To the half-cooled mass add one-half part crude acid oxalate of potassium in a finely powdered state and grind into complete homogeneity.

PLATINUM is easiest recovered from black sands by simple washing operations, for it is as easily recovered as gold and can be caught in the same way, with the exception that it will not amalgamate unless some strong reagent, like sodium amalgam, is employed. When platinum occurs with copper or nickel it is finally obtained in the refining of these metals, but the methods employed are complex and expensive and could not conveniently be used except at a large plant.

WORKING DESIGNS and sketches are easily soiled and rendered unsuitable for further use. This can be avoided by coating them with collodion, to which 24% of stearine from a good stearine candle has been added. Lay the drawing on a glass plate or a board, and pour on the collodion, as the photographer treats his plates. After 10 or 20 minutes the design will be dry and perfectly white, possessing a dull lustre, and will be so well protected that it may be washed off with water without fear of spoiling it.

IRON AND STEEL may be coated with glass by melting together 125 parts (by weight) of flint-glass fragments, 20 parts sodium carbonate, and 12 parts boracic acid. The molten mass is next poured on a hard and cold surface, stone or metal. After it has cooled, it is powdered. Make a mixture of 50°B. of this powder and sodium silicate (water glass). The metal to be glazed is coated with this and heated in a muffle or any other oven until the mixture melts and can be evenly distributed. This glass coating adheres firmly to most metallic surfaces, especially to iron and steel.

CALCITE veins, like quartz veins, have no essential connection with valuable ore deposits. Quartz and calcite are the commonest fillings of fissures because these minerals are the ones most commonly deposited from circulating solutions. When these solutions contain valuable minerals as well, the resulting deposit is very large compared with the cases in which it contains workable ore deposits. In the Cobalt region the minerals occur in calcite veins, but in many other districts calcite veins have no particular significance. The fact that there is no calcite in the adjacent rock merely indicates that the solutions have derived their mineral content at a distance.

A GOOD FURNACE JACKET may be prepared in the following way. A piece of asbestos millboard—10 by 4 by ⅜ in.—is perforated in about a dozen or more places with glycerined cork borers, then nicked about an inch from each short end and immersed in water until saturated; next the board is bent from the nicks at right angles and the perforated portion shaped by bending it over a bottle with as little force as possible. The result should be a perforated arched tunnel, resting on narrow horizontal ledges at each side. Dry this cover in the furnace, after setting it in position, and pressing it well to the supports. Three such covers, weighing one pound, replaced 24 fire-clay tiles, weighing 13 lb., and a higher temperature was obtained than with the latter.

GEM-STONES must possess three characteristics to fit them for purposes of ornament. They must be hard, so that their brilliancy will not be lost by the wearing away of the sharp angles and surface of the cut gem. They must be of uniform color throughout (except some semi-precious stones, where the difference in color are such as to make them attractive); and, finally, they must have a pleasing color. In most cases they must also be transparent or translucent, and free from flaws; though some semi-precious stones, such as coral and jet are opaque, and in others, such as aventurine and cat's eye, the presence of foreign material gives the gem its value. In gem deposits, diamond-bearing earth, for example, only a comparatively few of the stones found have a good enough color and are free enough from defects to yield cut diamonds of the best quality. The inferior stones are utilized in a variety of ways.

Discussion

Readers of the MINING AND SCIENTIFIC PRESS are invited to use this department for the discussion of technical and other matters pertaining to mining and metallurgy. The Editor welcomes the expression of views contrary to his own, believing that careful criticism is more valuable than casual compliment. Insertion of any contribution is determined by its probable interest to the readers of this journal.

Republic Mining District

The Editor:

Sir—In your issue of May 13, 1911, M. H. Joseph comments on plate XI of Bulletin No. 1 of the Washington Geological Survey, and presents many interesting facts concerning the relative importance of gold and silver, with depth, in the Republic veins; facts largely brought to light by developments since that paper was written. It may be worth while, however, to outline the manner of securing the data upon which the figure in question is based. From the records in the company's office, assays from the four levels were picked at random by an officer of the company and called off to myself, who recorded and averaged them. *Every* assay of the 107 thus secured appears in the average for the level to which it pertains. The ratios of gold to silver in ounces for the various levels thus appear to be: Glory Hole, 1 to 1.09; 203-ft. level, 1 to 2.45; 385-ft. level, 1 to 4.19; 565-ft. level, 1 to 6.19.

Figure 5 of the same report illustrates a similar condition in the Lone Pine mine. Here the *total number of ounces of silver and of gold* derived from all ores extracted above No. 2 level and the total derived from below it are used in securing the ratio. The relation of gold to silver thus secured is as 1 to 5.6 above No. 2 level and as 1 to 8.6 below No. 2 level.

It is noteworthy that most of Mr. Joseph's citations are from the Quilp-Surprise vein. On page 54 of the bulletin the following appears: "The Quilp vein has been explored 600 feet on the dip and continues north as the Surprise vein, while to the south it has not been identified. * * * Above the 100-foot level gold was to silver as 1 to 12.19, while at greater depth the ratio was as 1 to 6.08. It will be noted that this is the reverse of the rule for the camp, for in all other mines where data were available, the ratio by ounces of gold to silver decreases with depth. The incongruity may possibly be explained by a local concentration of silver in the upper levels." In referring to the same vein, Mr. Joseph states that "in February a deposit of ore was found on the 50-ft. level of the Quilp mine that was exceedingly rich in silver, from which, in fact, the finest specimens of native silver ever seen in the camp were taken."

To me plate XI and also Fig. 5 would suggest secondary enrichment of silver, but since other lines of evidence supporting this suggestion were not found, it seemed wise to present only the facts in the report. The Republic deposits, excepting the New Republic and Princess Maude, are very tight. This is especially true of the Quilp-Surprise vein, yet in this Mr. Joseph reports the recent discovery of native silver, a mineral generally, if not always, of secondary origin. Evidence of this sort did not appear during the investigation, but if found to be generally true it should be taken as proof that secondary enrichment of silver has taken place. Thus if the New Republic vein should be explored at greater depth and the averages of assays from lower levels subjoined to plate XI, it might very possibly show the silver area to close in and continue more nearly parallel in amount to that of the gold. It would seem that with recent extensive developments on the Quilp-Surprise vein—developments reaching several hundred feet below the bottoms of adjacent gulches and this below the level where secondary agencies have probably been effective—excellent opportunity is offered for constructing a similar figure which would combine the relations existing both within and below the zone traversed by the more active meteoric circulation. Since the Republic deposits are bunchy, care should be taken to compare only *broad* averages, and those should be from the *same* ore-shoot.

In brief, the figures represent relations in two important mines of the camp, and the statements refer to these figures and also to conditions said to have been met in other Republic properties. Although later developments may modify the conclusions stated in the report, yet it is firmly believed that they are correct so far as they go. If applied to the camp as a whole, I cannot agree with Mr. Joseph that the ratio of gold to silver has "no relation whatever to depth."

JOSEPH B. UMPLEBY

Washington, May 23.

Surface Indications of Ore-Shoots

The Editor:

Sir—Lorenz von Schoen, in your issue of May 27, has called attention to a condition frequently found in the desert regions. It is not an uncommon thing to find a well defined vein, consisting principally of quartz, in which pay-shoots occur, the limitations of which are of surprising sharpness, the valuable contents, metallic sulphides, as well as gold and silver, seeming to have been deposited in and confined to the sharply defined zone in which they are found, by some influence difficult to determine, while the barren quartz continues without any apparent reason for the difference. Occasionally there is incontestable evidence that a barren zone has at one time been mineralized, from which through some process of leaching, the minerals, both base and precious, have subsequently been dissolved and carried away in solution to be redeposited elsewhere. Such places generally give evidence that chemical processes have been at work, as shown by the porous or honey-combed condition of the vein material. Often the character of the mineral removed may be determined by the shape of the open spaces left in the quartz or other gangue. This is particularly true of pyrite, the dissolution of which often leaves hollow cubes which occasionally contain native sulphur, due to the incomplete removal of the sulphur of the pyrite, which may or may not have contained gold. Gold, however, is not always left in these hollow places, even when the original pyrite was auriferous. Pseudomorphs after various minerals are of frequent occurrence in these leached zones, especially limonite replacing pyrite by oxidation. If the original pyrite were gold bearing, then the limonite is likely to be also, though, like the hollow spaces, it is not invariably so. Occasionally these limonite pseudomorphs are far richer in gold than any of the normal pyrite that can be found, and this is not so easy of explanation, except upon the theory of 'secondary enrichment', a condition often occurring, but really little understood. Equally strange and unaccountable is the sudden termination of the occurrence of gold and silver in a vein of sulphide ore when the sulphides are found to continue without interruption, although it is true that in such cases there is generally a noticeable change in the character of the sulphide. I know of an instance in Yavapai county, Arizona, where a vein 1 to 4 ft. wide has a pay-shoot carrying sulphides of iron, copper, lead, and zinc, the pay in which quits within a foot, the mixed sulphides with their gold and silver giving place to a vein of solid pyrite 4 ft. wide, but which is almost destitute of gold and silver, as well as the sulpbides of the other metals mentioned. In this instance the pyrite, which was granular and loosely coherent, acted as a gangue mineral in practically the same manner in which quartz acts. When barren quartz is found to succeed a pay-shoot in a well defined vein, it is not always certain that the barren quartz has at one time been rich, for it may always have been in the condition in which it is found. Pay-shoots are often very erratic in their distribution in a fissure, and the reasons for their occurrence where they are found, and for their more or less sudden ending, when their limits are reached, are beyond positive knowledge, notwithstanding the many theories that have been advanced to account for them. It is not always the influence of geological conditions that results in the formation of a gulch, at the surface, that is responsible for the ending of a pay-shoot. More often the pay ends without apparent cause. In the Yander-

hill district at the north end of the New York mountains, that may be considered as a northeasterly extension of the Providence mountains, the ore-shoots occurred independently of each other in a fissure that could be traced along the surface for many hundreds of feet. The walls of the fissure were from 3 to 4 ft. to over 20 ft. apart, and the material between consisted principally of clay resulting from the crushing and complete alteration of the feldspathic minerals of the zone of shearing. This clay 'filling', as it was called, was split by a rude cleavage parallel to the walls of the fissure, due to subsequent pressure. Within this zone of fissuring, crushing, and alteration the pay-shoots of ore were formed. They overlapped each other both horizontally and vertically, their edges thinning out like a wedge. From 1 to 3 ft. of clay was usually found between the overlapping ends of these shoots. Incidentally, it is interesting to mention that these shoots terminated at the surface, upon reaching a gulch which crossed the strike of the vein. I inspected these ore-shoots and could see no reason why the several shoots had not formed as a single long and deep shoot, instead of a succession of comparatively short and shallow ones. There are a great many ore-shoots that do not come within hundreds of feet of the surface, although the fissure in which they occur is continuous for hundreds and in some instances for thousands of feet, both horizontally and in depth. In numerous instances the reason for the existence of an ore-shoot at a certain place can be stated with reasonable assurance of being correct, but there are a great many cases where no reason susceptible of demonstration can be given.

WILLIAM H. STORMS.

Berkeley, California, May 30.

The Editor:

Sir—The question propounded by Lorenz von Schoen in *Mining and Scientific Press* of May 27 is a difficult one to solve. That nearly all orebodies have these barren zones and spots within the shoot is a well recognized fact, but the cause of this has never been entirely explained. In some districts this condition can be easily explained by demonstrated facts; in others, all signs fail. I have found in the zone of weathering that surface waters would completely leach out the values in some parts of the vein only to enrich other portions. If a barren zone is encountered above water-level and the filling is crushed and loose-textured, or shows large quartz crystals of perfect shape, or a thin watery mud between the cracks of the gangue and a less amount of oxide stains than in the orebody, then a further sinking or driving is advisable. If the workings are below water-level in the zone of primary mineralization and the ore changes to barren gangue of the same composition as that in the ore-shoot, and the wall-rocks are still uniform, then both hanging and foot-wall should be exposed by short cross-cuts. If either wall shows a low undulation or swell toward the vein, but without pinching the same, and the filling is either harder or crushed more than the ore, then it is favorable for further exploration, vertical or lateral. These are personal observations from widely scattered districts and are not given as a rule. Every prospector should study the known facts about ore deposition, as by so doing he will avoid many a useless blow on a hand jack, and, conversely, will not be afraid to open up that which his added knowledge tells him is worth while.

Cazadero, California, May 29. R. L. MANN.

Federal Control of Water-Power Sites

The Editor:

Sir—There is much in your editorial in the issue of May 13, referring to the recent decision of the U. S. Supreme Court as to jurisdiction over Federal lands, with which I agree. But not with your statement, "There is a general impression in the East that the people of the West do not favor Federal control of water-power sites," as being a wrong impression. Insofar as Federal control of water-power sites or any other control of waters except for navigation purposes, which has been assumed by withdrawal of power sites, and control of the waters on forest reserves by Federal authority is concerned, I believe the people in the East are correct in their estimate of Western objection. Furthermore, the recent decision in no manner affects the right of control of waters or water-powers which had long since been passed upon by the highest legal tribunal of our country and confirmed State control. It will be remarkable indeed if notice is not served upon the Federal Government by State officials where the right of the State to the use and control of the waters therein is questioned, or an attempt is made to abrogate that right by the Federal Government or by any bureau thereof. Legislation which has been passed upon this subject by Congress is held of no legal force in face of other evidence bearing upon this question.

L. K. ARMSTRONG.

Spokane, Washington, May 20.

[Our understanding of the present situation as regards State and National authority over waters is that announced by the President; namely, where the Government owns the land upon which dams must be erected in order to utilize the waters, there is no necessity to inquire further. This position is made stronger by the Supreme Court decision, which confirms in the broadest terms the right of the Government to hold and to use Federal land in any manner Congress may see fit. The States have control of the water to the extent that such control is separate from land ownership, but no State can force the Government to sell a water-power site, whereas it is quite possible for it to force a private owner to do so. Whether Western sentiment would or would not endorse a reasonable control of such matters by Federal officers is admittedly a matter of opinion. Our own judgment is that prompt formulation of a reasonable plan would greatly relieve the situation, and we have found sentiment generally much more adverse to the present plan of withdrawal by a non-user than to the idea of Federal control itself. To prevent any possible misunderstanding, we repeat that this all applies only to water-power and mineral resources on land belonging to the United States, not to land privately owned.—EDITOR.]

Coal Production of Kentucky

Kentucky is the only one of the United States whose coal supplies are drawn from any two of the great fields. The eastern counties of the State are underlain by the coal measures of the Appalachian region, and the southern extremity of the eastern interior or Illinois-Indiana field is worked extensively in the western part of Kentucky. Coke, according to E. W. Parker in an advance chapter from 'Mineral Resources for 1910,' published by the United States Geological Survey, has been made from coal mined in both the eastern and western parts of the State; but, although the coals of the eastern counties are in large part included among the high-grade coking coals of the Appalachian field, and although little or no coke is made from the coals of the eastern interior field in Illinois or Indiana, the larger part of the coke made in Kentucky has been made in the western district.

Kentucky's coke production in 1910 amounted to 53,857 short tons, valued at $120,554, against 46,371 tons, valued at $101,257, in 1909, an increase of 7486 short tons, or 16.1 per cent, in value. The average price per ton advanced from $2.18 in 1909 to $2.24 in 1910. The quantity of coal used for coke-making in Kentucky in 1910 was 104,103 short tons, principally slack.

OF THE 2,069,266 short tons of coal used for coke-making in Colorado and Utah in 1910, 1,387,070 tons was cleaned by washing before being charged into the ovens. The washed coal included 836,067 short tons of mine-run and 551,003 tons of slack. In addition to the washed slack, 429,728 tons of unwashed slack and 252,468 tons of run-of-mine coal were used unwashed.

Mines of Western Australia

The following table gives the production for 1909 and 1910 of some of the leading mines of Western Australia:

ASSOCIATED

	Tonnage.	Value.	Profit.	Dividends.
1909	134,725	$1,250,000	$329,500	$245,000
1910	128,181	878,500	41,000*	.....
To date ...	1,252,823	15,925,000	.....	3,400,000

ASSOCIATED NORTHERN BLOCKS

1909	44,163	$407,500	$150,000	$162,000
1910	28,721	246,000	.....	87,500
To date ...	339,806	8,000,000	.....	3,410,000

BULLFINCH

1909	.....	.....	.....	.....
1910	1,123	$280,000	.....	.....
To date ...	1,123	280,000	.....	.....

CHAFFERS

1909	31,055	$260,000	.....	.....
1910	46,584	360,000	23,000	.....

GOLDEN HORSE-SHOE

1909	294,965	$3,030,000	$1,190,000	$1,200,000
1910	288,188	2,075,000	120,000	375,000
To date ...	2,641,989	40,500,000	.....	15,350,000

GOLDEN RIDGE

1909	26,540	$342,500	.....	$139,000
1910	28,999	378,000	167,500	135,000
To date ...	188,868	2,200,000	.....	445,000

GREAT BOULDER PERSEVERANCE

1909	192,178	$1,500,000	$310,000	$350,000
1910	91,852	570,000	70,500	.....†
To date ...	1,780,703	24,685,000	.....	7,130,000

GREAT BOULDER PROPRIETARY

1909	187,755	$2,955,000	$1,585,000	$1,310,000
1910	218,656	2,939,000	1,500,000	1,310,000
To date ...	1,910,611	39,375,000	.....	17,155,000

GREAT FINGALL

1909	139,985	$875,000	$54,000	$105,000
1910	125,871	950,000	149,000	62,500
To date ...	1,733,515	24,045,000	.....	8,605,000

HAINAULT

1909	66,737	$360,000	$62,000	.....
1910	68,719	455,000	74,000	37,000
To date ...	504,213	3,550,000	.....	270,000

IVANHOE

1909	231,063	$2,495,000	$1,215,000	$1,200,000
1910	231,842	2,465,000	1,240,000	1,200,000
To date ...	2,343,860	33,340,000	.....	12,940,000

KALGURLI

1909	128,220	1,730,000	$930,000	$750,000
1910	129,389	1,665,000	912,000	750,000
To date ...	1,014,014	14,935,000	.....	5,285,000

LAKE VIEW & STAR

1909	118,633	$827,000	$160,000	$87,000
1910	141,052	862,000	16,000*	87,000
To date ...	1,439,081	22,210,000	.....	7,240,000

OROYA EXPLORATION

1909	257,741‡	$335,000	$180,000	.....
1900.....		(See Oroya Links)		

OROYA BLACK RANGE

1909	52,976	$675,000	$245,000	$150,000
1910	53,972	535,000	130,000	50,000
To date ...	228,892	2,610,000	.....	325,000

OROYA LINKS

1909	150,031§	$1,305,000	$507,000	$225,000
1910	100,177	795,000	125,000	71,000
To date ...	1,287,629	25,980,000	.....	10,800,000

SONS OF GWALIA

	Tonnage.	Value.	Profit.	Dividends.
1909	159,057	$1,295,000	$458,000	$325,000
1910	162,082	1,415,000	565,000	485,000
To date ...	1,580,935	15,780,000	.....	3,385,000

SONS OF GWALIA SOUTH

1909	19,733	228,000	51,000	60,000
1910	24,642	230,000	57,000	17,500
To date ...	98,728	1,090,000	.....	140,000

SOUTH KALGURLI

1909	108,430	750,000	123,000	100,000
1910	110,738	578,000	117,000	100,000
To date ...	743,892	6,250,000	.....	525,000

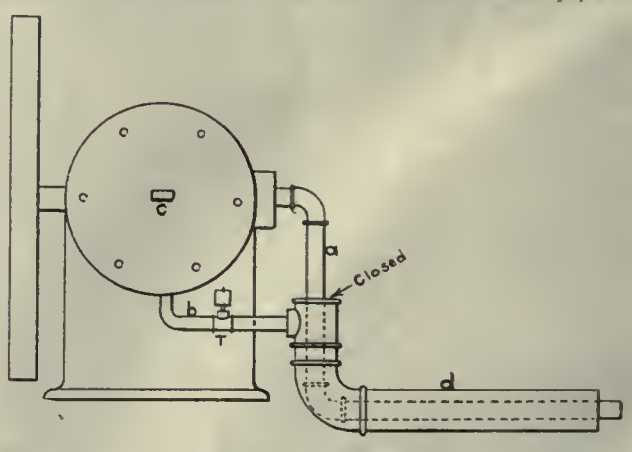
*Loss. †Fire in mill. ‡Separate from Oroya Links Co. §Residue included.

Inlet-Air Heater for Gasoline Engines

By E. R. RICE

In the mining camps situated on the desert, where fuel and water are scarce, the gasoline engine is quite generally used for hoisting and for miscellaneous power. It is often said that a gasoline engine has more whims than a pretty woman, but it has been my experience that it is as reliable as a steam engine, if properly taken care of. The greatest trouble with a gasoline engine occurs during cold weather, for then the gasoline is vaporized with difficulty. This is specially true for the engines that use 48 to 50° distillate, instead of the 72° stove gasoline. For perfect combustion, the gasoline should be in the form of a gas, and it will be readily seen that this condition is easier brought about if the inlet-air is hot. I have found the following scheme efficient in overcoming the difficulties due to too cold inlet-air.

In the figure, *a* is the exhaust-pipe of the engine, which passes through a larger pipe *d*. The pipe *d* should be about twice or three times the diameter of the exhaust pipe *a*.



INLET-AIR HEATER.

The inlet-pipe is shown at *b*, and is connected to *d* by means of a T and suitable reducers, so that when a fresh charge of air is drawn into the engine, the air has to pass through the pipe *d* and around the hot exhaust-pipe *a*. The carbureter is shown at *c*, and the air entering through *b* passes around *c* and the gasoline is drawn into the cylinder in the form of gas.

An engine will produce more power for a certain size of cylinder and certain speed if the inlet-air is cool, but an engine will produce a horse-power hour with less gasoline if the inlet-air is hot. Unless the engine is run up to its total capacity, it is economical to heat the inlet-air. Most gasoline engineers keep the jacket-water fairly cold. This is a mistake and the jacket-water should be kept hot. I prefer to have the jacket-water at such a temperature that I can just hold my hand on the overflow pipe for a moment without it burning my hand.

Gasoline engines are usually started by hand, compressed air, or by exploding a charge of gas in the cylinder. In

cold weather it sometimes happens that after the initial explosion, the engine will fail to explode the succeeding charges of lower-grade distillate that is generally used in the larger engines. This difficulty can be overcome by putting a T in the inlet-pipe as shown at *T*, and by means of suitable reducers, an ordinary sight-feed lubricator is connected to the T. This lubricator is filled with high-grade gasoline, and the gasoline fed directly into the feed pipe. As the engine draws in a fresh charge, the high-grade gasoline is readily vaporized and is drawn into the engine cylinder and easily exploded. As soon as the inlet-air and engine become warm enough to vaporize the regular distillate, the lubricator is closed. In the figure here shown, the right-hand fly-wheel is omitted so as to avoid confusion in the drawing.

Waihi Grand Junction Mine

STAFF CORRESPONDENCE

The history of this mine affords one of the most notable examples of a new manager turning a previous failure into a success, and William Frank Grace deserves a place in the roll of fame. The company was formed as long ago as 1895. Three of the lodes found in the Waihi mine continue into the Grand Junction territory, namely the Martha, Royal, and Empire. For many years the results of development work were disappointing and much capital was spent to no purpose. F. C. Brown, the manager, was succeeded at the end of 1909 by Mr. Grace, who had previously reported on the property for people intending to supply further capital. The results during 1910 show that Mr. Grace has effected a radical change all round, and that the position and prospects of the mine have been improved out of all recognition. He did 13,092 ft. of development work during the year, as much as in the three previous years put together, and he increased the ore reserve by 71,750 tons, besides sending 84,226 tons to the mill, which was a far larger yearly extraction than ever before recorded. At the same time the working cost, excluding development, has been reduced from 22s. 10d. to 15s. 3d. per ton. The cost of mining was reduced from 12s. 6d. to 7s. 7d. by altering the method of payment from footage of holes drilled to tonnage extracted, and the treatment cost was lowered by shortening the time occupied in air-agitation with a consequent reduction in cyanide consumption. As already stated, 84,313 tons was sent to the mill; from this, gold-silver bullion worth £133,315 was recovered. Mr. Grace does not report the separate gold and silver output, but I presume that the relative proportion of the two metals is the same as at the Waihi, though the total content is rather less. The profit for the year was £30,646 and a dividend at the rate of 5% has been paid, the first dividend ever earned. Mr. Grace's report is of great technical value, as it describes many interesting points in connection with milling in cyanide solution, all-sliming in tube-mills, and air-agitation. In writing this account of Mr. Grace's doings there is no desire to disparage the previous manager, F. C. Brown, in any way. Mr. Brown is a well-known engineer and is the inventor of the Pachuca agitator.

TO DETERMINE, if possible, why zinc ore prices are not as strong now, compared to the price of spelter, as they have been in the past, the Joplin Commercial Club has appointed a committee headed by P. L. Swartz to make an investigation. One interesting report has been made. Seven smelters buying zinc ore in the Joplin district, utilize the by-product, sulphuric acid, according to the committee. Last year the production of sulphuric acid from Joplin ore was 100,000 tons. The approximate valuation was $1,000,000, the wholesale price at which the acid was sold having ranged from $6 to $14 per ton. When refined the product sells for as high as $150 per ton, which would bring the acid up to $10,000,000 to $15,000,000, or about as much as the total paid for all ores—blende, calamine, and galena—shipped from the Missouri-Kansas-Oklahoma district in a year.

Tin

Straits shipments of tin for May, as reported by L. Vogelstein & Co., were 4310 tons; United States deliveries, 3400 tons. London and Holland deliveries are estimated from 2200 to 2400 tons, as usual, and the visible is expected to increase about 1500 tons—to 16,000 tons—which is 3000 tons less than a year ago when the price was £150. The position has improved 16% and the price 40%. It is useless to make comparisons of this sort, it being well understood that the present price is due to a corner, as shown by the decrease in price of £20 per ton. It may be useful, however, to review previous experiences of the same sort, as, for instance, during the Secretan corner in 1888 as follows:

	Spot.	Futures.
April 27	£166	£110
April 30	106	No price
May 1	92	No price
May 7	80	£80
Again, in 1907:		
July 5	£200	£181 10s.
July 31	182	181
August (low)	163 10s.	
September (low)	159 10s.	
October (low)	137 5s.	
November (low)	134 5s.	
December (low)	115 10s.	

Whether or not history will repeat itself is hard to foretell. It would be best to have the tin market return to a normal basis where it could be traded in like any other staple, and it is likely that this will happen in due time. With tin up and rubber down, the mines will again attract the labor from the plantations, and the small falling off in Straits shipments will soon be made good. By the end of June it will doubtless be counterbalanced by the falling off in American deliveries, besides the increase in quantities of tin coming forward from sources other than Straits, particularly Bolivia and China. In a recent report, G. E. Anderson, U. S. Consul at Hongkong, China, predicts that the introduction of improved modern machinery now being set up in Yunnan province "will probably double the output of the mines in that vicinity at once," adding "the ore deposits are known to be very large and of high quality, and production is likely to be expanded as much as the world's markets will justify."

Copper

The copper market is fairly firm. Some 60,000,000 lb. was sold for export during May, and while production has not decreased, it is expected that the producers' report will make a good showing. Domestic demand has been somewhat improved and a large aggregate of small-lot buying has been a feature. The Lake Copper Co., which was skyrocketed so violently in the Boston market last year, is again bidding for attention. Some of the best indications yet found on the property have been found by the diamond-drill.

Butte is adding its weight to the copper situation by the opening of rich orebodies in the North Butte at 2200 ft., in what is thought to be the Berlin vein, and in the Tuolumne a cross-cut has penetrated what is thought to be the extension of the Edith May vein of the North Butte. Ohio Copper is struggling for recognition as a real porphyry. The mill is handling some 1400 tons of ore per day and is making about 60,000 lb. of copper per month. Comparing this with a property such as Tuolumne, which puts out about 100 tons per day and produces nearly 1,000,000 lb. monthly, demonstrates the necessity for large and continuous operations by the low-grade milling copper producers. The United States Geological Survey's preliminary estimate places the 1910 production of refined copper in the United States at 1,422,039,135 lb., compared with 1,391,021,454 lb. in 1909, an increase of 31,017,681 lb., and the largest output in the history of the industry.

Special Correspondence

JOPLIN, MISSOURI

ZINC ORE PRODUCERS PERPETUATE CO-OPERATIVE ORGANIZATION.—PECULIARITY OF UNDERGROUND WATER CIRCULATION.—REJUVENATING A PIONEER TRACT.—CHICAGO BANKER ENTERS DISTRICT.—ZINC AND LEAD NOTES.

Zinc ore producers of the Joplin district have decided to perpetuate the organization which was launched a year ago. The membership includes operators in Missouri, Kansas, and Oklahoma. New Officers have been elected as follows: John R. Holmes, president; J. L. Bruce, vice-president; W. B. Shackleford, secretary; Howard Murphy, treasurer. B. K. Blair was re-elected active secretary. Through the Zinc Ore Producers Association, as the organization is known, operators believe they have been materially benefited. One of the chief objects of the association has been to gather data relative to zinc ore prices, and this information has been given to the members. Operators claim they have been enabled to secure much higher offers for their ore than otherwise would have been the case. The bulk of zinc ore is sold in open market to the highest bidder, and inside information on market conditions often makes it possible for the producer to command a much better figure for his output. Efforts to persuade the producers to accept the contract system of selling ore on a metal basis are to be continued by the association.

Mine tailing, emptied into a natural cave-in at the Mary C. mine in the Thoms Station camp, north of Joplin, has checked the heavy underground flow of water which had made pumping operations at the Federated Co.'s mine, 1½ miles to the east, a herculean task. This shows to what extent the drainage area of a Joplin mine may reach. Pumping at the Mary C. mine several months ago is thought to have exhausted the water in an underground reservoir and caused the surface to drop in, several hundred yards east of the workings. The pit thus formed afforded an excellent place in which to empty the mill tailing. As these began to accumulate in the pit it was noted that pumping at the Federated mine became less and less difficult. At the Mary C., on the other hand, the volume of water handled has increased. Other similar instances are reported from Thoms Station. When Frank Nicholson's Catharine mine was started, wells two miles to the north went dry and farmers threatened to sue for damages. A satisfactory settlement was made by the mining company. In new camps it is often noted that springs disappear with the beginning of deep pumping operations.

Drilling and shaft-sinking on the Connor estate in the Prosperity camp, east of Joplin, have revealed rich deposits of zinc and lead in a district which was a heavy producer in the pioneer days, but which has remained idle for many years. The finding of zincblende in a shaft 850 ft. east of John Durby's concentrating plant, which has been idle for months, will result in the renewal of activity at this mill. The ore will be trammed to the concentrator from the new shaft. Zincblende, running better than 50% of the dirt hoisted, has been found in a formation 14 ft. high. The extent of the deposit has not been determined by drill-holes, but at present it is regarded as one of the best finds of the year. This ore is found just west of a limestone bar which marked the western boundary of the famous Mt. Ararat mine, which was a heavy and consistent producer for many years. A similar strike has been made by a company operating on the old Monticello lease of the Connor land, farther to the north. Here, a limestone bar marked the north limits of the mine. Drill-holes sunk a short distance farther north have gone into good blende and galena, indicating that the bar was thin. The big Monticello mill was moved away.

Work at the Minor Heir mine, in the thin sheet-ground district north of Webb City, is to be resumed by W. M. Sheridan, president of the W. M. Sheridan Co., of Chicago, who has made several trips of inspection to the district. The Minor Heir is near the Yellow Dog, the Bull Dog, and the Red Dog, and is in the heart of what is known as the 'Dog' district, one of the steadiest sheet-ground areas north of Webb City. A sheet-ore face from 9 to 12 ft. in height is to be developed. The mine is equipped with a 250-ton concentrating plant. Mr. Sheridan has acquired the Cooley farm of 160 acres, in virgin territory north of Joplin, and will thoroughly prospect it with a drill.

For years, the John Jackson mine, in Chitwood, a suburb of West Joplin, was the richest zinc producer in the entire district. Then it suddenly went 'blind'; that is, blank limestone walls loomed up where good ore had formely been found. A few prospect drifts were driven into the blank walls, and then operations were abandoned, the big mill removed, and for years the John Jackson land produced nothing. Today it is among the leaders in the production columns of the Joplin camp. It is a perpetual contest between the Granby land, with a half dozen mills, and the John Jackson land, with less than half as many mills, which shall lead the weekly statistics. This shows that a 'blind' mine is not necessarily a dead mine. The John Jackson tract has been acquired by the St. Louis-Joplin Lead & Zinc Co., and in addition to the heavy production now coming from the old drifts of the John Jackson and adjoining leases, a new formation has just been opened in the Goodenough mine, a few hundred yards to the west. Here the ore is found on two levels, the upper ground being soft and pockety, while the lower is a typical sheet formation. A new zinc district, recently opened south of Shoal creek, in the Galena, Kansas, camp, is developing into a lead district as well. In the mine of the Clermont company galena has been found at a depth of 185 ft. The deposit is being blocked out and is proving to be extensive.

DENVER, COLORADO

A GRUBSTAKE FUND.—METHODS OF PROSPECTING.—THE STATE SCHOOL OF MINES.—POLITICS AND EDUCATION.—CRIPPLE CREEK ITEMS.—DRAINAGE TUNNEL EXTENSION.

The committee on mines and mining of the Denver Chamber of Commerce has started a campaign to raise a grubstake of $10,000. The idea is to outfit several prospecting parties to search for new camps. The contributions to the fund are reported as generous, and it is hoped that the desired find will be made. The dearth of prospectors has become a threadbare topic. Other and more attractive regions have claimed a few of our prospectors. The Forest Service has been accused of driving the timid, defenseless prospector from the public domain in Colorado. Many other reasons of more or less importance have been adduced to explain why the old-time burro outfit is such a rarity. The fact is that there are as many prospectors in Colorado as ever. The present-day prospector is the small lessee in the large and productive camps of the State. It may not be out of order to suggest to the committee that in selecting and outfitting these parties a small assay outfit and assayer with some knowledge of minerals should be provided for each party.

Affairs at the State School of Mines are undergoing the annual shake-up. Complaint comes from many quarters that the president of that institution is too active in politics. To anyone familiar with the political situation in Colorado such criticism seems unjust. The success of the school depends largely upon the funds available for equipment and teaching staff. With so many other State institutions, each strenuously urging before the legislature an increase in its particular appropriation, it would be folly for those representing the School of Mines to keep out of the political game. It is to be regretted that this necessity exists. There will be several changes on the faculty of the institution for the ensuing year. Arthur J. Hoskin and Alwyn C. Smith, members of the mining department, have resigned, and also C. E. Smith, assistant professor of mineralogy. Their successors have not yet been chosen.

The Bureau of Mines rescue car, which has been training men in the use of the rescue apparatus in the coal mines in Wyoming, Colorado, and New Mexico, made a short stay in Cripple Creek early in April. As a result, a mine-rescue association has been formed in the district, and two rescue stations are to be built. These stations are to be fully equipped with oxygen helmets, pulmometers, and storage-tanks. The mines in this district need this apparatus more than the usual metal mines on account of the gases given off in some of the mines when the barometer is low. The Deep Drainage tunnel is somewhat of a disappointment to the more optimistic in the camp. The 6000 gallons per minute which is steadily pouring from the tunnel is lowering the water in the southwestern portion of the camp about as fast as the development work needs to be advanced. The mine owners around Victor and Goldfield, however, are becoming impatient, and the directors at first asked for $40,000 to drive the main heading 2000 ft. farther, but nothing will be done at present. The effect of the drainage tunnel, the success of the local mills, and the low treatment-charges at Colorado City are all evidenced by the increased production. For May the production was 79,160 tons, with a gross bullion value of $1,453,437.

LONDON

WAIHI GOLD MINE.—PRODUCTION FOR YEAR.—PROGRESS ON POWER PLANT.—THE ELMORE PROCESS AT BROKEN HILL.—RESULTS OF WORK.—CHANGE OF POLICY.

The agitation against the directors and engineers of the Waihi Gold Mine, New Zealand, has collapsed. Briefly, the position is that the ninth level is not developing well, and shareholders and speculators are alike anxious as to the future. As is usual when calamitous times arrive, irresponsible people indulge in wild vituperation against anybody and everybody connected with the management and administration. In this case such accusations are baseless and the only legitimate ground for a disagreement from the policy of the board is in connection with the disinclination to commission a mining geologist to make a scientific examination. A perusal of the report for the year 1910 affords a calm opportunity for seeing how things stand. During the year 442,020 short dry tons was sent to the three mills, where by amalgamation, cyanidation, and concentration, 182,693 oz. gold and 1,339,707 oz. silver were produced, yielding an income of £926,099. The assay value of the ore treated was 9.3 dwt. gold and 3.8 oz. silver per ton, and was worth about 6s. 5d. per ton less than that treated in 1909, when 416,813 tons was milled. The tube-mill efficiency has been improved and coarser screens used in the stamps. The daily duty per stamp has been increased from 4½ tons in 1909 to 5 tons in 1910. Out of the total of 330 stamps an average of 295 were employed. The batteries are not worked on Sundays. The profit for the year was £559,191, out of which £396,725 has been paid as dividend, being at the rate of 80%. This compares with £446,316 or 90% in 1909, and £421,520 or 85% in 1908, and is identical with the distribution for 1907. Since 1893 the dividends have totalled £3,957,836. After much consultation with the engineers, the directors determined to maintain the present rate of output until the end of June 1911, and then to reduce it to 1000 tons per day. With the present reserve of ore, this policy will provide work for the mills for two years from now, with the prospect of profits at the rate of 40 or 45%. In the meantime development work is to be conducted vigorously at depth. Progress with the new Hora-Hora hydro-electric scheme is well ahead. The water-channel has been excavated and the foundations of the power-house built. There will be six turbines, each rated at 1500 hp., and the current will be transmitted at 50,000 volts over the distance of 49 miles. The directors naturally felt some misgivings as to the advisability of completing this work, after the position at the mine became uncertain. They decided, however, that it was best, as the mine, though at an anxious period of its life, is by no means moribund, to go ahead with the construction, and they are providing the expense out of the reserve fund, so as not to interfere with dividends. At the meeting of shareholders held this week the directors maintained the dignified and straightforward attitude that has always characterized their doings and showed that they never have had any direct or indirect interest in the ups and downs of the share market. Nothing was heard at the meeting of the opposition proposals to remove the office to New Zealand or to appoint lawyers to the board. But the chairman and shareholders were quite disinclined to spend money on a scientific examination of the geology of the district in its relation to the ore deposits.

In a recent letter I wrote at length with regard to the commencement of a campaign in America by the Minerals Separation company which is now introducing its flotation process to the notice of American engineers. I mentioned also that it had captured the Zinc Corporation of Broken Hill on the strength of an old agreement made years before the processes were perfected, and that the Elmore plant is being put out of employment in favor of the Minerals Separation plant. A good deal of misapprehension may arise through this suspension of the Elmore plant, and, in justice to the Elmore people, it is only right to give official figures relating to the excellent results that were obtained. During 1910, 270,637 tons of zinc tailing was treated; of this, 185,917 tons came from the Block 10 dump, 73,223 tons from the British Broken Hill dump, and 11,482 tons from the South Silver. The concentrate obtained assayed 43% zinc, 10.6% lead, and 14 oz. silver. This was re-treated on Wilfleys, and the commercial products were 85,625 tons of zinc concentrate assaying 46.7% zinc, 5.4% lead, and 11.4 oz. silver, and 9319 tons of lead concentrate assaying 56⅔% lead, 16% zinc, and 38⅓ oz. silver. These results refer entirely to the Elmore plant; no figures were available at the time of the report for the performance of the substituted plant. The income from sale of concentrates during 1910 was £324,040, and the profit was £97,906, out of which £89,513 was distributed as dividend at the rate of 50% on the preference shares. For the previous year the preference shares received 25%. They are entitled to 100% dividend before the ordinary shareholders get anything. It will be seen, therefore, that the profits were excellent, and the directors must feel mortified at having to throw out a successful plant. Recently the Zinc Corporation proceeded to acquire a mine, instead of depending on residues from other people's operations. The Broken Hill South Blocks mine has been purchased for shares. This mine contains a lode that is different in tenor from the main lodes of the district, in that it is higher in zinc than lead. Indeed, the assays show a relative proportion of zinc and lead similar to that in the zinc tailing now being treated by flotation.

WASHINGTON, D. C.

SENATE AND HOUSE MINES COMMITTEES.—FIRST-AID CONVENTION.—POWER-PLANT PROJECT.—INVESTIGATION OF THE STEEL TRUST.—ADJUSTMENT OF CONFLICTS.

The new committees of the Senate and House on Mines and Mining were only recently completed by the Republicans in the House naming the minority members. In the Senate, William Lorimer, of Illinois, was selected as chairman of the committee. The present indications are that another chairman will have to be selected soon, as the old charges against Lorimer are being renewed. It is understood that a number of the men who supported him in the old Congress are beginning to weaken under the pressure of public sentiment and that Lorimer must go. The other members of the Senate committee are: Weldon B. Heyburn, Idaho; George S. Nixon, Nevada; George Sutherland, Utah; Simon Guggenheim, Colorado; Miles Poindexter, Washington; Benjamin R. Tillman, South Carolina; Joseph F. Johnston, Alabama; Clarence W. Watson, West Virginia, and Henry L. Myers, Montana.

The House committee has as the chairman of its Mines and Mining committee, Martin D. Foster, a member who

is well liked, able, and takes an interest in mining matters. The other members of the committee are: William B. Wilson, Pennsylvania; Edward T. Taylor, Colorado; Ralph W. Moss, Indiana; George White, Ohio; W. J. Fields, Kentucky; Curtis H. Gregg, Pennsylvania; James A. Daugherty, Missouri; Adam B. Littlepage, West Virginia; Joseph Howell, Utah; Charles N. Pray, Montana; C. Bascom Slemp, Virginia; Robert M. Switzer, Ohio; Charles C. Bowman, Pennsylvania; and Ralph H. Cameron, Arizona.

The Bureau of Mines, with the coöperation of the Pittsburg Coal Operators Association, is planning a national first aid to the injured meet to be held in Pittsburg sometime in September. It has been proposed to invite every first-aid corps of miners in the United States to compete, showing their skill in this important work. The miners take kindly to the instruction as given by the trained miners on the various rescue cars and quite a number of places now have their first-aid corps.

The Lehigh Coal & Navigation Co. proposes to spend $3,000,000 at once in a plant at one of its mines in Pennsylvania, using the waste culm for fuel under the boilers of steam-engines. If successful, and there is no reason to believe it will not be, the company will ultimately extend its plant until $10,000,000 has been invested. It is hinted that not only the factories and cement-mills in the immediate locality will be served with power, but that the long-distance transmission wires will reach into Philadelphia and supply that great city. The culm piles near the proposed central power plant have more than 2,000,000 tons of fuel. It is believed that this plant is but the beginning of a practical utilization of waste fuel. There is no reason why plants cannot be established in the Middle West, using the low-grade bituminous coal direct from the mines, or in the lignite territory of the Northwestern States.

The new Democratic Congress has appointed a committee to investigate the United States Steel Corporation. The Bureau of Corporations has just completed an investigation of the great steel company, and its report is in the hands of President Taft. The results will be handed to the Congressional committee within a day or two.

Frank Mondell, of Wyoming, former chairman of the Public Lands. Committee of the House, has introduced a bill to provide for the adjustment of conflicts between placer and lode locators of phosphate lands. The bill reads: "That in case of any conflict between locators under the placer laws and the mineral-lode laws on locations heretofore made of lands containing valuable deposits of phosphate or phosphate rock, the respective claims of the locators shall be determined as though location of said lands under either of the above laws was valid at the time said locations were made." Miles Poindexter, new Senator from Washington, introduced a bill to authorize mineral entries on lands of the Spokane Indian Reservation, classified and reserved as timber lands.

NEW YORK

Investigation of Steel Transactions.—Miami-Inspiration Consolidation.—Situation at Porcupine.—Foreign Listing of American Securities.—A. S. & R. Co. Dividends.—Reorganizations.

Not many months ago something was said in this column concerning those banking interests which took credit for averting disastrous panics, but at the same time took as salvage some choice bits of cargo from those institutions that found themselves hard aground on a lee shore. One much-criticized transaction of this kind was the 'benevolent assimilation' of the Tennessee Coal & Iron Co. by the Morgan interests, to be later turned over to the United States Steel Corporation. John W. Gates has recently been before the Stanley Committee at Washington to testify as to this deal. It is rather expected that various New York bankers will be called later, and further light sought on the transactions which were jammed through during the strenuous days of 1907 when the depositors stood in double lines extending around three sides of a city block, waiting while paying tellers behind bank and trust companies' counters fought for time, and paid checks only after every possible delay had been interposed.

The situation at Porcupine is in large part unchanged. The most striking feature is the hostility of the big market and of the press. The New York newspapers will not talk about Porcupine. The endorsement of such men as J. Malcolm Maclaren, who recently came over for Bewick-Moreing, or of Walter Harvey Weed, seems of no avail. When railroad connection is completed, there will probably be a rush that cannot be ignored.

The Mines Company of America, which controls the old Creston Colorada at Minas Prietas in Sonora, Mexico, the El Rayo and the Dolores, both in Chihuahua, and the La Dicha in Sonora, has been listed on the London Stock Exchange. The preferred and common stock issues of the A. S. & R. Co. have also been officially listed in London. The Guggenheim companies are just declaring their regular quarterly dividends. There is quite a little harmless exaggeration in these disbursements, as some of the funds are handled three times before reaching a shareholder. A holder of Guggenheim Exploration gets revenue from Nevada Consolidated only when it is paid out as a dividend for the third time. First by the Nevada Con. to Utah Copper, by that company to the Exploration company, and by the latter to the stockholder.

The Black Mountain Mining Co., a reorganization of the old Nogales Copper Co., is defendant in a foreclosure suit brought by a security-holders' committee representing bonds to the amount of about $170,000. The company is chiefly owned by Chicago interests connected with the Chicago & Northwestern railway, and by Green Bay, Wisconsin, people engaged in the pulp and paper trade. The stock has been traded in Boston for some years. The reorganization committee of the United Rico Mines Co. is having trouble in getting its plans adopted. The company was at one time sponsored by an international banking house of New York, members of the New York Stock Exchange. The committee has been able to secure deposits of stock, but is unable to get the necessary cash for prospecting, development, and working capital. The stockholders are now asked to consent that the money on hand be spent in doing prospecting work.

TORONTO, CANADA

The Fire at Porcupine.—Reconstruction Work.—Progress Reports from Porcupine Properties.—Railroad Extension.

On May 20 a bush fire, fanned by a strong wind, destroyed the mine buildings of the Hollinger, McIntyre, and Pearl Lake mines, and damaged other properties. The loss was at first estimated at from $300,000 to $500,000, but later reports are to the effect that it will not exceed $150,000. The Hollinger sustained the principal damage, as nearly all the machinery, excepting the heavier parts, was destroyed and the shaft-houses were burned, the men underground escaping with difficulty. Immediate steps will be taken for the reconstruction of the plant, which may necessitate the building of miles of road to enable the getting in of heavy machinery and material. All underground work will necessarily be suspended in the meantime, and many of the men have been paid off. Shortly before the fire, cross-cutting to the east intersected an orebody 24 ft. wide, yielding an average value of $15 to $18 per ton. The management estimates that there is enough ore blocked out to supply the 30-stamp mill for ten years. At the McIntyre where one power-house and camps were burned, work on the south vein now down 80 ft. will proceed uninterruptedly. New machinery is being purchased for the shaft on the north vein. The Pearl Lake, which lost its office and store-houses and some small buildings, will not be seriously affected. There was a considerable drop in Hollinger and other stocks for a day or two after the fire, but they speedily rallied and at present prices are well maintained, though trading is quiet.

The Scottish-Ontario is driving a cross-cut from No. 1 shaft north 300 ft. to pick up a vein indicated by surface

outcroppings. Several veins have been found in the course of the work. At the Dome the foundation for the stamp-mill has been completed and the building commenced. No. 7 shaft has been made into a double-compartment working shaft to connect with all the workings. The orebody has been tested by drilling to a depth of 700 ft. At the West Dome the compressor house has been finished and the main shaft is down 85 ft., at which level underground work will be carried on. The Preston East Dome has started sinking on two veins and has a large force engaged in trenching and stripping. The Standard is down 60 ft. in No. 2 shaft on a contact between schist and porphyry, following a pay-shoot in the porphyry about 6 ft. wide, stated to average $33 per ton to a depth of 25 ft., when it dipped out of the shaft. A cross-cut will be run at the 100-ft. level to pick it up. A New York syndicate has taken over the Leblanc claims, adjoining the Eldorado Porcupine, which is reported as very rich. It is announced that George E. and T. J. Drummond, of Montreal, have acquired a controlling interest in the Jupiter mines.

The Swastika mine, about twenty miles south of Matheson on the Temiskaming & Northern Ontario railway, has become a shipper. Development has been in progress for three years; a shaft is down 100 ft., a winze 100 ft. below that level, and 1250 ft. of driving and cross-cutting. A five-stamp mill has been for some time in operation and gold to the value of $4400 has been produced. The shaft is to be sunk 500 ft. Trains are now running on the Porcupine branch of the Temiskaming & Northern Ontario railway from Kelso on the main line to Frederickhouse river, a distance of fifteen miles, though subject to frequent delays and uncertainties, owing to the unfinished condition of the track. As a rule travelers prefer to walk. The remainder of the journey can be accomplished by water.

GOLDFIELD CONSOLIDATED MILL.

GOLDFIELD, NEVADA

MAY OPERATIONS OF THE GOLDFIELD CONSOLIDATED.—JUMBO EXTENSION DEVELOPMENT.—THE FLORENCE GOLDFIELD.

Preliminary estimates of the May production of the Goldfield Consolidated Mines Co., just issued by the general superintendent, place the gross recovery from 29,410 dry tons of ore milled at $882,000, an average of close to $30 per ton; operating costs at $215,000, and net profits at $667,000. This is the largest tonnage mined and treated during any month in the history of the company, although the average grade of ore for May was lower than that of the previous two months. The mill treated an average of 949 tons daily, an increase of considerably more than 100 tons per day over the average of last year. The bullion shipment of nine bars last week was valued at $310,000. It is reported that an important ore discovery has been made on the 600-ft. level, at a point between the Clermont and Laguna shafts and, from its position, may be the downward extension of the rich orebody opened in the Bulldog Fraction, purchased a short time ago from the Red Top Extension Co., after the vein had been exposed by lessees. This vein is a part of the Red Top ore channel and has its apex on Consolidated ground. There is said to be an improvement on the 1200-ft. level of the Grizzly Bear workings, where the quartz mass, as stated in the last report of the superintendent, has greater width than on the 1000-ft. level of the Clermont. Results of development on the 900-ft. level of the Clermont are reported to be satisfactory; and the $200 ore reported in the Combination mine is said to be holding out.

Development work on a large scale is to be carried on by the Jumbo Extension Mining Co. In this work the company has the advantage of beginning at a depth of 1030 ft. and has the use of a good plant. The work will be conducted on the Polverde claim, adjoining the Clermont and Laguna of the Consolidated, and the St. Ives and Velvet claims of the Goldfield Merger Mines Co. All of the surrounding claims have produced ore of high grade, and the Polverde itself has been producing ore of shipping grade for the greater part of a year from the Annex lease, covering the central part of the claim. The lessees have exposed ore on the 760, 800, and 850-ft. levels and have explored to the southern boundary of their territory on the 1030-ft. level. A station has just been completed on the 600-ft. level, where the shaft cut the vein. The Jumbo Extension company will continue driving the southern cross-cut on the 1030-ft. level from the Annex shaft, the work to be under direction of Walter S. Norris. The directors of this company last week declared a dividend of 10c., to be paid July 15 to stockholders of record July 1. Of the 1,250,000 shares, constituting the company's capital stock, 971,657 shares have been issued. After the forthcoming dividend is paid the treasury will contain a cash balance in excess of $100,000.

A discovery of good-grade ore has been made on the 500-ft. level of the Florence Goldfield mine at a point between the main shaft and the old workings of the Engineer's lease. High-grade ore is now being broken from this ore-shoot in which drifts are being extended north and south. The main shaft has reached a depth of 900 ft., at the bottom of which station No. 10 will be cut, making the tenth level the main working level below the 500-ft. Laterals are to be extended north, east, and south from this station to explore the downward extension of several ore-shoots from which the company and the early lessees have extracted high-grade ore on upper levels.

General Mining News

ALASKA

Ketchikan District

The Victor Copper Co., whose work on Gravina island is in charge of Patrick Heaney, has driven a cross-cut over 2000 ft., whereby several veins of chalcopyrite ore have been interseeted at great depth. Driving is to be continued some distance farther to cut other veins before stoping and shipping are begun. James W. Malcolmson and M. McTernan, of Kansas City, stockholders in the company, inspected the property last month. The principal supply point is Ketchikan.

Prince William Sound

William Morris has purchased a controlling interest in the Brooks-Hardenburg copper property in the vicinity of Iliamna, on the west side of Cook inlet. Mr. Morris is said to represent some of the large copper operators in the States.

Seward Peninsula

The steamships *Victoria* and *Senator* sailed from Seattle for Nome the first week in June, both loaded to full capacity with passengers and freight. It is expected the former will be the first of the larger boats to lead the way through the ice floes of Bering Sea this season.

The Tanana

(Special Correspondence.)—W. F. Copeland, representing the Guggenheims, has opened offices in Fairbanks and has a Keystone drill ready for work on lower Fairbanks creek, to prove the ground tied up on options by Falcon Joslin last year. The prospect is that dredges may be operated there. The Fairbanks Quartz Development Co. has taken a 15-year lease on the Butler-Petree and Rex properties, on Chatham creek. It is the intention of the company to develop the property this season. It has a good surface showing. The directors of the company are J. R. Mathews, Tony Nordale, E. R. Peoples, Martin Harrais, and R. C. Wood. Stock in the Fairbanks Core Drill & Mining Co. is now being subscribed for by local people, and the intention is to have one Davis Calyx drill that will extract a 3-in. core to a depth of 800 feet.

While most placer areas are speedily worked out, those of the Fairbanks district seem to persist with new finds every year. A summary of placer work last winter shows new pay on several creeks. Besides the new paystreak found on the left limits of both Fairbanks and Goldstream, Eva, Fish, and Ester creeks will be producers. Probably the biggest producers will be the Niggerhead and Alabama associations at the mouth of Dome creek, with the left limit pay on Goldstream a close second. Rich ground is also being prospected by Jim Lashbaugh on Engineer creek.

Fairbanks, May 25.

ARIZONA

Cochise County

The lessees working in the mines of the Tombstone Con. Mines Co. are making regular shipments of ore to the Douglas and El Paso smelters. The Great Western M. Co., operating in Courtland camp, is shipping one car of ore per day to the Douglas smelter.

Greenlee County

The 1910 production of the mines of this county, according to data supplied the county assessor, aggregates $9,262,202, distributed as follows among the mines of the Clifton-Morenci district: Shannon Copper Co., 15,873,481 lb. copper, 984.47 oz. gold, 47,726 oz. silver, valued at $2,067,735; Arizona Copper Co., 33,391,530 lb. copper, valued at $4,253,413; Clifton Copper Co., 206,419 lb. copper, value, $26,293; Detroit Copper Co., 22,546,201 lb. copper, valued at $2,871,935; Standard Consolidated, 50,582 lb. copper, 3347 oz. silver, valued at $8235; Standard Copper mines, 270,540 lb. copper, value, $34,461. The Shannon and Arizona Copper companies both increased their output for 1910 over that of 1909. The April production of the A. C. Co. was 2,840,000 lb. of copper.

Mohave County

The Frisco Mines & Power Co., the property of which is at Union Pass, is mining and milling ore having an average value of $12 per ton. A recent mill-run of 100 tons showed an average of about $20 per ton. The principal metal of value is gold, and the mine workings expose a big tonnage of ore in a wide vein. This camp is about 25 miles west of Kingman.

The Bi-Metal mine and mill, 3 miles from Kingman, were inspected last week by mining men from Denver, with the idea of resuming operations if, on examination, the conditions appear to justify doing so. The property has been

MORENCI, ARIZONA.

idle since last year. The property comprises 100 acres of mineral ground on the Santa Fé railroad, where the formation is granite-porphyry, with intrusions of diorite, through all of which some free gold is disseminated. It belongs to the Arizona Gold Mines Co., in which E. M. Lamont, of Denver, was managing director. The last week's run of the Gold Road mill resulted in a clean-up of $17,000. The tonnage of ore treated during that week was smaller than usual.

Pima County

The Helvetia Copper Co., having an area of about 800 acres of mineral land at Helvetia, in Santa Rita mountains, 30 miles south of Tucson, has ceased operations because of the lack of funds to pay further expenses. It is said, however, that the company has no debts. The mine development has exposed a big tonnage of copper ore, both carbonate and sulphide, running 2 to 3%, but as the mine is 20 miles from the railroad, expenses of operating are high, leaving no profit. The smelting plant contains a 100-ton copper furnace. The heaviest production was during 1906 and 1907.

The Cerro Colorado mining property, 4 miles west of Arivaca, is being equipped with a 150-hp. steam boiler, a double-drum hoist, cages, air-compressor, and drills, F. J. Snyder being in charge. Assays of one lot of samples of the ore by E. A. Jacobs, of Tucson, are said to have shown 24% copper and 58 oz. silver; another lot assayed 12% copper and 156 oz. silver.

Pinal County

The Magma Copper Co., which is developing its Queen mine, at Superior, has finished the work of sinking the 2-compartment shaft to a depth of 800 ft. A cross-cut, being driven from the side of the hill, is to be connected with the shaft at 280 ft. below the collar of the latter. A good-sized station is to be cut at this connecting point, where a hoist will be put in position, making this the principal hoisting station for ore and waste, which are to be hauled out to the surface through the cross-cut. The fissure vein has been opened by cross-cuts driven from the 300, 400, and 650-ft. stations, whereby it was demonstrated that the vein is about 8 ft. wide, the ore assaying high in copper and silver. A similar cross-cut is now being driven to the ore from the 800-ft. station. This camp is about 30 miles north of Florence.

A proposal to consolidate the interests of the Ray Con-

tral and Arizona-Hercules, at Ray, is being considered by those concerned. The Ray Central holdings lie on the west side of Mineral creek and north of the Ray Con. group; while the Arizona-Hercules holdings of 240 acres lie on the east side of Mineral creek, extending about 3900 ft. along both sides of the Ray fault, or contact of diabase and schist. The Ray Central is developed from a vertical shaft, and the Arizona-Hercules has been thoroughly prospected by churn-drill holes. The former is controlled by stockholders represented by J. B. Cummins; the latter is owned by W. P. Dunham and associates. Both are within the zone of copper-bearing Pinal schist, in which the Ray Con. has developed great ore reserves.

Yavapai County

The Gray Eagle and Cleveland mines, in the Bradshaw mountains, near Crown King, have passed to the Tiger Gold Co., for $60,000, the last payment of $5000 having been made recently to P. Kearney for his interest in the property.

W. C. Clark, manager for the United Verde Copper Co., operating the mine and smelter of that name at Jerome, recently visited most of the smelting plants in Arizona, and is reported as having stated that a new smelter probably would be built at the United Verde mine. The plant now in use, while it has been altered and enlarged some in the last 10 years, was originally built about 16 years ago.

CALIFORNIA

Amador County

(Special Correspondence.) — The Kennedy shaft has reached the depth of 3550 ft., including a 100-ft. sump. The shaft is expected to cut through the hanging-wall vein at a depth of 3800 to 3900 ft., and the foot-wall vein at about 500 ft. deeper. The lowest working level at present is the 3450-ft.; from the 2300 to the 3450-ft. levels the orebodies range from 5 to 12 ft. wide, the ore being of milling grade throughout. North of the shaft the shoots are about 500 ft. long, while to the south they have a length of 700 ft. On the bottom level the vein is 15 ft. wide. In addition to the usual grade of ore mined and milled, there are in places small bodies of high-grade quartz, assaying $1000 per ton, the management guarding this closely at all times. Ore for the 100-stamp mill is being taken from ten levels, and 500 tons per 24 hours are crushed. From the mortars the ore passes to amalgamating plates, thence to forty 6-ft. vanners. The tailing is treated on canvas tables, and the concentrate is treated by the chlorination process, the company having its own plant for this purpose. About 92% of the assay-value of the ore is recovered at a cost of $5.50 per ton. Approximately 350 men are employed. The company pays monthly dividends, ranging from 15 to 30 cents per share. Webb Smith is superintendent. It is reported that a 4-ft. vein of ore assaying $22 per ton has been opened on the 800-ft. level of the Lincoln Consolidated. The discovery was made in the south drift. Developments will be conducted from the next lower level to prove the extent of the discovery. The mine was formerly a noted producer. South Eureka orebodies are reported to be showing up favorably. The mill is running at full capacity. It is reported that persons representing Eastern interests are about to resume work at the Plymouth Consolidated.

Jackson, June 5.

Inyo County

The Estella Mining Co., having a group of claims on Cerro Gordo mountain, 4 miles from Keeler, began two years ago to drive the Troeger cross-cut to tap at great depth the Morning Star vein in which high-grade ore had been mined near the surface. This cross-cut now has a length of 4000 ft., and in the vicinity of the present heading a vein was intersected which is said to contain 12 ft. of tetrahedrite ore, samples of which assay about $200 per ton. The place where the vein was discovered is 2000 ft. vertically below the surface. The cross-cut is to be extended to the vein for which it was started. At the portal of the tunnel is an air-compressor, driven by a gasoline engine. By other development this company has placed 200,000 tons of ore on the dumps. R. C. Troeger is manager for the company.

Mariposa County

The Oro Rico Mines Co. has just purchased of the Joshua Hendy Iron Works the complete equipment for a 20-stamp mill, including amalgamating plates and Deister concentrating tables.

Merced County

The Yosemite Dredging & Mining Co. is operating a dredge with 3½-cu. ft. buckets, on the Merced river, the operating headquarters being at Snelling. James W. Neill of Pasadena is one of the directors.

Placer County

(Special Correspondence.)—The Pioneer mine, situated near Towle, is an old property, comprising 17 patented and 8 unpatented lode claims, containing two parallel veins, about 900 ft. apart, each having a dip of about 65°, and lying between greenstone and slate. Both veins have been opened to a depth of 1100 ft. by a 2600-ft. cross-cut, which is used as the main working-level. Drifts on the veins, at this level, aggregate about 2500 ft. The width of the veins varies from 4 to 70 ft., the gangue material consisting of quartz and argillite, containing gold that occurs free and associated with arseno-pyrite. The property is equipped with a mill, having four 5-stamp batteries of 900-lb. stamps, amalgamating plates, and Frue vanners, in which about 80 tons of ore per day is being treated. Of the saving made, close to 80% is recovered on the plates, and 20% in the concentrate. The average value of the ore milled is close to $10 per ton. The mill machinery and air-compressor are driven by water-wheels under pressure of water from the American river. The property is now owned by the Consolidated Pioneer Gold Mines Co., by which it has been operated during the last year, and for which H. W. Morris is superintendent.

The Helen-Esther M. Co., which is operating what was formerly known as the Rawhide mine, two miles north of the Pioneer, and on the same vein system, is adding 30 stamps to its 10-stamp mill. This company, for which J. L. Bryson is manager, purchased the property two years ago. The former operators are said to have milled 40,000 tons of this ore, which averaged $5 per ton. The Helen-Esther company is made up of Massachusetts people.

Towle, June 3.

The El Dorado-Placer Gold Dredging Co. is operating a dredge of the Risdon type, with 3½-cu. ft. buckets, on the middle fork of American river, the work being in charge of Charles H. Schooler. The ground being dredged is in the deep canyon of the river, the walls on both sides rising to a height of 3000 to 4000 ft. The equipment and material for building the dredge had to be lowered from the top of the cliff to the bed of the stream by means of a surface tramway provided with winding machinery. The work is in the vicinity of Newcastle.

Shasta County

The Little Nellie mine, in the vicinity of the Iron Mountain mine of the Mountain Copper Co., near Keswick, has been equipped with a 10-stamp mill, which is now in operation, in charge of A. B. McVay. The ore being treated is said to run about $17 per ton.

Siskiyou County

A. B. Dodd and S. J. Silva are operating the Mono mine, situated near Yreka, under an option to purchase it. The work is in charge of G. Winwood. J. Salisbury has leased the Hazel mine, near Hornbrook. The water is being pumped out of the shaft, and the timbering is being repaired.

Gold nuggets and fine particles of gold of the value of $1400 were extracted last week from the Little Bonanza mine, in the vicinity of Hawkinsville, by Newton Gordon, owner of the property.

Tuolumne County

(Special Correspondence.)—Operations are to be commenced at the New Era mine by A. C. Redding and W. F.

Russell, to whom the property was recently bonded by W. T. Carter. A body of good-grade ore was uncovered a few days ago on the 1150-ft. level of the Harvard mine. At the Helm-Hiatt mine, near Deer creek, an adit is being driven to tap the vein far below the old workings. With only an arrastre to crush the ore, the property was worked with fair success a number of years ago. The Tappie mine, situated between Rawhide and Tuttletown, has been bonded to Albert Morgan and Walter Talbert, and preparations are under way for the operation of the property. Repairs are being made to the mill, and a building to be occupied by the employes is being erected. The milling of 220 tons of ore from a 6-ft. vein at the Chileno mine, on Jackass hill, operated by C. A. Gillis, gave returns of $5 per ton in free gold, in addition to which 24 tons of concentrate was saved which yielded $20 per ton. The crushing plant on the property is unsatisfactory and a new one will probably be constructed. The Berkeley Mining Co., which recently brought suit against the owners of the Ida Klein mine to recover money paid on the purchase price of the property, alleging that fraud had been practised, is the defendant in an action instituted on May 31 by A. A. Jacobs, who seeks to force the mining corporation to pay $1238. Of this sum $814.25 is said to be due for supplies furnished by plaintiff, the balance representing two assigned claims, one of $227.16 from the Jamestown Lumber Co., and the other of $196.69 from W. E. Booker.

Tuolumne, June 3.

COLORADO

Clear Creek County

(Special Correspondence.)—The Lucania adit, on Bellevue mountain, is being driven at the rate of 200 ft. per month. An 8-in. streak of gray copper ore has been uncovered on the third level of the Lombard mine, assaying $300 to $500 per ton in silver and gold. Chalcopyrite has been found at the bottom of the 60-ft. shaft, on the Empress vein, running $90 per ton in gold and silver. It is stated that work will be resumed in the Honest John adit on Chicago mountain. The bore is now in 2300 ft. Work on the reduction plant that is to be provided with the McKelvey amalgamating process has been commenced. A shipment of 8 tons of smelting ore from the Silver Horn mine sampled 200 oz. silver and 2 oz. gold per ton. E. Hunter is manager. N. J. Pike & Co., leasing on the Old Town mine, sent out a carload of smelting ore last week, gross returns for which were 5.70 oz. gold, 10.20 oz. silver per ton, and 4.10% lead.

Idaho Springs, May 19.

(Special Correspondence.)—A. Erickson, leasing on the third level of the Seven-Thirty mine, has started a drift on an 8-in. streak of gray copper ore that samples 395 oz. silver per ton. The 50-ton mill at the Conqueror mine, Covode mountain, was started last week. George Schneider, the manager, states that work on the new 200-ton mill will be started at once. J. L. Cutting has a contract to drive 500 ft. on the Clinton vein, in Daily district. S. A. Offerson, leasing on the Gold Dirt mine, is stoping on a body of smelting ore 18 in. wide, that assays $70 per ton in gold. Ore is being shipped to the Golden smelter. A body of steel galena 2 ft. wide has been uncovered in the 300-ft. raise driven from the adit on the Aetna vein at the Capital mines. A shipment made shows the ore to be worth $120 per ton in gold, silver, and lead. A road is being constructed from the flat on Alpine mountain to the Sporting Times mine.

Georgetown, May 28.

Gilpin County

(Special Correspondence.)—The London claims, in Twelve Mile district, have been taken under bond and lease by A. T. Holman, representing a syndicate of Michigan investors. There is a 100-ft. shaft, with some drifting on the vein. The Moon Anchor mine will be an ore-shipper this summer. It contains a 3-ft. vein of smelting ore on which a drift is being advanced. The ore samples $40 per ton in gold. P. Fransen is manager. Stephens & Co., leasing on the 600-ft. level of the Topeka mine, are shipping mill ore that has a value of $10 per ton. The smelting ore samples $25 per ton. A shipment of 20 tons of smelting ore from the Federal mine, made by R. Hughes, brought a settlement of $51.38 per ton in gold and silver. Operations are on the 400-ft. level.

Central City, May 29.

Lake County (Leadville)

Burton, White & Co., lessees on the Chrysolite mine, have developed a body of zinc carbonate, 12 ft. wide in some places, the ore in which is about 36% zinc. The property is a regular shipper. The Western Mining Co., S. D. Nicholson, manager, is operating the Wolftone, Maid of Erin, and other mines on Carbonate hill, and shipping zinc ore.

Teller County (Cripple Creek)

The ore output of the mines in Cripple Creek district during May amounted to 79,160 tons, of an average grade of $18.35 per ton, the total value of bullion extracted being

GOLDEN CYCLE MINE, CRIPPLE CREEK DISTRICT.

$1,453,437. The tonnage and value of ore treated at the six principal mills, which run on Cripple Creek ore, together with that sent to smelters, are given as follows:

Plant.	Tons.	Average Value.	Gross.
Golden Cycle	29,070	$20.50	$595,935.00
U. S. R. & R.	14,165	22.00	311,630.00
Portland	10,000	20.00	200,000.00
Portland, Victor	10,075	3.57	35,967.75
Stratton (Est.)	10,600	3.10	32,600.00
Wild Horse	1,050	4.10	4,305.00
Smelters	4,200	65.00	273,000.00
Totals	79,160	$18.35	$1,453,437.75

It will be noted that only the highest-grade ore was shipped to the smelters; that the mill ore grading from $20 to $22 per ton was shipped to the big mills at Colorado City, while over 21,000 tons of ore sampling from $3.10 to $4.10 per ton was treated at the Portland, Stratton, and Wild Horse plants in the district. The Western Reduction Co., operating a mill at the Isabella mine, has commenced work, and will doubtless make a report of June business.

The Elkton Con. M. & M. Co. is sinking its main shaft as rapidly as the water-level is lowered as the result of the drainage through the Roosevelt tunnel, the bottom of the shaft being now below the 900-ft. station. A winze has been sunk 60 ft. below the 900-ft. level in ore that assays about $40 per ton. The ore below this level, without sorting, is said to average $35 per ton. Henry Von Phul and associates are shipping ore taken from the Fair Chance ground, on the western slope of Beacon hill. Their ore is mined in a 3-ft. vein, samples of which assay $15 to $40 per ton. George Diamond and Charles Walker have a 2-years lease on a block of the Coriolanus mine, on Battle and Squaw mountains, expecting to operate through the Columbine-Victor lateral, by which this property is tapped at 600-ft. depth. Charles Stream and Charles Erne have a similar lease on another block of Coriolanus ground. The royalties to be paid by lessees will vary according to the grade of the ore. This property belongs to T. B. Burbridge.

D. H. Curry, lessee on the Monument mine, near Victor, is mining ore running about 2 oz. gold per ton from the 500, 400, and 500-ft. levels, and is shipping 3 to 4 cars per week. The Rubie Mining & Leasing Co. has its lease renewed on the Rubie and Lafayette mines, on Bull hill. These mines belong to the Princess Alice G. M. Co., and the lease continues till January 10, 1914. The leasing company is shipping 100 tons per week of ore assaying 2 oz. gold per ton. It pays royalties graded from 10 to 25%. The Ajax mill, being built on Battle mountain, probably will be ready for work in July. The equipment provides for the Clancy method of cyanidation, in which the Moore filters perform a part. The Cavanaugh cyanide plant, being erected at the Jo Dandy mine, Raven hill, is soon to be ready to treat ore. The Jerry Johnson, Forest Queen, and W. P. H. mines, situated on Ironclad hill, all in the hands of lessees, are regular ore shippers, 5 cars having been sent out on May 30. Shipments of two cars were made on the same date from the Deerhorn mine, Globe hill, belonging to the Stratton estate, and under lease to William Fitts.

It is announced that the directors of the drainage company have decided not to undertake the extension of the Roosevelt tunnel at present. The average subsidence of water in the district since the water channels were tapped by the tunnel is said to be about 36 ft., or not more than 6 ft. per month, which is much slower than was anticipated. One estimate places the volume of water in the district basin at 40,000,000 gal. per vertical foot. The outflow through the tunnel is 6000 gal. per minute.

IDAHO

Blaine County

The Blaine Mining Co. is to re-open and work the Solid Muldoon mines, at Tustin, in the Wood river country. Samuel and David E. Crawford, of Michigan, and E. C. Eastman, of Wisconsin, are principals in the company, and H. J. Allen of Hailey is to have charge of the work.

The Boulder Con. M. Co., composed of William Schultz, of Hailey, M. W. Wood and L. J. Falk, of Boise, and others, has driven an 800-ft. cross-cut on a group of claims, 25 miles north of Hailey, by which two veins of ore have been opened, and from these some high-grade ore has been extracted and sold. The group is on Boulder creek, at the base of the Sawtooth range. The cross-cut is to be extended, and if continued to a point below the crest of the range, as contemplated, it will have attained a depth of 3800 ft. Mr. Schultz located the claims 31 years ago.

Idaho County

The custom mill of the Elk City Reduction Co. is expected to be ready for work by July, and a sufficient tonnage of ore is said to have been pledged to keep the mill running the rest of the summer. Most of the ore mined in this locality is incidental to development work. The Elk City Mines Corporation, which operates the South Fork mine and mill, near Elk City, cleaned up gold bullion valued at $3500 as the result of 12½ days run of a 5-stamp mill. Operations are to be continued.

Shoshone County

(Special Correspondence.)—The report for the seven months of the fiscal year ended March 1911, just issued by the Federal company, shows a gain of $347,000 over the corresponding period a year ago, which means there was a surplus of $194,000 after paying charges and dividends on preferred stock, as against a deficit of $153,000 for the same period 12 months ago. The earnings for March were $118,000, an increase of $55,000 over the same month a year ago. As preferred dividends call for $840,000, the company already has earned for the current year within $156,000 of its needs in this respect.

Wallace, June 1.

The Bunker Hill & Sullivan Mining & Concentrating Co., the great mines of which are at Wardner, is reported as having seven years' supply of ore blocked out. The company is operating two concentrating mills and a tailing plant at Kellogg, the two mills treating about 1350 tons of ore per day. The third concentrating plant is being erected, and when it is ready to operate the combined capacity of the three mills will be 4500 tons of ore per month.

MONTANA

Broadwater County

(Special Correspondence.)—The Ohio Keating M. Co., operating in the Radersburg district, has about completed arrangements for building a concentrator for treating its low-grade ore. The company at present is shipping three carloads of ore each week.

Radersburg, June 3.

Silverbow County

(Special Correspondence.)—Although no official information has been given out, there is a report, which seems to be well founded, that the Butte & Superior company will not undertake construction of a concentrator this year, but will continue to ship its ore to the Basin reduction works. Under present conditions the company is getting good results, and it is felt that a large treasury fund should be accumulated before the erection of the mill is undertaken.

Butte, June 3.

NEVADA

Humboldt County

The Gold Ledge M. Co., made up of Kansas City people, has developed its mining claims, situated on Kramer hill, 2 miles south of Goleonda, and has constructed a mill that is to be ready to operate this month. The ore is taken from the mine through an adit-level by which 200-ft. depth on the vein is gained. A winze is also being sunk on the vein from the adit-level. Charles J. Frye, of Kansas City, is manager for the company. The Wanonah Mining Co. is developing a mining property at Gold Run, 12 miles south of Goleonda. A body of ore, opened by a long cross-cut, has proved to be 20 ft. wide, some of the ore therein being of shipping grade. A raise made from the cross-cut to the workings above it has given good ventilation. D. E. Moore is in charge of the property. Work is being performed on the West Dip, Black Diamond, Nevada Crown, and Warren placers, in the same district.

Esmeralda County

(Special Correspondence.)—The estimated production of the Goldfield Con. Mines Co. for May amounted to 29,410 tons of ore. Gross value of metals recovered, $882,000; operating costs, $215,000. Net profit for the month, $667,000. Mines looking well.

Goldfield, June 3.

Lyon County

The Nevada-Douglas group of mines, in Yerington district, comprises the Douglas, with 200,000 tons of ore developed that is estimated to run 3% copper; the Copper Basin, on which close to 50,000 tons is opened, running 4.5%; the Ludwig, in which there is claimed to be developed nearly 600,000 tons of ore, estimated to assay 5.4% copper. A shipment of 1192 tons of ore from the Douglas mine sampled 13.49% copper, 0.01 oz. gold, 0.67 oz. silver, 20.28% iron, 22.72% silica. This company built the Nevada Copper Belt railroad from Wabuska to Douglas, via Mason, a distance of 33 miles, now in operation.

Nye County

(Special Correspondence.)—The control of the Plamenaz lease on Union No. 9 claim has passed from C. B. Putman and James Shea to the Manhattan War Eagle M. & M. Co. for a reported consideration of $20,000. In addition to the cash payment, the purchasers have granted a long-term lease to Putman & Shea on the Jumping Jack. Operations on the latter will be commenced by the lessees. The Jumping Jack is near the Big Four, being separated from it by the Golden Wedge. The Big Four Leasing Co. has its air-compressor and motor in place, and electrical connections are being made. The sinking pump, at the 220-ft. station, soon will be lowered to the 300-ft. level, and driving for the vein will be started at this station.

Manhattan, May 31.

The output of the mines of Tonopah for the week ended

June 3 was as follows: Tonopah M. Co., 3000 tons; Belmont, 2910; Montana-Tonopah, 1045; Tonopah Extension, 980; Midway, 50; West End, 150; total, 8135 tons, of the estimated value of $203,375.

The Bonnie Clare M. Co., for which J. L. Hisey is manager, is starting its 100-ton mill in operation at Bonnie Clare station. The ore supply is being hauled from the mines of this company on Gold mountain, 9 miles away. It is expected that some custom ore will be received from other mines at Gold mountain and Horn Silver. The mill machinery is driven by electric power from the line of the Nevada-California Power Co. The proposal to build a trackless trolley line from Bonnie Clare to Gold mountain, for service in ore haulage, is being considered.

STOREY COUNTY (VIRGINIA CITY)

The Mexican G. & S. M. Co., during the week ended June 3, did some cross-cutting on the 2200-ft. level; and drove the north drift No. 2, from the east cross-cut, 18 ft., extended the south drift 11 ft. on the 2300-ft. level; and started a raise from the south drift, from which 66 mine-cars of ore were taken, averaging $57 per ton. On the 2400-ft. level, the north drift from the west cross-cut off north drift No. 2 was extended 25 ft., and from that drift 108 cars of ore averaging $19.47 per ton were taken; and in the north drift from east cross-cut No. 2, at 366 ft. in, a raise was driven 15 ft. in ore, from which 72 cars of ore, assaying $72.98 per ton, were mined, and in cutting out for a chute 15 cars of porphyry and quartz were taken of an average value of $19.04 per ton; work was done on the first, fourth, and fifth floors of the stope at the end of the north drift on the 2500-ft. level, from which 101 cars of ore were mined, assaying $88.90 per ton, also 6 cars of porphyry sampling $20.65 per ton. During the week there were shipped three railroad cars of first-grade ore to the smelter.

The estimated production for the week of the Mexican, Ophir, and Con. Virginia, known as the north-end mines, aggregated 757 tons, of the value of $32,459. The Mexican produced 368 mine-cars of ore, valued at $21,011; the Ophir's output was 230 tons, worth $9902; that of the Con. Virginia being 159 tons, valued at $1545.

WHITE PINE COUNTY

The Allen mine, under lease to Ed Wilson and Ole Johnson, of Ely, and situated in the Red Hills district, 40 miles northeast of Ely, is a producer of high-grade lead-silver ore. These lessees have hauled 80 tons of the ore 60 miles to Currie station, from which place it was shipped to the smelter.

NEW MEXICO

The gross output of coal mined in New Mexico during the last fiscal year amounted to 3,293,486 tons; coal consumed in operating the mines, 38,533 tons; unwashed slack and coal sent to coke ovens, 802,676 tons; coal shipped to market, 2,433,739 tons; coke marketed, 397,102 tons. Value of coal and coke shipped, $4,693,870, an increase over that of the preceding year of 19.7 per cent.

GRANT COUNTY

The Chino Copper Co. has four 90-ton and one 40-ton steam shovels in operation on its copper properties at Santa Rita; the result of their operations is that 334,000 cu. yd. of overburden has been stripped off the orebodies, and 134,000 tons of copper ore has been accumulated in the stock piles. The first unit of the concentrating mill is expected to be in operation next month.

SOCORRO COUNTY

(Special Correspondence.)—The Maud Mining Co. has its steam-hoist in place for sinking its two-compartment shaft. About 15 men are now employed. The clean-up last week at the Deadwood mines amounted to 2350 oz. gold and silver bullion. The tonnage of ore crushed was 280, with 15 sacks of concentrate. The third drift west of the Socorro mine is still in good ore. This is the level from which a shipment of high-grade ore was made some time ago. The mill is treating 150 tons daily, operating on average-grade ore. The Oaks Company has advanced its tunnel 15 ft. About half of the crew's time is spent in grading a road leading to the site. The portal of the tunnel will be timbered with square-sets as soon as the material can be delivered. An air-compressor is to be provided, to be driven by a gasoline engine.

Mogollon, June 3.

OREGON

JOSEPHINE COUNTY

The smelter of the Almeda Con. Mines Co., situated at Galice, is treating about 100 tons per day, and turning out 10 tons of matte.

UTAH

SALT LAKE COUNTY

(Special Correspondence.)—Utah Copper is making preparations to increase its production. It is probable that the company will increase the output sufficiently to leave a good margin over the $3 annual dividends. The last statement showed that the company was cutting close to the line with its previous rate of production. The regular quarterly dividends of the Utah Copper and Nevada Consolidated have been declared, the former 75c. per share and the latter 37½c. The total of Utah Copper dividend is $1,171,987, bringing the gross amount to date to $9,136,565. Nevada Con. will pay $749,380, bringing its total up to $5,081,371. Both dividends are payable June 30. The annual statement of the Bingham Mines Co., gives the total assets December 31, 1910, as $2,148,676, of which $128,812 is in cash and accounts receivable. Accounts payable are $352, and floating indebtedness $47,439. Capital stock is $945,560, and the balance of the liabilities are in the funded debt. Ohio Copper Co. will hold its annual meeting June 7, at Portland, Maine. It is reported that the gathering will show F. A. Heinze to have surrendered his control. The directors of the Bingham Mines Co. have submitted two plans of reorganization which will be considered at the annual meeting June 21. The present capital is 800,000 shares, par value $1. One plan is to increase the number of shares and issue convertible bonds. Another is to form a new company of 300,000 shares, par value $5, set aside 160,000 shares for exchange of the old stock, and put the balance in the treasury for sale. It is also suggested to make the stock assessable. The directors state that the orebodies already developed justify vigorous development.

Salt Lake, June 1.

WASHINGTON

FERRY COUNTY

(Special Correspondence.)—There was shipped from the mines of Republic district 3700 tons of ore to the smelters during May. It is estimated that over 7000 tons of ore of milling grade was broken and stored, in the meantime, to await the completion of the mill of the North Washington Power & Reduction Company.

The Knob Hill company has received the smelter returns from 3 cars of ore which show as follows: 198,036 lb., assaying 3.62 oz. gold and 7.01 oz. silver per ton. The gross value of the shipment was $7166.94; net returns, $6065.18. Returns from another carload show 1.835 oz. gold and 3.85 oz. silver per ton; dry weight, 91,922 lb.; gross value, $1692.14; net returns, $1177.53. The Knob Hill company declared a dividend May 29 of $10,000. The Quilp M. Co. paid a dividend of $15,000 on May 25, making $52,500 to date. The mine is leased to the Imperator-Quilp company.

Republic, June 3.

CANADA

BRITISH COLUMBIA

The Standard Silver-Lead M. Co., operating the Standard mine, near Silverton, has sufficiently advanced No. 6 adit to enable the miners to drive a cross-cut to the ore-shoot on that level. This shoot of silver-lead ore has been well opened on No. 5 adit, those workings extending from No. 5 to No. 4. The orebody has been followed below No. 6 by a winze. The concentrating mill and aerial tramway are both under construction and probably will be in operation by August.

Decisions Relating to Mining

Specially reported for the MINING AND SCIENTIFIC PRESS.

ACTION TO RECOVER FOR DRILLING—CONTRACT FOR CORE DRILLING

In an action to recover for services in drilling under a contract calling for 'core' drilling, the fact that the first five holes were drilled by hand did not make the drilling by hand a separate and independent contract, where the hand drilling was also 'core' drilling.

A. J. Yawger Co. v. Buttz, (Indiana) 91 Northwestern, 568. April 1910.

TITLE TO OIL

The owner of land has no specific title to the oil therein until it has been removed from the earth. Petroleum oil is a mineral, and while in the earth it is part of the realty. If it moves from place to place by percolation or otherwise, it forms a part of that tract of land in which it remains for the time being, and if it moves to another tract it becomes a part and parcel of such tract, and it forms a part of some tract until it reaches a well and is raised to the surface, and then it first becomes subject to distinct ownership separate from the land and is personal property, the property of the person who has taken it from the well into which it came. This rule applies whether the oil moves, percolates, or exists in pools or deposits. In either event, it is the property of and belongs to the person who reaches it by means of a well, and severs it from the realty and converts it into personalty.

Bender v. Brooks, (Texas) 127 Southwestern, 168. April 1910.

TAXATION OF MINERALS.

Where the ownership of the surface and of minerals under the lands has been separated, an assessment and sale for taxes of mineral rights in a tract of land is a sufficient description of the ownership of the property in such minerals, and a tax deed containing such description is not void for uncertainty. The payment of taxes on a tract of land by the surface owner is not payment of taxes on minerals beneath the surface owned by another person and separately assessed with taxes in the name of the owner of minerals.

McGraw v. Lakin, (West Virginia) 68 Southeastern, 27. April 1910.

MINING RIGHTS

Mining rights must include incorporal hereditaments lying in grant but not in seisin; such as rights of way over the surface, the right to dig and drive slopes and entries, and the like rights of an intangible nature and incapable of being delivered of possession by the owner. Such rights include not only the minerals, but right of way and other uses of the surface necessary for the enjoyment of title to the minerals.

McGraw v. Lakin, (West Virginia) 68 Southeastern, 27. April 1910.

MINING LEASE—EFFECT OF NEW LEASE

Where the lessees under a mining lease accepted a new lease containing a part of the same and other property, and containing material provisions inconsistent with the old lease as to certain rights and liabilities under the original grant, such new lease constitutes a surrender of the old lease by operation of law as to so much of the land within the old lease as was included in the new. But the surrender of such old lease by the execution of the new, imposing different obligations not being a condition of the grant, could not effect the interests of a prior attaching creditor as to rights previously created and then existing against the tenant in the leasehold estate.

Hughes v. Farmers' National Bank, (Vermont) 76 Atlantic, 33. May 1910.

Personal

Professional men are invited to send news of their engagements and travels. Such news is interesting to friends.

J. W. FINCH is at Goldfield.

S. F. SHAW is at Elkton, Virginia.

JAMES W. NEILL is in San Francisco.

O. H. PACKER is at Sutter Creek, California.

WILLIAM C. GREENE, of Arizona, is in San Francisco.

GEORGE E. COLLINS returned from Wisconsin, June 3.

H. FOSTER BAIN is in SaltLake and will go to Virginia City.

WALDEMAR LINDGREN was in San Francisco and has gone to Nevada.

C. H. VOLL has gone to Valdez, Alaska, where he has opened a branch office.

H. VINCENT WALLACE has returned to El Paso from Mora county, New Mexico.

M. A. NEWMAN, manager for Cia. Minera Jesus Maria y Anexas, is in San Francisco.

WALTER S. BICKLEY has been elected president of the Penn Steel Casting & Machine Company.

ELLARD W. CARSON, of Los Angeles, is manager for the Colonial Mining Co., near Quartzsite, Arizona.

ROBERT E. CRANSTON will be at Wonder, Nevada, for two weeks, examining the Nevada Wonder mine.

J. R. FINLAY has been selected by the Michigan Tax Commission as State Appraiser of mining property.

JAMES W. MALCOLMSON was in San Francisco last Saturday on his return from Alaska, and has gone to Mexico.

HERBERT C. ENOS, of Mexico City, has completed an examination of mining properties in Jalisco for New York interests.

JOHN M. BOUTWELL, consulting geologist for Phelps, Dodge & Co., is making a geological survey for the Moctezuma Copper Co. at Pilares de Nacozari, Sonora, Mexico.

WILLIAM J. HALL has been appointed assistant to the general manager of the Federal Mining & Smelting Co., and RUSH J. WHITE has been appointed superintendent of mines for the same company.

S. W. BRETHERTON, of San Francisco, has been engaged as consulting engineer for the Adaven Mining & Smelting Co., of Nevada. He is also consulting engineer for the Dominion Placer Mining Co. in Plumas county, and two copper properties in Shasta county, California.

The purchase which has just been consummated by the UNION IRON WORKS CO. of San Francisco of the good-will, patterns, records, etc., of the RISDON IRON WORKS, is of interest to those familiar with the history of manufacturing in the West. The United States Steel Corporation recently purchased the site and plant of the Risdon Iron Works, but did not take over any of the equipment, and through its acquisition by the Union Iron Works Co. the latter has added materially to its position as a large manufacturer of mining machinery, etc. R. H. Postlethwaite, formerly manager of the Risdon Iron Works, will superintend the department created by this consolidation. Back in the '60s the Risdon Iron Works operated a boiler shop at Bush and Market streets, San Francisco, and in 1849 the Union Iron Works Co. was started by James and Peter Donahue. Both of these companies have been large factors in the development of the Pacific Coast, being pioneers in the design and installation of the heavy mining machinery used in the old Comstock days and also equipping some of the largest mines in the Transvaal and Australia, and have had honorable careers. The Risdon Iron Works will be missed, but the Union Iron Works Co. having acquired its business and records and with the addition contemplated to its already large plant, will be able to continue the manufacture of mining and dredging machinery, boilers, etc., and to furnish spare parts for machinery already in service.

Recent Publications

ADMINISTRATIVE REPORT OF THE STATE GEOLOGICAL SURVEY OF TENNESSEE. By George H. Ashley. 59 pp. Nashville, 1911.

BIBLIOGRAPHY OF TENNESSEE GEOLOGY. By Elizabeth Cockrill. Extract 1-B from Bull. No. 1, 'Geological Work in Tennessee.' Pp. 11. Nashville, 1911.

BREMEN OIL FIELD. By J. A. Bownocker. Geol. Surv. Ohio, Ser. 4, Bull. 12. Pp. 68. Ill, index. Columbus, 1910. A new and important though small field in Ohio.

THE BADLANDS FORMATION OF THE BLACK HILLS REGION. By Cleophas C. O'Harra. Bull. No. 9, South Dakota School of Mines. 152 pp. Ill., maps. Rapid City, S. D., 1910.

WATER-SUPPLY PAPER: No. 258, 'Underground-Water Papers, 1910,' by M. L. Fuller, F. G. Clapp, G. C. Matson, Samuel Sanford, and H. C. Wolff; 1911; 123 pp.; index.

GEOLOGY AND ORE DEPOSITS OF REPUBLIC MINING DISTRICT. By Joseph B. Umpleby. Bull. No. 1, Washington Geological Survey. 65 pp. Ill., maps. Olympia, Wash., 1910.

GEOMORPHOGENY OF THE SIERRA NEVADA, NORTHEAST OF LAKE TAHOE. By John A. Reid. Bull. of the Dept. of Geol., Univ. of Cal., Vol. 6, No. 5. 71 pp. Ill. Berkeley, California, 1911.

COAL-DUST EXPLOSIONS. By George S. Rice. Miners' Circular No. 3, U. S. Bureau of Mines. Pp. 22. Washington, 1911. A valuable discussion of recent studies, written in simple language, and containing recommendations of first importance.

GEOLOGY OF AN AREA ADJOINING THE EAST SIDE OF LAKE TEMISKAMING, QUEBEC. By Morley E. Wilson. Dept. of Mines, Canada. Geol. Surv. Branch, Pub. 1064. Pp. 46. Ill.; map. Ottawa, 1910. An important contribution to the geology of a region now much in the public eye.

INFORMES Y MEMORIAS DEL INSTITUTO MEXICANO DE MINAS Y METALURGIA. Sec. I, Proceedings of the Institute; Sec. II, Discussion of the paper by H. S. Denny, on 'Sampling of Orebodies,; 'The Estimation and Valuation of Ore Reserves,' by G. A. Denny. 49 pp. Mexico, 1911.

ESSENTIAL FACTORS IN THE FORMATION OF PRODUCER GAS. By J. K. Clement, L. H. Adams, and C. N. Haskins. U. S. Bureau of Mines, Bull. 7. Pp. 57. Washington, 1911. A thorough discussion of the physico-chemical facts and principles involved, with data derived from experimental research.

Copper Producers' Association Report

The monthly report of the Copper Producers' Association for May, issued June 8, gives stocks of metal on hand June 1 as 165,995,932 lb., compared with 165,559,908 lb. on May 1. Production for May was 126,962,544 lb., against 118,095,223 lb. in April. Domestic and foreign demand for May aggregated 126,522,520 lb., an increase of about 2,000,000 lb. over the previous month. The detailed statement follows:

Stocks of marketable copper of all kinds on hand at all points in the United States May 1, 165,558,908 lb.; production of marketable copper in the United States from all domestic and foreign sources during May, 126,962,544 pounds.

Deliveries of marketable copper during May: For domestic consumption, 84,543,963 lb.; for export, 61,978,557 lb. Total, 126,522,520 pounds.

Stocks of marketable copper of all kinds on hand at all points in the United States June 1, 165,995,932 pounds.

Market Reports

LOCAL METAL PRICES.

San Francisco, June 8.

Antimony	12—12¾c	Quicksilver (flask)	46.50
Electrolytic Copper	14—15¼c	Tin	47—48¾c
Pig Lead	4.75—5.70c	Spelter	7—7¾c

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

METAL PRICES.

By wire from New York.

Average daily prices in cents per pound.

Date.	Electrolytic Copper.	Lead.	Spelter.	Silver, per oz.
June 1	12.10	4.36	5.35	53¼
" 2	12.10	4.36	5.35	53⅜
" 3	12.10	4.36	5.35	53⅜
" 4	Sunday.	No market.		
" 5	12.15	4.36	5.35	53⅜
" 6	12.18	4.36	5.35	53⅛
" 7	12.20	4.36	5.35	53¼

ANGLO-AMERICAN SHARES.

Cabled from London.

	May 31. £ s. d.		June 8. £ s. d.
Camp Bird	1 10 9	ex div.	1 11 9
El Oro	1 4 3		1 4 6
Esperanza	1 10 0		1 10 7½
Dolores	1 5 0		1 5 0
Oroville Dredging	0 6 9		0 6 9
Mexico Mines	8 0 0		8 5 0
Tomboy	0 15 0		0 15 6

(By courtesy of W. P. Bonbright & Co., 24 Broad St., N. Y.)

MINING STOCK QUOTATIONS—NEW YORK.

(By wire from Catlin & Powell Co., New York.)

	Closing prices, June 8.		Closing prices, June 8.
Amalgamated Copper	$ 68⅛	La Rose	$ 4¼
A. S. & R. Co.	81¼	Mason Valley	9⅛
Braden Copper	4½	Miami Copper	20⅜
B. C. Copper Co.	5⅜	Mines Co. of America	5⅜
Butte Coalition	19½	Nevada Con	19⅛
Chino	24⅛	Nevada Utah	¾
Davis Daly	1⅝	Nipissing	10½
Dobie	3	Ohio Copper	1⅛
Dolores	5¼	Ray Central	1½
First National	1¾	Ray Con	17⅛
Foley O'Brien	1¼	South Utah	⅞
Giroux	7	Superior & Pittsburg	17¾
Goldfield Con	6	Tenn. Copper	40¼
Greene-Cananea	7⅜	Trinity	4¼
Guanajuato Con	⅝	Tuolumne Copper	4½
Hollinger	13⅜	United Copper	3⅝
Inspiration	8¾	Utah Copper	48
Kerr Lake	5⅞	Yukon Gold	4

COPPER SHARES—BOSTON.

	Closing prices, June 8.		Closing prices, June 8.
Adventure	$ 6	Mohawk	$ 48
Allouez	31½	North Butte	34¾
Atlantic	6	Old Dominion	46⅝
Calumet & Arizona	62	Osceola	102
Calumet & Hecla	475	Parrot	12⅛
Centennial	12½	Santa Fe	1⅝
Copper Range	61¼	Shannon	11¼
Daly West	6¼	Superior & Pittsburg	17⅝
Franklin	13⅛	Tamarack	35⅛
Granby	37⅛	Trinity	4
Greene Cananea, ctf	7¼	Utah Con	18⅛
Isle-Royale	18	Victoria	1¾
La Salle	4	Winona	8
Mass Copper	6	Wolverine	112

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

NEVADA STOCKS.

San Francisco, June 8.

Atlanta	$ .10	Mayflower	$ .04
Belcher	.81	Mexican	4.25
Belmont	6.25	Midway	.18
B. & B.	.48	Montana Tonopah	.75
Booth	.07	Nevada Hills	3.15
Choliar	.16	Ophir	2.02
Combination Fraction	.07	Pittsburg Silver Peak	.62
Con. Virginia	1.15	Round Mountain	.57
Florence	1.25	Sandstorm Kendall	.08
Goldfield Con	6.00	Savage	.28
Gould & Curry	.22	Tonopah Extension	.97
Jim Butler	.22	Tonopah of Nevada	5.90
Jumbo Extension	.27	Union	1 52
MacNamara	.12	West End	.48

(By courtesy of San Francisco Stock Exchange.)

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EDITORIAL

HIGH TEMPERATURES were the topic of the meeting of the Faraday Society in London on May 23, but the discussion was not a heated one.

THOUGH Congress is a national body, it shows signs of having come from Missouri. Sixteen congressional investigations are now under way.

FAULTS have puzzled many an engineer, and the discussion of the problems of faulting, by Mr. C. F. Tolman, Jr., in this issue throws much light on perplexing cases.

POVERTY-STRICKEN is a word apparently not in the lexicon of the Anaconda group of properties. Their current assets are given in a statement recently made public as over $45,000,000, or an excess over liabilities of more than $30,000,000.

JAPAN is a country of dense population, but the necessity of safeguarding youth is there none the less appreciated. A recent labor law provides that children under twelve years of age may not be employed in factories, and regulates the hours of labor of older workers.

POPULAR election of Senators assumes greater possibility since the Senate passed, on Tuesday last, the resolution amending the Constitution. This has already passed the House, and when approved by the Legislatures of three-fourths of the States, will become the law of the land.

REPORT has it that the United States Smelting, Refining & Mining Company has exercised its option on the Gold Road mine near Kingman, Arizona, making an outright purchase at $1,700,000. The mine has been an active producer and is said to have 300,000 tons of $10 ore in sight.

JAPANESE mines and mining have an added interest derived from the forthcoming visit of the American Institute of Mining Engineers to Japan, and Mr. Yamaguchi's description of the Nishisawa mine, near one of the objective points of the trip, is therefore timely as well as interesting.

CHIEF JUSTICE WHITE will head a committee, of which the other members are Justices Lurton and Vandevanter, to revise the rules of practice in courts of equity, formulated in 1852. If our legal practice can be changed from a trial of skill of opposing counsel in the avoiding of technical errors, to the prompt obtaining of substantial justice, much will be gained.

EXCELLENT work has been done by the Colorado Geological Survey, especially in the tungsten district of Boulder county, and at Montezuma. This work has been recognized by the Legislature, which has just increased the annual appropriation to $15,000. We are sorry to record at the same time that the State Geologist, Mr. R. D. George,

is now in a Denver hospital as a result of overwork, and trust that he may soon recover and resume his field work.

ERRORS in type-setting and proof-reading lead to many curious mistakes. Fortunately they are usually obvious. Occasionally they mislead. In the interesting description of the 'Gold Quartz Deposits of Porcupine, Ontario' by Mr. Reginald E. Hore, appearing in our issue of April 29, misplaced figures made him responsible for the statement that the saving by amalgamation at the Dome mine is 48 instead of 84 per cent. In the new mill now being built the combination of amalgamation and cyanidation will give an unusually high rather than a low extraction, as might have been inferred from the statement as it was printed.

TALK of a copper merger has again been rife, and the improved foreign demand for metal has steadied prices a bit. Consideration of the impending new production, however, induces pessimism as to natural improvement in prices, and the threatened criminal proceedings by the Government against officers of the Standard Oil and American Tobacco companies suggest caution in forming new monopolistic combinations. Any merger of copper producers that did not control production and raise prices would not offer sufficient inducement to attract the majority of producers. Court decrees may modify the Sherman law, but they seem ineffective as regards the law of supply and demand.

GRUBSTAKE funds have been responsible for the discovery of many important mines despite the well known dissipating influence of a jug and a convenient shade-tree. In Colorado an effort is being made to systematize prospecting by means of a general fund, raised through the efforts of the *Denver Republican,* and administered by a committee from the Chamber of Commerce consisting of Messrs. Max Boehmer, James Doyle, and E. Le Neve Foster. It is proposed to grubstake prospectors, to regularly inspect their work, and to test their finds. An excellent feature of the plan is the proposal to send recent graduates of the School of Mines with the prospectors. The scheme ought to eliminate much of the waste of ordinary prospecting, it will certainly advertise the State, and it may make good prospectors out of the young graduates. The last is by no means the least important feature, for more and better prospectors are needed rather than more engineers. It is by no means certain but that greater rewards will accrue to the school men who learn prospecting than to those who devote themselves to engineering.

FINANCING mining enterprises is a matter that demands, and fortunately is receiving, much carefnl study. Legitimate mining involves sufficient risk at best, and, while in any system of estimating probable returns there must be a large unknown element, that constitutes no reason against eliminating as many variables as possible. We discussed recently some of the conditions under which capital could be obtained in London for mining. In the current issue of *The Mining Magazine,* Mr. M. H. Burnham begins a series of articles on 'The Finance of a Mine,' in which he details the correct methods of appraising mines and stocks. This discussion is extremely valuable both from the point of view of those who would buy, and of those who would sell. There is probably as much ignorance among mine owners as to what sort of examination a property should be able to stand in order to make it readily salable, as there is among buyers of mining stocks who speculate on the chance of selling to some later but more optimistic 'investor.' Mr. Burnham points out the fallacy of adding together 'positive' and 'possible' ore, and announces the theorem that "the risk-rate for each block should vary inversely with the number of sample sections, and directly with the tonnage therein." This principle will be developed and its application explained in later articles.

The Hegemony of the Pacific

In his Charter Day address at the University of California, Mr. Theodore Roosevelt remarked: "It is on the Pacific that the great crises of the future have to be met and faced." This obvious truth is worthy of further exposition, and a brief review of the more salient features of the present status and probable future development of international interests on this great ocean is worth while.

The Pacific Ocean has an area equal to one-quarter of the surface of the whole globe, or one-half of its water surface, stretching from pole to pole, and its coast-line of 47,000 miles includes territory belonging to each of all the principal nations of the world. These nations may be divided into four great groups, the Anglo-Saxon group, including the United States, Australia, Canada, and Great Britain; the Oriental group, embracing Russia, Japan, and China; the Teutonic group, including Germany and the Netherlands; and the Latin group, comprised by the Mexican and South American republics. The interests of the Netherlands and Germany are centred in colonies belonging to those nations, while Great Britain appears in a dual rôle, as the mother country of Australia and Canada, and as the European power having the greatest commercial interest in the Orient. The Latin-American republics may be dismissed without any further mention, since their history for the century past indicates that they will not exert any marked influence in Pacific affairs in the immediate future. The following table gives interesting and significant data regarding the other countries:

	Area, sq. mi.	Population.	Annual revenue.	National debt.
United States	3,756,884	103,992,727	$894,876,855	$1,039,861,531
Russia	8,647,657	160,095,200	1,379,591,803	4,588,502,684
Japan	147,655	51,458,037	284,428,325	1,305,901,499
China	4,278,170	433,500,000	21,221,722	601,916,605
Australia	3,076,894	5,405,714	244,002,008	1,530,631,158
Canada	3,729,665	7,358,000	85,093,404	323,930,279

The consideration of this table must be prefaced by calling attention to the fact that both in the United States and China many of the functions of government are performed by State or provincial authorities, allowing a corresponding decrease in the national income. In a recent thoughtful article, Rear-Admiral A. T. Mahan has discussed the influence of the Panama Canal upon sea-power in the Pacific. Without minimizing the importance of naval and military strength it is scarcely possible to over-emphasize the strategic and cohesive power of commercial interests, the political value of invested capital. This was strikingly illustrated recently when a people noted for their diplomatic skill, the Chinese, executed the cleverest diplomatic coup of their history by borrowing $30,000,000 from a syndicate of English, German, French, and American bankers and pledging the revenues of the Manchurian provinces as security. The events which have been steadily shaping themselves since 1898 had, by the beginning of the present year, practically shaken off the grip of China's sovereignty from her three Eastern provinces, with no prospect of its ever being regained. By the negotiation of this loan, and the clever basis upon which it has been placed, China has reasonably secured the sovereignty of these rich and important provinces. Nicholas Murray Butler once strikingly referred to "the cohesive force of public plunder," and the adhesive power of invested capital should not be overlooked. This should not be taken in any derogatory sense: it is natural and normal. Each of us, for example, reads daily of the death of estimable people in various parts of

the world, with scarcely a flicker of emotion, but when we see chronicled in the daily journal the death of one who is attached to us by ties of former associations or kinship we are profoundly moved. The political vicissitudes of Chinese provinces are matters of little more than academic import until millions of foreign capital have firmly attached to them a significance which they previously lacked.

Recently there have been frequent references to 'dollar diplomacy' as though it were an American invention rather than the tardy recognition of the trend of European diplomacy for the last decade, in all cases where diplomacy can be dissociated from military strategy. The commercial position of the United States is much like that of a wealthy farmer who by the growth of his interests has gradually been led into banking and trade. That the methods of banking and trade are not those of agriculture is too obvious for remark, but that our international relationships are now markedly different from those of even so recently as two decades ago, apparently needs emphasis.

The hegemony of the Pacific must necessarily appertain to the nation that possesses the greatest interests in the Pacific. Great Britain has held the leadership; Hongkong is the second seaport of the British Empire, and the Dominion of Canada, the Commonwealth of Australia, New Zealand, and the British East Indies are strong outposts of Great Britain in the Pacific. But the future development of Canada and Australia must inevitably widen the gap that already exists between their interests and those of the mother country; British interests in the Pacific will gradually become Canadian and Australian interests, and these latter will not quickly become great enough to dominate the situation. Since the battle of Manila bay the trend of events has steadily been forcing upon the United States the hegemony of the Pacific. Whether we desire it or not, this responsibility can not be evaded. The future will show whether we, born of English blood, will in turn take up the white man's burden intelligently, unflinchingly, and with cheerful heart perform our task.

A Notable Reunion

It happens that this month four distinguished engineers long connected with the mining industry, and who have had much to do with the mining history of California, have been in San Francisco. We do not often publish eulogies of our friends who are still living, but they will in this case pardon, we hope, some reference to their work. Three of them have retired, but one is active. They are Messrs. A. J. Bowie, of Yokohama, Gardner F. Williams, of Washington, D. C., Waldemar Lindgren of the same city, and Louis Janin, of Los Olivos, California. Not only have these gentlemen rendered distinguished service to mining in California, but all of them have made the profession their debtor by contributions to technical literature. Mr. Augustus J. Bowie was for many years a resident of San Francisco, during which period he was active as a mining engineer in many places on this Coast. He was especially interested in gravel mining, and in ditch and dam construction. He, however, also had experience in quartz mining, and designed and built the first of the large mills in the Black Hills, South Dakota. He was consulting engineer for the famous North Bloomfield hydraulic mine during its palmy days, and was connected with other large gravel-mining and ditch enterprises in both this State and Idaho. Mr. Bowie is the author of 'A Practical Treatise on Hydraulic Mining,' which, though published in 1885, is still the standard work on that subject. It contains descriptions of the use and construction of ditches, flumes, wrought-iron pipes, and dams, with much of value on the flow of water on heavy grades, and its applicability under high pressure to mining, and the tables are especially valuable and are standard. Mr. Bowie went to the Klondike in 1897 for a syndicate, of which Mr. James R. Keene of New York was the head. He has been absent from this State for the past nine years, during part of which period he has been engaged in mining enterprises in the Philippines and for the Japanese Government. He is now making a visit home, but will shortly return to Japan.

Mr. Gardner F. Williams was also interested years ago in gravel mining in California, being connected with mines in Placer and Butte counties. In the latter he was with the old Cherokee hydraulic mines. A long time since he went to South Africa to report on some possible hydraulic ground, and while in London became connected with the De Beers Consolidated, which controls the great Kimberley diamond mine. He subsequently became manager at that property, a position he held until he resigned to be succeeded by his son, Mr. Alfred Williams, also a Californian. While manager of the De Beers, Mr. Williams sent to California for much machinery, and he also took men from this country to help him in his work. Mr. Williams is the author of a standard work on diamond mining, 'The Diamond Mines of South Africa,' which is beautifully printed and illustrated. Since his retirement from active mining work he has made his residence in Washington, D. C., but makes an annual journey to California to visit relatives and friends.

Mr. Waldemar Lindgren, now of Washington, D. C., is one of the most distinguished members of the U. S. Geological Survey, being chief of the division of Metals and Metallic Ores. He was for some years a resident of California, when offices were first maintained by the Survey in San Francisco, being then associated with Mr. H. W. Turner, Mr. G. F. Becker, and others. Later he resided near Auburn, in Placer county, while engaged in studies of the auriferous gravels. The field work of his forthcoming treatise on the 'Tertiary Auriferous Gravels' has been completed, but the volume has not yet been published. Mr. Lindgren is the author of many papers published by the U. S. Geological Survey, and is well known for his contributions to the knowledge of the genesis of ore deposits. He has succeeded to the position long held by Mr. S. F. Emmons on the Survey, and has much of the same peculiar hold on the esteem and affection of mining engineers here and abroad that Mr. Emmons had.

Mr. Louis Janin, who has retired to his ranch in Santa Barbara county, was one of the earliest of the group of mining engineers who came to the West from Freiburg to begin the practice of his profession. For many years he was actively engaged in its various branches. He left his mark particularly in his metallurgical successes in milling Comstock ores, and was long one of the most active and sought-after consulting engineers in America. He has written much on subjects connected with both mining and metallurgy, and still interests himself in them. His last active work was in determining important geological questions for the North Star Mines company of Grass Valley. For some years before that he had given up the examination and management of mining properties and confined his activities to work as a geological and mining expert witness in important litigation between large mining companies. One of his sons, Mr. Louis Janin, Jr., was a pioneer in cyanidation, and another, Mr. Charles Janin, follows his father in consulting work, and is one of the authors of the bulletin in 'Gold Dredging' recently issued by the State Mining Bureau. Throughout the lives of all these men runs a vein of achievement. They are successful. They have influenced their times and their profession broadly because they are broad men looking at things in a broad way.

Graphic Solution of Fault Problems

By C. F. Tolman, Jr.

A common occurrence in mining is to have a drift on the vein meet a polished wall, on the other side of which no ore is discovered. The life of the mine depends upon rediscovering the ore, but in many cases the vein is never found again. Occasionally the break is older than the ore deposit; the ore solutions may not have passed through the fault gouge, and so no ore exists beyond the break; but in every case where the break is younger than the ore, it exists somewhere beyond the 'trouble', as the Cornish miners call the fault. One superintendent may be unfortunate in his search; the next may have more knowledge or better luck, and when the vein is found he has scored a hit with the owners. Finally, if the ore is valuable and the superintendent unsuccessful, an expert in faulting may be called in to collect, study, and plot all data, but meanwhile important evidence may have been obliterated, which could have been observed when the fault was first found. For these reasons every man engaged in mining should be interested in fault problems.

The study of faults must be carried on according to the methods of applied geology, and the methods of detailed and exact geological mining investigation are of but recent development. For instance, in the somewhat generalized mapping of a large area, geologists once believed it only necessary to consider the vertical component of fault movement, an assumption which is entirely inadequate when accurate graphic investigations are undertaken. J. E. Spurr, in his excellent text-book 'Geology as Applied to Mining', emphasizes the occurrence of fault movement in all directions on the fault plane, but vertical sections, so universally used to portray generalized geological structure, show only the vertical component, and the importance of horizontal displacement, and pivotal fault motion, was not thoroughly appreciated, until the San Francisco earthquake gave emphasis to these factors.

It is strange that in the standard text-books on geology, faulting has received such incomplete and unsatisfactory treatment, and so little attention has been paid to accurate graphic methods of solution, especially when we remember that nearly thirty years ago R. W. Raymond published a summary of Hoefer's work on faulting,[1] involving the application of descriptive geometry to fault problems. Hoefer appreciated that faulting may involve movement in any direction on a fault plane, and that translatory movement may be combined with rotatory movement. With the exception of this article, no exposition of the graphic methods applicable to these problems has appeared in English until recently.[2] The engineer confronted by such problems must discover original solutions, remembering what he can of his early studies in 'Churches Descriptive Geometry', or be probably overlooks the possibility and value of the graphic solution, and may not know just what data it is necessary to collect in order to solve the problem.

The problems presented below are selected from those given in the laboratory courses in structural geology at the School of Mines of the University of Arizona since 1905, by myself and assistants, especially Theodore B. Chapin. The methods given are the most simple of the many that I have used both in engineering practice and teaching. The discussion is confined as closely as possible to the graphic solution of a set of type problems, and only the briefest possible statement of the various kinds of fault motion is made, with such a summary of fault nomenclature as is necessary for understanding them, and with a brief statement of the practical bearing of some of the solutions. The reader desiring a summary of the phenomena by which faulting is detected, as well as the modern ideas on the general subject of faulting, is referred to a paper entitled 'Methods of Investigating Problems in Faulting',[3] and to the valuable discussion in *Economic Geology*[4] for 1907, 'How Should Faults Be Named and Classified?'

Nomenclature of Fault Movement

A direct measurement of the amount and direction of fault movement on the fault plane is, unfortunately, not often possible; at times only the direction of movement, or the perpendicular distance on the fault plane between the two broken portions of the faulted body, is known; or again, possibly only the component of the fault movement in a vertical plane, or in a horizontal plane, or in a plane perpendicular to the trace of the faulted body on the fault plane. Since measurements in all these different planes are made, and, further, since the complete measurement in any one plane often cannot be taken, a complete and orderly set of names for all these is desirable, and is of great assistance in the discussion and solution of fault problems. Therefore the nomenclature previously suggested[5] is introduced here, with the substitution of the word 'normal' for the word 'vertical' throughout, on account of the criticism that the measurement there called 'vertical displacement' is not vertical, when the fault plane is inclined, but normal to a horizontal line. When rotation and translation are combined, these names are applicable to the movement at any given point of the break, the amount of the movement changing with the distance from the pole. In this case, however, a complete solution of the problem involves only the location of the pole about which the known angular rotation will produce the displacements observed; for it is evident that a combined rotation and translation can be considered as a pure rotation, and translation can be considered as a pure rotation about an equivalent pole. The term 'angular displacement' may be used, and the location of the pole designated.

Methods of Projection

In fault problems we have to deal with at least two planes, namely, the fault plane and the faulted vein, dike, or stratum. (Hereafter the word 'stratum' will be used for any faulted body which has two dimensions of decidedly greater magnitude than the third.) This involves representation in three dimensions, and only the four methods most valuable for our purposes will be mentioned, two of which are discussed and used.

1. *Mine Models.*—The use of mine models has become increasingly popular in the last twenty years; their development being due largely to the need of giving a clear idea of workings, veins, and faults, to non-technical judges and juries. More recently they have been found to be valuable in impressing still less technical stockholders. To those with experience underground, and a trained geometrical sense, models have little if any advantage over mine maps.

2. *Stereogrammatic Projection.*—An effective method of indicating spacial relations is by means of a diagram of a block; mine workings, fault planes, veins, etc., are located by measurements along the edges of the block. Of the various methods of projecting these blocks, the isometric is the most valuable, and is the only one used in this discussion, and is described below.

3. *Orthographic Projection on Two Mutually Perpendicular Planes.*—This is a simple and at the same time a valuable method for representing underground conditions. However, the projecting of the two perpendicular planes on the single plane represented by the sheet of paper is

[1] Raymond, R. W. 'Hoefer's Methods of Determining Faults in Mineral Veins'. *Trans.* Amer. Inst. Min. Eng., Vol. 10, pp. 456-465.

[2] Reid, H. F. 'Geolometry of Faults'. Bull. Geol. Soc. of America, Vol. 20, pp. 171-196. This valuable contribution goes over some of the ground covered in this discussion. The author does not adopt the simple concept presented by me in a following article regarding rotary fault movement. Mr. Reid conceives that poles of rotation may lie at various angles to the fault plane, and introduces artificial solutions, involving such movements as a rotation about, and translation along, one and the same pole.

[3] Tolman, C. F. *Mining Magazine*, New York, February 1906.

[4] *Economic Geology*, Vol. 1, No. 8; Vol. 2, No. 1, 2, 3, 4, 5, 6, and 7.

[5] Tolman, C. F. 'How Should Faults Be Named and Classified?' *Economic Geology*, Vol. 2, pp. 506-511.

unsatisfactory where the workings are extensive, and especially where they are not confined to a definite plane, and for most purposes, especially for the solution of problems, the following method is superior.

4. *The Two-Level or Contour Method.*—Mines are mapped by 'levels'. Exploration and extraction workings are generally driven at regular intervals (100 ft. is the most common interval) and the group of workings at each depth is a 'level'. Given the trace of a vein on two levels and it is completely located unless it suffers some distortion lower down, in which case the new position is shown by the traces on the lower levels. By using the simple method of mapping faults and faulted strata on two levels

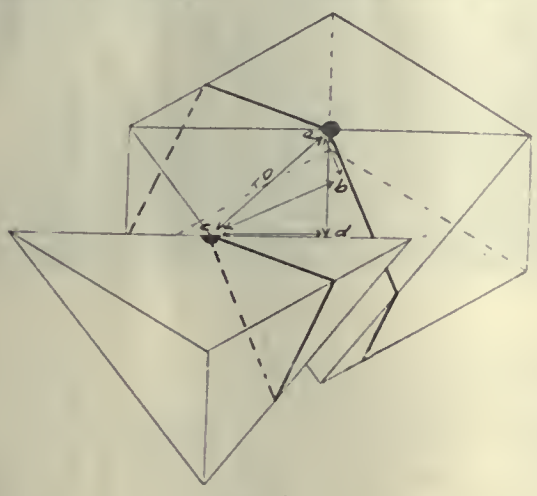


FIG. 1.

(one 100 ft. below the main or reference level), the graphic solution of fault problems is made easy, and is the one adopted in the following discussion.

Measurements of fault movement are made in the following planes:

1. On the fault plane. All such measurements are designated as 'displacements'.

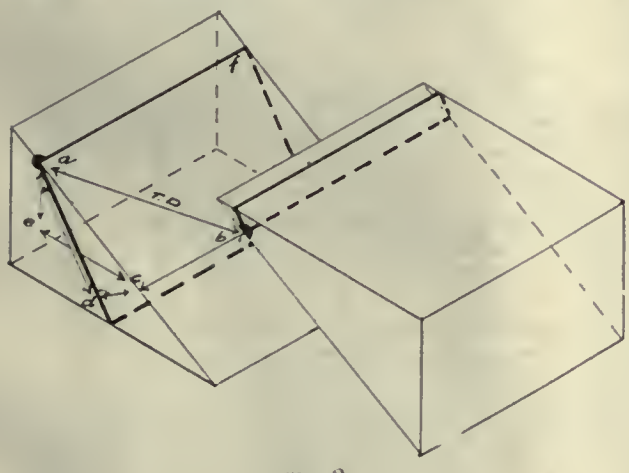


FIG. 2.

2. On a plane normal to the trace of the faulted body on the fault plane. These measurements are the 'separations'.

3. On any perpendicular plane. 'The throws'.

4. On a horizontal plane. (Generally the earth's surface.) 'The heaves'.

These are represented in Fig. 1 to 4 and in each diagram the vein or stratum is represented to contain a lens or nodule which has been split open by the fault movement, thus indicating at a glance the direction and amount of fault displacement.

The displacements. Fig. 1. The 'total displacement' is *ac*. This is taken as the hypothenuse of a triangle, the adjacent side of which is parallel and the opposite side perpendicular to the trace of the faulted stratum on the fault plane; *ab* is called the 'parallel displacement', and *cb* the 'perpendicular displacement', and the angle $cab = e$. With *ac* again as the hypothenuse, a second triangle is constructed with the opposite side a horizontal line, and the parallel side normal thereto; *ad* is called the 'normal displacement' and *cd* the 'horizontal displacement'.

The separations. Fig. 2. These, as defined above, are in a plane normal to the line *af*, and as this line happens to be horizontal, the measurements in this particular case are in a vertical plane, and are therefore both separations and throws. The 'total separation' *ac* lies in the fault plane and has already been named 'perpendicular displacement'; *ad* is the 'parallel separation' and *cd* is the 'perpendicular separation', the latter being the only important measure-

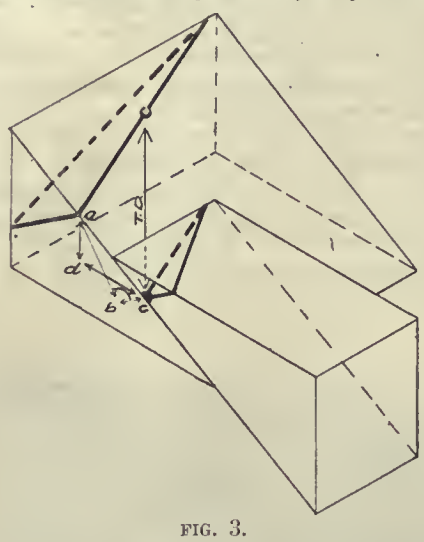


FIG. 3.

ment of this set. It is, of course, the shortest distance between the two faulted portions of the stratum or the faulted portions produced; *cc* and *ae* are, respectively, the 'horizontal' and 'normal separations'.

The throws. Fig. 3. These are measurements in any vertical section, and are of importance because in making structural sections the throw in that section must be determined. With reference to any particular fault plane under consideration, the section normal to the strike of the fault is the most important, and if the direction of the section is not designated in describing a throw, this section is understood. In the figure *ac* is 'total throw', *bc* is 'parallel

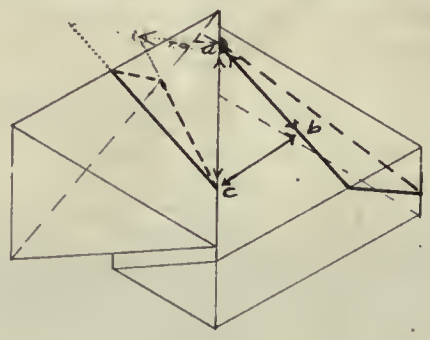


FIG. 4.

throw', and *ab* is 'perpendicular throw', *cd* is 'horizontal throw', and *ad* 'normal throw'.

The heaves. Fig. 4. The heaves are measurements in a horizontal plane. In the figure *ac* is 'total heave', *ab* is 'parallel heave', and *bc* is 'perpendicular heave'.

Isometric Projection

Space is represented in Fig. 5 by a cubical or rectangular block, position in which is determined (1) by locating the point in a horizontal plane, and (2) locating this plane according to its distance below the top of the block. The edges of the block are projected orthographically on the plane of the paper, by directing the line of sight at a corner of the cube. The edge of the block representing depth is projected vertically, and the other two edges are projected upward to the right and left, the angle between the projections being 120 degrees.

The projections of the edges of the block are shorter than the projecting edges, and all measurements parallel to these edges are measured in the 'isometric scale'. Those lines parallel to the diagonal *bc* are the only ones projected full length. Of all directions in the horizontal plane, the 'short diagonal' *ad* is most inclined toward the line of sight and is therefore most reduced in projection. Points are usually located by taking the coördinate measurements parallel to the edges, but occasionally it is convenient to take measurements parallel to either of the two diagonals, and it is therefore valuable to know the ratio of these three scales. To determine this ratio, revolve the block around the diameter *bc* until the top coincides with the plane of the paper, taking the position *a'bd'c*. The ratio of the lengths of the projections of a given distance, taken (1) parallel to 'long diameter' *bc*, (2) the edges *bd*, and (3) the 'short diameter' *ad* is $bd' : bd : b'd$.

To find the length of the projection of the line kl in these three directions. Take bl' equal to *kl*. Draw $l'l''$ perpendicular to *bc*. bl'' is the length of the projection parallel to the edges. Take dl''' equal to this isometric length (bl'') and as $l'''\ l'''\ ''$ is parallel to *bc*, $dl'''\ ''$ is the length of the projection when *kl* is parallel to *ad*.

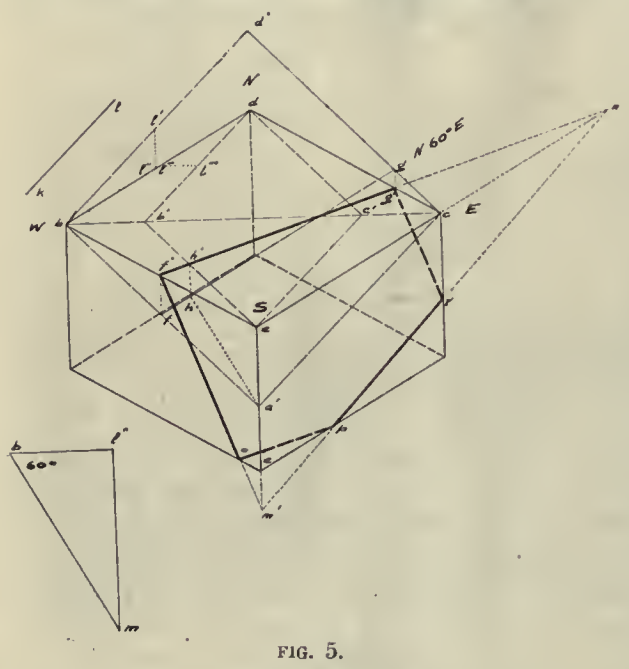
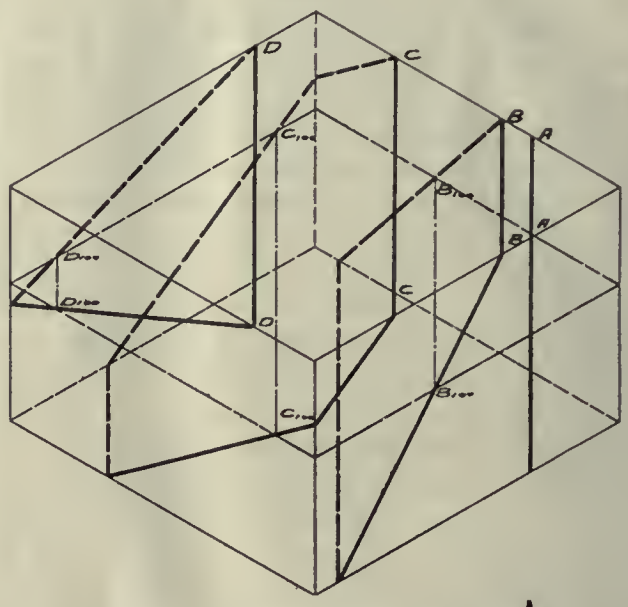


FIG. 5.

To draw a plane whose dip and strike are known. Locate the points of the compass on the block. (In Fig. 5, north is parallel to the 'short diagonal'.) Lay off *fg* in the revolved position (*a'bd'c*) of the top of the block according to its strike (north 60° east). Draw *a'h* perpendicular to *fg*. Locate *f'g'* in its proper position in the isometric block by drawing *ff'* and *gg'* perpendicular to *bc*. *a'h* then becomes *ah'*; *a'h* is equal to *bl'*, therefore *bl''* is the corresponding isometric length. The dip of the stratum *f'g'* is given as 60° to the southeast, and since *ah'* is taken perpendicular to *f'g'*, a plane passed through *ah'* and *ae* will show the dip. Constructing a triangle with a 60° angle, and the isometric equivalent of *ah'* being used as the adjacent side, the opposite side *ml''* shows the proper isometric length to be laid off on the edge of the cube. Point *m'* is taken this distance below *a*. By connecting *m'* and *f'* trace *f'o* is obtained. By projecting the edge *ac* and the line *f'g'* until they meet in point *n* and connecting *m'* and *n*, trace *pr* is found, and the other traces are then drawn in.

The two-level or contour method of projection. The relation of the isometric to the graphic method of projection is shown by Fig. 6 and 7. In these, every plane, unless perpendicular, is located by two lines. The heavy line (*BB*) is the map of the plane on the reference level, and may be called 'the strike line'. A line of light dashes the trace of the plane on the level below and this is the contour line of the plane. Any number of contours may be used if the plane changes dip or strike with depth. The dip of the stratum is shown by the distance between the strike line and the contour, and the 'dip triangle' may be constructed by drawing a line perpendicular to the two traces

FIG. 6.



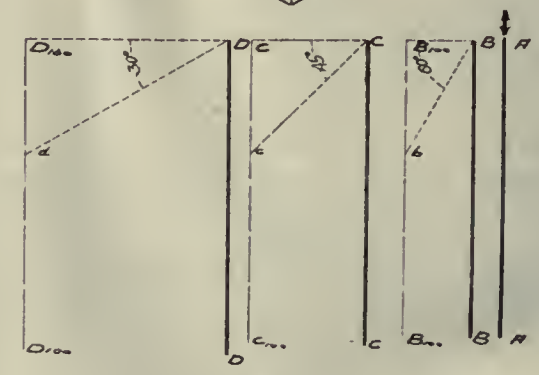


FIG. 7.

($B\,B_{100}$) and laying off to scale 100 ft. on the contour ($B_{100}b$) and completing the triangle ($B_{100}\,B\,b$).

The scheme of lines chosen to represent planes, traces, lines, points, etc., used in this and succeeding discussion, is shown by the legend below.

Visible trace of plane with side of block.
Invisible trace of plane with side of block.
Intersection of plane within block.

Trace of plane with reference surface (strike line).
Trace of plane with surface 100 ft. below.
Projection of intersection of any planes.
Projection rotated back into reference surface.
Projection of a line—portion above reference surface is light solid line; that below is dot and dash. Dip of line theta is given by rotating same around its projection. (See Fig. 5).
A point is located by a small circle and the distance above or below reference plane by a dotted line.
Construction lines.

(To be Continued)

IT IS ESTIMATED that in the process of mining and treatment of the zinc ores of Missouri, one-half of the metal is lost. In much of the copper mining, in some of the gold and silver mining, and other metal mining, the waste is estimated to be from one-fourth to one-half of the total product. In the mining of coal, the average loss throughout the country is nearly one-half of the total product. this loss amounts to nearly 250,000,000 tons of coal each year. And in this the waste does not cease with the mining of the coal; it continues even on a larger scale in the burning of the coal brought to the surface, as it is consumed in the furnaces for the development of power and light.

Early-Day Mining in California

The maps and scenes depicted on this page will serve to call to mind again the early days of mining in California, and will revive many memories among those who participated in the stirring events which occurred when the placer mines of the State were pouring forth their golden millions.

THE MINERS.

It was labor, not capital, which was omnipotent then, and rich ground was abundant for those who sought their fortunes with pick, pan, and shovel. In the 'days of '49', and for years after, thousands who came to California hunted for and worked claims in the southern mines, including the counties of Amador, Calaveras, Eldorado, Mariposa, and what are now Fresno and Madera counties. C. D. Gibbes, a civil engineer who was among the early arrivals

MAP OF CENTRAL CALIFORNIA, 1852.

in the goldfields, made, among others, the map shown herewith. This was printed in 1852 and was at that time considered a very perfect one indeed.

The sketch of 'The Miners' is one the counterpart of which may still be seen in many places, but was universally characteristic when placer mining was the principal industry of the State, and men sunk shafts to bedrock to get at the shallow auriferous gravel along the gulches and on the flats near the streams. The old bowlder and gravel piles still seen in hundreds of places in the mining regions are about the only historic marks remaining of the past industry of thousands of miners long since passed away.

The two views of Placerville, Eldorado county, and Mariposa City, Mariposa county, may be taken as pictured types of the mining camps of the early 'fifties'. The structures were of temporary character, usually built on the sides of a central street. Few of those who came to California in those days expected to remain after they had dug their fortunes from the soil, and fewer still had even a remote idea of the possibilities of the permanent future of the State or its varied industries. They came to mine and then to leave for 'The States', again with no thought of continued residence. Most of the old-time towns are still in existence, though numbers of once flourishing camps have been long since abandoned with the exhaustion of the neighboring placer fields. Those which still exist are of a decidedly different appearance and character from what they were when the nomadic miner was the only inhabitant. For the loan of the lithographs from which these cuts have been made we are indebted to Stephen Vivian, whose father was in California in the days of '49.

In the earlier history of gold mining in California most of the precious metal was procured from surface washings in gulches, canyons, river bars and beds, and for many years an enormous amount of gold was derived from these sources. In 1852 the placer miners of the State mined out $81,294,700 in gold. Gradually, however, the area available for this kind of mining was narrowed, as ground was worked out, and then attention was turned to other sources of supply. Limited areas of these surface placers still exist in portions of the State.

When the quartz veins and hydraulic and drift mines

PLACERVILLE, ELDORADO COUNTY.

were found, companies built ditches to bring in the water to the gravel claims, and mills to crush the ore from the quartz veins. It became necessary to employ capital as well as labor in the mining operations of the State. The miners gradually stopped mining for themselves so universally, and became permanent residents of the little mining camps and larger mining towns where they were sure of steady em-

MARIPOSA CITY, MARIPOSA COUNTY.

ployment in the mines and mills. With them disappeared the romantic features of mining so graphically depicted by Bret Harte and writers of lesser note. There are, of course, still many prospectors in the mountain and foothill countries, as well as many miners who work their own claims, but the majority of the mining population is now engaged in work for the various companies which are operating the mines on a larger scale than is possible for an individual.

The Nishisawa Gold Mine

By Yoshikatsu Yamaguchi

According to a tradition, this mine was worked as a lead mine in the era of Kokwa (1844 to 1847). At that time the mine was governed by the priests of temple of Nikko, and working gold and silver ores was prohibited under the Tokugawa government. In spite of this, the mine was worked for silver and gold by Denyemon Konoike, a wealthy Osaka merchant. The mine was therefore confiscated, and Nagai, high commissioner of Nikko, was punished.

The mine lay idle until 1893, when the villagers of the district were granted permission to work it, and it was soon taken over by Gentaro Takahashi, who undertook exploratory work and in 1893 found a rich zone of auriferons and argentiferous bismuth ore on the Asahi level. During the following seven years, barrel amalgamation was carried on until 1902, when a disastrous flood carried away all the surface plant. Interested local gentry then organized the present company. Since that time exploration has been carried on, and the expansion of the surface plant has been steady. The mine is situated within a very rugged area in the mountains of the Nikko group (see map), and may be easily reached by way of Lake Chuzen-ji where there is an old temple called the Futa-ara Ginsha on the north beach. The mine is about 17 miles from Nikko. Near the mine there is a precipitous pass called Sanno, consisting of an ascent of about 2½ miles from the mine to the plain of Senjo-ga-hara; the road through this pass is now under reconstruction and is almost finished, so that travelers will be enabled to go by cars shortly after. From the above-named plain, the road is even and good along the beach of Lake Chuzen-ji to Chugushi. Between Chuzen-ji and Umagaeshi, there is a steep descent to Nikko. The road is very good from the hamlet down to the town; electric cars run four miles from Nikko to Futamiya, where the main road from Nikko to the Ashio copper mine branches toward Hosoo. As said before, the mine is situated among high mountains belonging to the Nikko group. Narrow valleys and steep ravines have been cut by erosion, so that there are frequent waterfalls. Although the mountain sides are covered with thick forests, rock-cliffs appear in many places in the mining area, the rock which contains the gossan and forms the outcrops of quartz veins being left unattacked by weathering, on account of its relative hardness and soundness as compared with the surrounding rocks. Those outcrops frequently occur coinciding in positions with lines of valleys, forming cataracts.

The rock at this mine is chiefly quartz-porphyry, frequently covered by liparite. The porphyry is white or light gray, and contains remarkable quartz crystals. The rock often appears to have been changed into tuff, shading imperceptibly into the unaltered rock, while those parts coming in contact with Paleozoic rocks contain abundant inclusions of quartz, clayslate, and sandstone, so that the liparite resembles a breccia. The liparite is of gray or brown color; it is loose, platy, or columnar, or frequently with a rhyolitic structure. It occurs in the higher parts of the mountains, being rarely found in the valleys. It is occasionally interbedded with clastic rocks; but it is not accompanied by any volcanic ash. A small area of sandstone and clayslate is also exposed, the strikes of both being obscure. The clayslate has been partly changed into hornfels by the metamorphic action of the quartz-porphyry.

The ore deposits are fissure veins, occurring in the liparite and the liparite tuff; but they are not found in the Paleozoic nor in the quartz-porphyry. The outcrops, though occurring in over two hundred places, do not permit a determination of the real number of veins, because they differ in strike and dip as well as appearance, though belonging to the same vein. The veins are perhaps fifty or sixty in number and may be divided into two groups: (a) those striking N. 60-90° E.; (b) those striking N. 40-50° W. The first group includes the greater number of the veins, having steeper dips, mostly 70 to 90°. The veins pinch and swell, being only 2½ in. wide in some places. Out of a little more than 200 veins, 144 have a width of over 6 inches.

The gangue consists of white and colorless quartz, containing native gold, argentite, wolframite, proustite, maldonite, galena, zincblende, chalcopyrite, pyrite, etc. The distribution of these minerals varies in parts of the veins. They often occur in symmetric bands, the richest part being usually next the central zone consisting of argentite and wolframite. The veins are frequently crossed by fault fissures, so that the levels exposing the veins exhibit very varied and complicated features. The richest shoot now worked is considered to have been formed by the joining of several veins. Maltidite rich in gold and silver was found and mined many years ago; but it is not found at present, although it occurs in some places underground in a little quantity. Exploration has not made great progress, only a few veins having been partly developed. The nature

MAP OF NIKKO DISTRICT, JAPAN.

of the deposit, it is believed, gives promise of great future prosperity.

The veins are explored by levels 5 ft. wide and 6 ft. high. Cross-cuts are driven from the level to search for other veins. When a rich zone or an ore-shoot is found, a winze is then raised or sunk. The minerals are thus worked by both overhand and underhand stoping. There are four important levels: the Yamanokami, the Asahi, the Daikoku, and the Kainn. The Kainn level, the highest, is a cross-cut started in a valley called Nebarisawa, and it is now being extended. The Daikoku level is the highest of the other three, while the Yamanokami level is the lowest one, that is, nearest to the water-line of the main valley. The Yamanokami adit will be made the main haulage road in future, because it is nearest to the metallurgical works, now being enlarged. The Asahi and Yamanokami levels are connected by winzes, and have many important working places. The No. 3 vein is at present worked chiefly on the Asahi level. The Daikoku level is now closed off.

At present rock is broken by hand drilling and dynamite. The output of the mine for the ten months from January 1907 was 4363 tons. The average content of the ore is 0.001 to 0.002% of gold and 0.0478 to 0.800% silver. There is natural ventilation and drainage. Transportation underground is carried on by half-ton cars running on 9-lb. rails. The ore is brought to the picking-house and dumped over a horizontal grizzly with 2-in. spaces. The oversize is classified into rich ore, common ore, and waste. The rich ore is cobbed, while the common ore is crushed by a

Blake crusher. The crushed ore, together with the grizzly undersize, is allowed to fall upon grizzlies with 1-in. spaces and is sorted, according to value, into best ore, common ore, middle ore, poor ore, and waste. The best ore and the common ore are sold to the Hitachi and the Ikuno mines; and the poor ore and the ore finer than ½ in. are again divided into ore to be sold and ore to be treated in the metallurgical works.

The mill consists of one horizontal grizzly 4 ft. wide and 36 ft. long with 2-in. spaces; and six inclined grizzlies 5 ft. wide and 8 ft. long, three of which have 1-in. spaces, and the remaining three have ½-in. spaces; and one 4 by 10-in. Blake crusher. In this plant, 1320 tons of ore is treated monthly, the average value of the finished ore being 0.05 to 0.0125% gold and 0.0582 to 0.0900% silver. The poor ore obtained by picking is crushed by the breaker to below 1-in. size and passed through a grizzly with 1-in. spaces. The grizzly oversize, together with the ore between 1 in. and ½ in., is crushed by a roll-jaw crusher, and is allowed to pass over a ½-in. screen. The undersize is then sent to a Huntington mill, together with the fine ore, which comes directly from the picking work.

In the mill the crushed ore passes through screens, of 30 meshes per one *sun* or about 1.2 in., to amalgamated copper plates, where the gold and silver amalgam are caught. The pulp passing over the plates is sorted by a hydraulic classifier into sulphide ore, sand, and slime, each being dressed on Overstrom and Wilfley tables. The products from the concentrators are wolfram concentrate, sulphide concentrate, sand, and slime. The wolfram and the sulphide are both sold, while the sand and slime are to be subjected to cyaniding. The plant used for fine crushing and amalgamation is one 4 by 10-in. Blake crusher; one inclined grizzly, 5 ft. wide and 8 ft. long with ½-in. spaces; three 4 by 12-in. roll-jaw breakers; four rotary ore-feeders; four 3½-ft. Huntington mills; four amalgamated plates, 3 ft. wide and 7 ft. long; three Overstrom concentrators; and four Wilfley concentrators.

The auriferous and argentiferous sand from the dressing works is leached in vats by cyanide solution, the solution being 0.2 to 0.4% cyanide in strength. The solution which has passed out from the zinc-boxes is raised up to solution tanks by centrifugal pumps, and conducted into distribution tanks, where the solution is restored to the proper strength, ready for the leaching of fresh ore. The gold precipitate is melted in crucibles with borax and sodium carbonate for gold and silver bullions.

The slime is poured with cyanide solution of 0.2 to 0.4% strength into the leaching-vats and agitated by man-power with agitators attached to the vats. The pulp is conducted into discharging-vats, whence it is forced into a filter-press by means of a force-pump. The gold and silver solution passing from the press, free of slime, is then sent into zinc-boxes for precipitation. The barren solution from the boxes is sent into the distributing-tanks. The precipitate is fused and refined for gold and silver bullion in the same way as described in case of the sand-treatment.

The cyanide plant consists of one 5 by 10-ft. strong-solution vat; two 5 by 10-ft. weak-solution vats; four 5½ by 15-ft. sand-vats; two 5 by 6-ft. slime-vats; three 4 by 5-ft. gold-solution vats; four 2 by 2 by 12-ft. zinc-boxes; two 4 by 7-ft. discharge-solution tanks; one 3-hp. centrifugal pump with 3-in. delivery pipe; one filter-press with plates 2½ ft. square; one 1-hp. pump for the filter-press. With this plant 600 tons of ore will be treated monthly, producing 201 oz. gold, 310 oz. silver, 3 tons of wolframite concentrate, and 72 tons of sulphide concentrate.

Power is obtained from a boiler and a Pelton water-wheel, taking its water from the main stream at the mine. Power is also transmitted about seven miles to the mine from the electric-power station at Shyobu-ga-hara. The boiler is a multi-tubular type of 40 hp. and drives a 40-hp. engine. The electric-power plant consists of a turbine driven by a flow of 1020 cu. ft. per minute under a head of 85 ft., generating 123 effective horse-power. It is geared to a 75-kw. three-phase dynamo.

The ores to be sold are put into bags (kamasu) and sent on horseback to Nikko, whence they are transported by railway to the Ikuno and the Hitachi mines. The transportation for the 19½ miles to Nikko costs 13* yen per ton. The cost of transportation from Nikko to the Hitachi mine is 2.22 yen per ton, the distance being 104 miles. Part of the waste is used for packing the stopes underground; and the rest is piled on dumps. The mine water runs out by gravity. The waste water from the dressing and metallurgical works is made to precipitate its slime in settling-ponds, built on the ground just below the metallurgical works. The cyanide tailing is deposited behind rubble walls near the cyanide plant.

Re-Surveying Land

By P. B. McDonald

Re-surveying land on which many of the corners have been lost is as delicate a surveying problem as can ordinarily be undertaken, and requires judgment and experience. F. Hodgman, in his excellent handbook on the subject, remarks that, "Many very intelligent gentlemen suppose that if the surveyor can but find one of the corners of the original United States survey he can readily determine the position of all the rest from it." He then cites the following instance which is well worth repeating. "I have measured sections 22 and 23 on a level prairie, along the line of highways, where no obstacles of any kind interfered to prevent accurate work. I took the greatest possible care in the chaining to have it as accurate as chain work can be done. On the north line of section 22 my chaining tallied exactly with that of the United States survey, viz., 79.60 [chains]. On the north line of section 23 my measurement was 80.96, that of the United States survey, 80.40—a difference of 56 links (some 37 feet). Fortunately, all the corners of the original survey on this two miles of line were well preserved, and the distance between quarter-post and section corners was uniform on the same section in both sections. But suppose that a part of them had been lost, and it was required to restore the middle section corner (N.E. of 22) from the remaining ones. Omit all consideration of corners north and south, and there remain four different solutions of the problem, depending on which corners were lost and which preserved. Of these different solutions, one would place the corners 9⅓ links, one 14 links, one 18⅔ links, and one 28 links, all east of the true corner. This is not by any means an extreme instance, as I have observed discrepancies twice as great." Such a case might not affect farm or timber lands to any serious extent, but not infrequently in mining districts a rich body of ore crosses a disputed line, so that every foot in a mile strip is worthy of serious consideration. It often happens that one surveyor will fail to find the marks of an original corner, while another, more apt in discovering the evidence, will hit upon it readily.

The ordinary mining engineer is called upon to do re-surveying of land so seldom that he is apt to be at a loss how to proceed. He remembers that there is a vast amount of discussion of the subject in his old textbook used in college, but the quantity of this usually appalls him, so that he merely looks up the general rule and goes out in the field, trusting to find convenient landmarks that will solve the problem. The following remarks upon such work are by no means conclusive; they merely represent some methods which have been found to be convenient in the upper peninsula of Michigan.

Preparatory to re-surveying land, write to the State Capitol for the original survey notes, which will be furnished at a small charge for copying. If subdivision work is still in progress, as in many of the Western States, this record can be obtained from the U. S. Surveyor General of that State. In the Middle West, where the government surveying was completed years ago, apply to the State Land Commissioner. These original survey notes are indispensable where any doubt exists as to the correct boundaries; they

*1 yen = 49.8 cents.

describe the stakes left, the bearing-trees, line-trees, and general topographic features of the country traversed. The following is a sample of the notes for one mile:

5.22	chains.	Sugar maple 9 in. [in diameter], line-tree.
12.20	"	Fir 10 in., line-tree.
40.02	"	Set sugar-maple post, quarter-section corner.
Bearing-trees.		Yellow birch 12 in., N. 62 E., 26 links. White pine 20 in., S. 70 W., 27 links.
75.00	chains.	Stream, course S.E.
80.04	"	Set alder post, section corner.

Bearing-trees described as follows, etc.

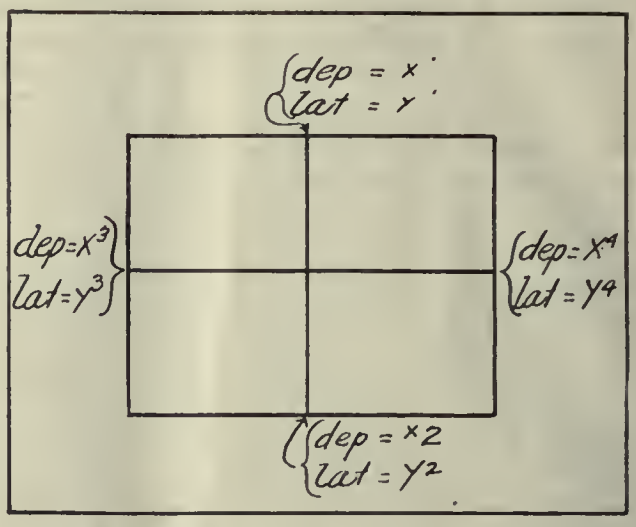
Often not a trace of the original corner can be found, until, from the notes, two stumps are located corresponding in direction and distance with the bearing-trees. Then usually careful digging with a shovel at the measured spot will disclose the rotted remnant of a stake under the vegetation and sub-soil. Although foreign to the habit of most surveyors, "there is great virtue in a pick and shovel intelligently applied to the finding of corner posts and monuments." Also the best, and sometimes the sole, evidence of a corner has often been destroyed by an ignorant person striking deep into the ground, expecting to find a sound stake, and casting away the decayed wood or filling up the hole of a rotten stake without observing it. The same precaution applies to chopping away the encroaching bark which tends to hide a blaze on a bearing-tree; frequently all that remains of a lettered blaze is a narrow slit which, if carefully cut back, will disclose the scribe marks of the original surveyors. In general, it is better to chop from the outside in, than to try to enlarge the slit by slicing, for the latter method usually cuts off the faint lettering.

In some cases where no stakes or bearing-trees could be found, the original line-trees (which were merely blazed without lettering) have been discovered and taken as authority, since the purpose of re-surveys is to establish as nearly as possible the stakes placed by the original surveyors. For convenience in referring to the original survey notes, they can be copied in the field notebook and the pages of the book numbered; then on a sketch map of the sections being surveyed, in the front of the book, each section line can be marked with the number of the page where the notes for that line are copied.

Some customs of the original government surveyors are here given. Two bearing-trees were left for each section corner and quarter-stake, usually in opposite quadrants; present practice is to leave four. Bearing-trees at a quarter-stake were cut by a steel 'scribe' with the inscription '¼.' At section corners the trees were marked with the number of the section, the township, and range. Bearing-trees, in addition to being blazed and marked, were notched just above the ground, so that where there remains only a short stump, the notch identifies the tree. Section corners were squared at the top and notched on four edges; the notches indicate how many sections there are in each direction in that township, in this manner identifying the stake. Thus the northeast corner of section 14 would be notched twice on the north side, four times on the south, once on the east, and five times on the west. Only the section corners and quarter-stakes were put in; the sixteenth or 'forty' posts and the centre of the section were left unmarked.

The general rule to follow in establishing lost corners is as follows: "Retrace the known lines of the description and find how the lengths and directions of these lines by your survey agree with those of the same lines as laid down in the original description. Then run the unknown lines and place the lost corners so that they will bear the some relation to the known lines and corners as they are required to do by the description of the original survey."

The centre of a section is the point of intersection of the two lines connecting the north and south, and the east and west quarter-stakes. Knowing the total latitudes and departures of the quarter-stake, the latitude and departure of the centre-pin can be conveniently computed by analytic geometry, thus, by an hour's work in the office, saving considerable time in the field.



$$\frac{y - y_1}{x - x_1} = \frac{y_2 - y_1}{x_2 - x_1} \qquad (1)$$

$$\frac{y - y_3}{x - x_3} = \frac{y_4 - y_3}{x_4 - x_3} \qquad (2)$$

Substitute total latitudes and departures in equations (1) and (2), paying attention to the sign in each case. Equation (1) will be the equation of the line connecting the north and south quarter-stakes; equation (2) will be the equation of the line connecting the east and west quarter-stakes. Solve the two equations together simultaneously, and the values obtained for x and y will be respectively the departure and latitude of the centre of the section, since that is the only point common to both lines. After determining the coordinates of the centre of the section, its angle and distance from a quarter-pin can be easily computed.

As to subdividing quarter sections into forties, instructions from the General Land Office have not been uniform. Several commissioners have maintained that the dividing lines should be straight lines running through the sections to points on the section line, but other commissioners and general practice have decreed that the quarter-quarter posts are to be placed at points equidistant, and on straight lines between the section and quarter-section corners, and between the quarter-corners and the common section of the section. The latter method is the simpler and easier of the two, and the one generally used.

Previous to starting the work, it will pay the surveyor to take a walk around the sections in question, and talk with old residents thereabouts. Very often through the use of a little time and tact, he will learn whether or not stakes and fences are authentic, besides acquiring a working knowledge of the country that will enable him to plan his work to advantage.

It is desirable to do the taping with a tape divided into links and chains so that all readings are direct. A tape two chains long can be purchased for about $4, and if the chainman has learned the knack of twisting a tape through the figure-eight into a circle he can carry it conveniently around his neck. Many surveyors prefer a light transit such as is used for mountain work in the West; a No. 4 instrument on a No. 5 tripod is a popular combination.

Oil is the greatest foe of catching gold on amalgamated plates. The catching of the gold is done by the gold breaking the mercury surface and sinking beneath it; the gold sinks in the mercury just as ore does in water. But since the gold is in small fragments of no great weight and the surface tension of the mercury is strong, the surface of the gold must be clean or else the mercury will not wet it, and the gold will float on the mercury just as a greasy needle may be made to float on water. Grease may be removed by the use of an alkali which converts it into soap. It is much better to prevent grease getting on the ore or in the battery than it is to try to remove it afterward.

The Repeal of the Apex Law

By W. P. Rodgers

Mining men generally feel that there is something wrong with the apex law, as is shown by the many references to it in our mining journals. The following is an attempt to show that the legislators of the apex law had in mind fissure veins only; that the law is not adaptable to other and anomalous forms of deposits and should not be applied to them.

The whole mining industry may be divided into coal, iron, quartz, and placer mining. The last of these, having no relation to the apex law, will receive no further attention. Lands containing the coal and iron mines in the East were taken up under the common law and have no bearing on the apex law. It is worth noting, however, that peace and prosperity has attended these branches of the industry, operating under the common law, in contrast to the litigation among followers of the apex law. There is no geologic reason why a coal miner should not have the same right to go down on his vein as the quartz miner has on his. There is no geologic reason why the same general law should not regulate both these branches of mining. Typical vein mining is carried on in Michigan, in the great copper mines, under the common law, but no complaints are made of the industry being hampered because of this. If the apex law is a fundamental conception, it should be found regulating the greatest branches of the industry instead of the least. If it had the merits claimed for it, better conditions would exist where it does operate than where it does not; yet the opposite is true.

On certain Indian reservations in the Northwest, where mining privileges are granted to prospectors, the clause containing the extralateral-right feature is stricken out. The Philippine Commission adopted a mining code that excludes the apex law in its entirety. In certain mining camps in the United States owners have voluntarily abrogated the apex law, by adopting the common law, where the geologic conditions were such as to endanger the rights of adjoining owners. This has created industry where the operation of the apex law hampered it, and has stimulated where the old law has discouraged. In speaking of the Arizona copper camps, James Douglas says: "The wonderful development of mining in this district has unquestionably been brought about through this liberal policy." Again: "From every point of view, therefore, I believe the companies of both districts have benefited, and undoubtedly the population of both has prospered, and the whole of southern Arizona has advanced with rapid strides through this abolition of the law of the apex and the voluntary adoption of the common-law rule."* All these facts show that there are serious limitations to the apex law. The action of private ownership in withdrawing its support, and of the Government in omitting it in late legislation, shows a change in opinion regarding it and that general experience with the apex law has proved unsatisfactory. Surely this evidence of its being unsound is opposed to the idea that it is a 'fundamental conception'.

The adoption of either law where applicable would have a tendency to involve rather than simplify. This demands a definition of such terms as lead, lode, vein, deposit, and orebody. Definitions of these terms have never been rendered, either by geologists or courts, to convey a general yet specific and concise meaning, without ambignity. It is impossible to do so, because of pertinent conditions. Geologists have classified orebodies, and where the difference between classes is distinct, little difficulty would arise in applying the better law. These would be the exception rather than the rule. The geologic conditions of a mine, to a certain point, may be suited to one law, but upon further development, they may change sufficiently to cause confusion in knowing which law to apply, or so distinctly as to be covered by the other law. Where the difference between classes is indistinct, who is to judge which law to apply? If any person is capable of knowing, it is the geologist, yet his judgment would hardly prevent a plaintiff from resorting to an action at law, nor would any precedent be strong enough to satisfy him.

The right of the miner to go down on his vein appears, on its face, to be true enough to be a maxim. Writers have declared it and courts have decided cases on it, basing their opinions on the right of discovery, and as a reward for his labors and incentive to further discovery. In the first place, has not the discoverer as much right to the length of his vein as he has to its depth and width, based on right of discovery? Who has a greater right to it? It appears that his right applied to length is a variable one. At one time it was only 50 ft., at another 400 ft., at another 1400 ft., and even 3000 ft. in an association claim. At the present time it is 1500 ft., as a Federal limitation. If justice, based on right of discovery, demands that a miner follow his vein on its width to its depth, it also demands that he follow it to its length. Why is he restricted in his right as to its length? Furthermore, the discoverer is allowed a right only to what is included within his stakes. Beyond these he has no right whatever. He discovers a vein, and it may so happen that he locates that part which is unprofitable to work. Another prospector locates the extension, which proves to be the bonanza of the whole vein. Now what becomes of the 'right of the discoverer as a reward for his labors and incentive to further discovery'? The following from a speech by W. M. Stewart, Senator from Nevada, has been cited in support of the apex law: "To extend the preëmption system applicable to agricultural lands to mines is absolutely absurd and impossible. Nature does not deposit the precious metals in rectangular form descending between vertical lines into the earth." Did Mr. Stewart mean to say that soil was deposited in rectangular form? There is a law of deposition that governs soil and precious metals alike. That law is, where conditions are favorable deposition will take place, and, it may be added, without regard to geometrical form. When President Jefferson approved of the rectangular system of public-land surveys, he did not do so thinking that soil was deposited in 'rectangular form', but as an improvement over the then existing system of metes and bounds. It may have appeared that the 'dictates of plain justice' demanded that a man had a right to choose the productive soil, and enclose it by an irregular line of metes and bounds, as was the custom, rather than be compelled to buy it in rectangular form, the barren along with the fertile. The Senator's speech, instead of being sarcasm, furnishes us a good example of how a long-established custom of the division of real estate was completely changed to a system that had really less justice for the individual but more for the whole people, and which substantially put an end to litigation over boundaries.

It is said that a greater confusion of rights will result in a change from the apex law to vertical boundaries. That is to say, greater confusion will arise where there is a definite boundary to rights, than where that boundary is indefinite. It is not clear how any confusion can arise when the new claim is to be staked subject to all the rights claimed by the senior locator under the old law. The new law would take effect where the rights under the old law cease. This will make the transition gradual and without a nonconformity. No more 'confusion of rights and resulting inevitable litigation' can occur than if the new claim were staked under the old law.

It is affirmed that the apex law was made for the fissure-vein type only, and it seems that this opinion is held generally among both the friends and opponents of the law. Contemporaneous history supports this view, and the internal evidence in the law leads to the same conclusion. The Federal law of May 10, 1872, uses the words 'vein', 'lode', and 'ledge'. 'Deposit' appears but twice in all Federal legislation and Land Office regulations in connection with quartz mining. An examination of the State codes discloses the fact that those legislators have followed closely

*The Engineering and Mining Journal, Nov. 23, 1907.

the meaning in the Federal law by making use of the same terms. Another reason for believing that they had in mind 'veins' of the fissure type only, is, they did not mention any other. If they contemplated other orebodies, why did they not mention them? The language in which it is expressed is not such that something else or something more can be deduced by way of implication; it is specific. If they contemplated deposits with irregular boundaries, having a large superficial outcrop, the length and breadth of which are approximately equal, why did they adopt a long, narrow claim to cover it? The width of the claim appears to have been a variable, too, varying from 50 to 600 ft., the Federal limitation, but never equaling the length.

There is an example before us. The following is a quotation from the opinion of the Court of Appeals, in the case of Lawson *v.* The United States Mining Co.: "Where two or more mining claims longitudinally bisect or divide the apex of a vein, the senior claim takes the entire width of the vein on its dip, if it is in other respects so located as to give a right to pursue the vein downward outside the side lines. This is so because it has been the custom among miners, since before the enactment of the mining laws, to regard and treat the vein as a unit and indivisible in point of width, as respects the right to pursue it extralaterally beneath the surface; because the width of the vein is so irregular, and its strike and dip depart so far from right lines, that it is altogether impracticable, if not impossible, to continue the longitudinal bisection of the apex through the vein on its dip or downward course; and it conforms to the principle pervading the mining laws, that priority of discovery and location gives the better right, as is illustrated in the provision giving to the senior claim all ore contained in the space of intersection where two or more veins intersect or cross each other, and in the further provision giving to the senior claim the entire vein at and below the point of union, where two or more veins with distinct apices and embraced in separate claims united in their course downward. Rev. Stat., Sec. 2336."

The first thing engaging the attention is, that the "senior claim takes the entire width of the vein on its dip." That is to say, it is necessary to stake only one claim in width over any broad showing, whether that claim covers all the apex or not, as that senior claim will hold all the ground between the boundaries of the orebody. In an old established camp where mines have been working, on newly discovered ore-shoots, or by the invention of processes making lower-grade ore profitable, the senior claim may be enabled to extend its ownership over every parallel property and dispossess all other owners; a fact certainly not the intention of the framers of the law. It is true that the early miners were not accustomed to divide the apex. It is also true that the law of 1872 both expressly and impliedly does not intend that the side lines should be destroyed. The law is specific in stating that a claim shall not exceed 600 ft. in width. The deputy mineral surveyor is the only person authorized to move the boundaries of a claim. When the original location stakes are beyond the legal dimensions, he is authorized to move them in to the proper limits, but never to move them out when it is staked less than the legal limits.

There is an implied limit that the width should not exceed 1500 ft. If the framers of that law thought that 1500 ft. in length along the lode was enough for a claim, should not that be enough for the width, when the apex is that wide? But the interpretation of the courts is that the length of a claim is only 600 ft. when staked across the lode. Would it not seem as plausible to extend ownership along the vein to the full 1500 ft., the Federal limit, and dispossess the junior locator, as it is to extend the width, destroying the Federal limits and dispossessing every parallel junior locator? But it was done according to the custom of miners. What was the miners' answer at Leadville, Colorado? When the owners of claims there having the apex of those deposits came up for trial for their extralateral rights, there was not a jury that would grant them.

Again, the court says that it is impossible to continue the bisection of the apex throughout the vein. Has not the principle of that very thing been accomplished by private ownership in the way of amalgamation of companies? While it would in a sense be impracticable for each company to have continued operation on the same vein, they could have effected a working agreement, whereby each was to receive a certain percentage of the profits based on a proportional cross-section of the vein at the surface. Another argument for the apex law is based on "priority of discovery and of location gives the better right." Better right to what? To the vein, of course. If a discoverer has a right to the vein, he has as much right to its length as to its width and depth, which the laws do not grant him. If he has a right to it, he has a right to the best part of it, which is plainly not true in all cases. Curtailing his right a little more, he should have it at least to the full Federal limit, 1500 ft. along the vein, but not so in all cases. If the prospector happens to stake across his vein, he gets only the width of his claim, whatever that is, but it must not be more than 600 feet.

If he misses the vein altogether and stakes off at one side, he gets the better right to nothing at all, as a "reward for his labor and incentive to further discovery." If the prospector is fortunate enough to locate on the vein and along it, he will enjoy all the rights and possession accorded to the Federal limit, but how often is the vein exposed enough to do this? In the case of a broad apex his rights become more apparent. The trouble is in knowing where they cease. When the claim is located with the strike of the deposit, rights extend to the boundaries of the ore, wherever they may be. This is not a criticism of our courts. I am fully conscious that our system of jurisprudence is as good as any. The courts have done all that human judgment can do. History discloses the fact that their task has been arduous, but they have performed it with untiring zeal, sincere devotion, and a conscientious struggle for the right. The fault is not theirs; it is in the statutes. No court ever will be able to lay down a hard and fixed rule defining a boundary of rights while the statutes do not indicate any, only on condition. The law has not a general adaptability, it was not constructed for broad apices, it has been stretched beyond the intention of the framers, and is, therefore, no law at all.

The evil is fundamental and demands fundamental treatment. No remedial legislation, no revision, no modification along the old lines will do. A new principle must be established. Therefore, a repeal of the apex law is recommended. The laws of location, too, should go, as they fail to render the expediency they should. They are cumbersome to the prospector and shoulder on him unnecessary expense. In their place is recommended the 1500-ft. square claim, bounded by vertical side lines, as fixed and rigid as the North Star, without a proviso, without a condition in the law regulating it, which should be devoid of language implying instability. These fixed boundaries and determined rights will give a title that is unquestioned, and on this account will remove the causes that otherwise intimidate capital. The enactment of the common law will unify the whole mining industry, by bringing together the coal miner and the quartz miner. There is no valid reason why the common law should not be adopted: it has been done before. British Columbia made the change from the apex law and adopted the square location, and their laws have excited the admiration of every mining man who has had experience there. The Philippine code is expressed in parallel language. That system, already adopted within the jurisdiction of the United States, is an initial step.

Who is to construct the law? The lawyer says that the geologist should not, because he has not read Blackstone. The geologist thinks the lawyer should not, because he has not studied geology. A knowledge of both law and geology is necessary, and both are equally important. It would appear, therefore, that the law should be constructed by a special committee composed of lawyers and geologists. Let it be done with deliberation, with comprehension, with judgment and reason, and a law will be evolved that will deliver the development of all future discoveries from the burden that now encumbers it.

Combination Melting and Cupelling Furnace

By Will H. Coghill

Coke-fired melting-furnaces of sufficient size to hold large crucibles have been used for several centuries. In operating this type of furnace the melter is obliged to expose himself to intense heat while drawing the crucible from the furnace and pouring its contents. As the result of the recent development of the cyanide process in which the 'clean-up' must be given a preliminary treatment and melted, the furnace has been greatly improved, and we now have the tilting furnace in common use. This furnace is fired either by gas or gasoline; it rests on trunnions, and can be tilted through more than 90° by means of a crank, thus discharging the contents of the crucible, and relieving

TILTING MELTING FURNACE.

the melter from exposure to the heat. The burner is fastened rigidly to the pipe-line and must be shut off before the furnace is tilted. I am using a No. 40 Donaldson tilting furnace manufactured by the Denver Fire Clay Co., and have modified the burner connection at an expense of about $3, thus greatly increasing the usefulness of the furnace. The picture shows the furnace tilted ready for cupelling, with the burner made fast to the furnace by means of strap-iron, and connected to the gasoline pipe-line by a flexible copper hose furnished by the Pennsylvania Flexible Metallic Tubing Co. The copper tube is nearly as flexible as the ordinary steel hoisting cable of the same size, and is guaranteed to be non-corrosive and to stand 100 lb. pressure. With the burner connected in this way the furnace can be tipped to any angle below the horizontal without interrupting the blast. I have cupelled in this furnace, forming liquid litharge, which was drawn off through a pipe connected to an air-line by means of a hose. For this work a cement cupel was built in an old crucible. A board was made to fit snugly into the crucible, dividing it, in the direction of the axis, into two equal parts and to the under side was fastened the pattern which was to shape the cupel bowl. The cement was then tamped into place and the board slipped out and the pattern removed. The pattern was 7 in. long, 6 in. wide, and 1¾ in. deep with sloping sides and gave a bowl which after making allowance for litharge gutter had a capacity of 25 lb. of lead.

This furnace can also be used to demonstrate the roast-reaction process of lead smelting. The hearth bottom is built in the crucible, as previously described, except that the pattern is left out, thus giving a hearth with a plane surface in which a lead gutter can be cut. The pipe for applying the air-blast should be straight, and direct the blast against the side and end of the crucible, thus allowing the air to reverberate and become preheated before it comes into contact with the material to be roasted.

The accompanying table, showing a temperature test on this furnace, may be of some value to those considering the use of this type. The gasoline used was 62°B. (really petroleum naphtha) and was consumed at the rate of one gallon per hour. The temperature determinations were made with a Bristol thermo-electric pyrometer, with the fire-end placed about one inch from the bottom of the crucible. At 11 o'clock, after a preliminary warming and drying for one hour, the blast was turned on full force. At this time the outside of the furnace was barely warm. The blast was turned off at 11:35, and the continued rise in temperature indicated at 11:37 was probably due to a lag in the pyrometer.

Time of day.	Degrees F.	Change.
11:00	1557	..
11:05	1600	43
:10	1680	80
:15	1744	64
:20	1800	56
:25	1850	50
:30	1890	40
:35	1920	30
:37	1930	10
:40	1890	40
:45	1820	70
:50	1750	70
:55	1680	70
12:00	1590	90
12:05	1530	60
:10	1465	65
:15	1390	75
:20	1330	60

Hinged Guide Shoes

The ordinary method of removing a cage from the shaft requires hoisting it above the surface level, taking out two of the guides held in place by bolts, dropping the cage to the correct position, swinging it out, and detaching the cable. To substitute another cage the reverse process is

HINGED GUIDE SHOE, KENNEDY MINE.

then necessary, the whole maneuver being awkward and time consuming. As a result, cages suitable for a special sort of work are not as often used as is otherwise desirable. At the Kennedy mine, Jackson, California, the superintendent, Webb Smith, has met this difficulty by using a hinged guide shoe, illustrated in the figure above. With this it is unnecessary either to have removable guides or to first hoist and then lower the cage. Instead, the latter is brought a little above the level of the shaft collar, the flat-headed locking pin shown is withdrawn, the cage swung out, and rope detached. At this mine the cages not in use are swung to one side on an overhead trolley, and are readily available at any time. The guide shoes when in place are locked by the pin shown. The head is shaped so that the pin when in position prevents any possible unlocking by accident.

Dredging in California

STAFF CORRESPONDENCE

The Yuba Consolidated Gold Fields, for which W. P. Hammon is managing director, is operating twelve dredges at Hammonton, situated on the Yuba river, twelve miles east of Marysville, California. The ground in which these dredges are being operated has an average depth of 64 ft. below water-line, being the deepest ground in California on which work is now in progress. In fact, the problems in connection with deep dredging were worked out here with the first two dredges that were built. Each of these was equipped with a digging chain of 6-cu. ft. buckets, and was designed to excavate 60 ft. below the water-line. The top soil, consisting of tailing deposited as the result of hydraulic operations years ago, has a depth of 10 to 30 ft.; the material between this and the bedrock is made up of compact bench gravel and modern river-wash. The value of this ground is 18 to 20c. per cubic yard. The other ten dredges, built since the first two were tried out, are equipped with 7-cu. ft. buckets. These twelve dredges handle an average of 100,000 cu. yd. per month of gravel per dredge, or about 3300 cu. yd. per day. Yuba dredge No. 13, under construction, an illustration of which is given herewith, is expected to be in operation next month. This was designed and built by the Yuba Construction Co., and has a 124-ft. steel digging ladder, carrying ninety 15-cu. ft.

YUBA DREDGE NO. 13.

buckets, by which excavating can be extended to a depth of 65 ft. below the water-line. The ladder, buckets, rollers, and lower tumbler have a combined weight of 676,150 lb. This dredge probably will have a capacity of over 10,000 cu. yd. per 24 hours. The operations at Hammonton are under the general management of Newton Cleaveland.

The Natomas Consolidated of California, one of the Hammon interests, is operating Natoma dredge No. 8 on American river, near Folsom, handling material at the rate of 500 cu. yd. per hour; this consists of heavy clay and cemented gravel, and is considered difficult ground. The same company's dredge No. 9, now practically ready for work, will be operated on Rebel hill, one mile from dredge No. 8. Both dredges are equipped with 15-cu. ft. buckets, the length of the ladders being such that digging may be extended to a depth of 55 ft. The placing of an order by this company for the construction of Natoma dredge No. 10 has been already announced. It is to have a steel hull, 150 by 50 ft., 10 ft. deep; is to have 15-cu. ft. buckets, and will be operated on Humbug hill, near Folsom.

The Oroville Dredging, Ltd., is operating five dredges in the Oroville district. Two of these are of the Yuba Construction Co. type, having 7½-cu. ft. buckets; two others are of the Bucyrus pattern, with 5-cu. ft. buckets; the fifth is a Risdon dredge, having 3-cu. ft. buckets, close-connected. These are working in ground running 12 to 15 cents in gold per cubic yard.

The Calaveras Engineering Co. is using a Lidgerwood-Crawford scraper-bucket excavator, a gravel washer, and gold-saving plant of the Risdon type, in working over the auriferous gravel of an ancient river channel close to the Calaveras river, three miles north of San Andreas. The material, lying on a schist bedrock in which are stringers of quartz, is dry, except between certain limestone crevices. The excavator consists of a car, resting upon rollers by which it is moved on a plank track. It has a 60-ft. boom upon which the scraper-bucket works, weighing 1½ tons, and having the capacity of 1½ cu. yd. The bucket is raised and lowered by means of a hoisting cable working over a sheave at the end of the boom; it is loaded by means of a drag-line running between a set of traveling sheaves in front of the floor plate. The loading and dumping is accomplished by means of an equalizing cable attached to the drag-line and front of bucket, and which passes over a sheave fastened to the bucket bail. The excavator has a bottom plate of steel, 14 ft. square, a 14 by 28-ft. floor plate of steel; between the two plates is a turn-table of 12 cast wheels resting on 80-lb. rails. The machine is turned by a single-drum winding engine, having two cables attached, whereby a complete circle can be made and the bucket operated on all sides. The machine is operated by steam-power, wood being used as fuel. Thus equipped, the machine has excavated to a depth of 35 ft. at this mine, and can be worked to a depth of 50 ft. without any changes. It handles 300 to 500 buckets of gravel in 10 hours. The material is dumped by the bucket into a 12 by 12-ft. hopper which constitutes the top part of washer and gold saver. It passes from the hopper through two chutes into an iron cylinder, 4½ by 22 ft., which revolves at 12 to 15 r.p.m., the receiving end being about 3 ft. higher than the discharge end. The upper part of the cylinder has ⅜-in. perforations, those in the lower 18 in. being ¾ in. The oversize discharges from the cylinder upon the stacker, by which it is carried to the dump; the undersize passes into an iron box that is lined with Hungarian riffles, in which 80% of the saving is made. The sand and gravel are then carried to a riffled sluice-box in which quicksilver is deposited, and finally it passes on to a 20-ft. sluiceway in which cocoa matting is used for recovering the fine gold. The cylinder and stacker are operated by a 15-hp. electric motor, and the water used in the cylindrical screen and sluice-boxes is pumped to the top of the washer from a ditch in the vicinity, from 150 to 250 in. being required. The channel being dredged contains a considerable amount of barren clay, occurring in layers. This is removed separately, and not allowed to become mixed with the gold-bearing gravel, as it would rob the sluices of gold. By utilizing the equalizer cable on the bucket the operator is able to excavate in layers, and thus remove the clay. A certain amount of water is pumped into the hopper by which the material is washed through the cylinder, the feed into the latter being so regulated as to make it uniform. S. R. Fox, manager for the company, states that the ground being worked averages 25c. per cubic yard and that he washed an average of 245 buckets of gravel per day of 10 hours during April, under unfavorable conditions. It requires two men on the excavator, one to operate, the other attending to firing, water-supply, and oiling; one man is required on the washer. All bedrock material, except the limestone, can be excavated by the bucket. By using a few sticks of giant powder on the limestone banks these may be broken down. The water supply required at the excavator is obtained at the washer. The washing plant is moved by the excavator equipment, by using a block and cables fastened to trees or anchors. This ground is being worked on the basis of a royalty.

Quicksilver in Mexico

The quicksilver mines in Mexico are few, past production has been irregular, and the amount now produced is exceedingly small. The most important mines are in Huitzuco, State of Guerrero. The deposits, very irregular, occur in Cretaceous limestone, filling cavities or as replacements. The ores are cinnabar in small amount, and a sulpho-antimonide of mercury in various stages of alteration, accompanying stibnite. As by-products of alteration, some sulphur and gypsum occur. Secondary alluvial deposits filling chimney-like cavities have been more import-

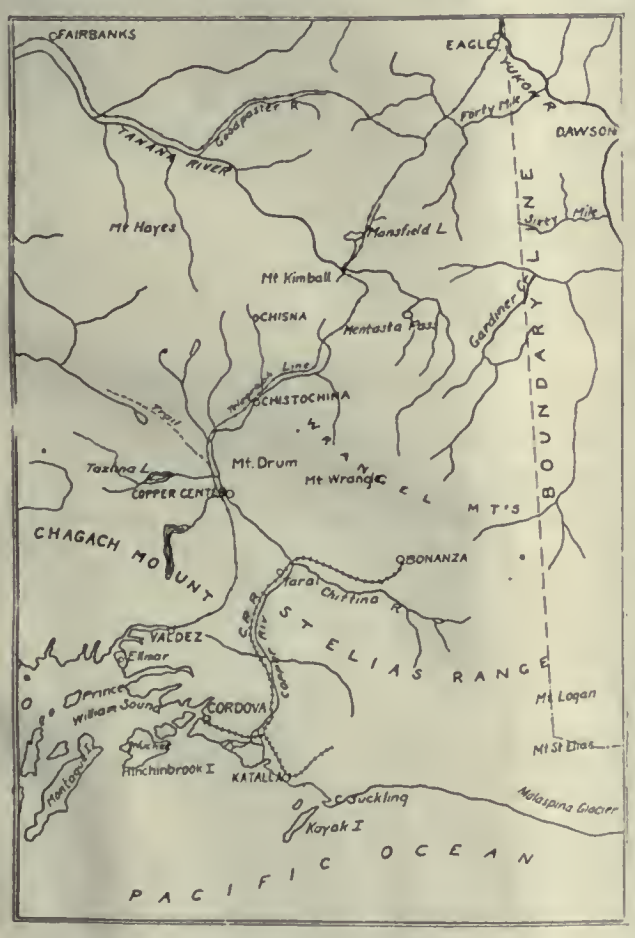
ant, though of low grade; many of these deposits are now almost exhausted. The other district is Guadalcazar, in the State of San Luis Potosi, with a small-scale production from irregular deposits in limestone. Working has now almost ceased. In both districts exploration is difficult, in view of the uncertainty of conditions. A thorough examination of the quicksilver properties might result in more intelligent development. The Huitzuco mines are now under option to an English syndicate.

In many Mexican mines cinnabar is occasionally found near the surface, especially in the States of Guerrero and Michoacan, associated with silver or copper ores. Many of these mines were discovered and worked during the Spanish domination, when the Government explored the whole country for quicksilver to supply the needs of the patio process.

Quartz Mining Near Valdez

By Anthony McCauley

It was not until the discovery of the rich veins surrounding Valdez that quartz mining became practical in Alaska. Here conditions are good, the climate is mild on account of the Japanese current, and transportation is easy, as the smelters can be reached by all-water transportation, the cheapest in the world. This marks the beginning of an era of quartz mining in Alaska, which from all indications will eclipse the records of even its famous placers. The little group of rich mines opened up around Valdez will be the



MAP OF SOUTHERN ALASKA.

incentive for further prospecting and work, and from this beginning it will spread, new discoveries will be made, and new towns spring up. From the time that the first discoveries were made and the first rich deposits opened up in the Cliff mine in the summer of 1910, prospectors ranged the hills and within a very short time a number of sensational finds were made, and specimens were brought in lavishly sprinkled with coarse gold. The snows beginning to fall early put a stop to prospecting for the winter, and development was to a great extent retarded by the lack of roads, and the difficulty of getting in supplies for the winter, but from all indications the present summer will witness the opening up of some of the most sensational mines ever found in any camp, as the veins are strong and the surface rock is phenomenally rich. The district is remarkable for the great extent of its mineral territory, covering an area of about twenty miles long by ten miles wide, the great number of veins, and the numerous properties from which 'specimen rock' can be obtained.

Synthetic Rubies

Staff Correspondence

The manufacture of artificial precious stones has always had a fascination to the physicist, and also, it must be said, to the swindler. The much-advertised but secret discoveries are to be treated with due caution. 'Imitation' stones, as distinct from 'artificial', have been with us since the days of the Romans, who produced beautiful glass imitations of almost every known stone, but the problem of producing a ruby or sapphire from pure corundum is of course quite a different matter. They have been formed in microscopic crystals, as also have diamonds, by simulating the condition under which it is supposed that the natural stones are formed, but they have never had any commercial value as yet. During the last few months London has been flooded with advertisements issued by a Paris firm called Tecla, that has recently established a business in England. The statements made in these advertisements have been taken with large grains of salt, for the claim that the rubies were real corundum, undistinguishable from the Burma or Oriental ruby, sounded too much like a trap to catch the unwary. Nevertheless, the claim appears to be a valid one, and the scientific explanation that has been issued seems reasonable and sound. Noel Heaton read a paper recently before the Society of Arts giving an account of the process.

The system of manufacture consists of building up a stone from tiny natural stones, fragments, and cutter's dust, and also from amorphous corundum, by means of the heat of the oxyhydrogen blowpipe. As long ago as 1819 a book on the blowpipe by E. D. Clarke described how if two pieces of ruby were placed upon charcoal and exposed to the blowpipe flame they would melt into one bead. About 1870 Gaudin revived these experiments, and in 1885 these stones were sold for a short time as 'reconstructed' or 'Geneva' rubies. The amount of skilled labor required in making them was so great that their cost was almost as high as that of the natural stone; and it was not until 1904, when Verneuil invented an automatic machine for conducting the operation, that the process became of commercial value. The principle on which it works is to first break the stones or cutter's refuse to powder, and then place a thin layer upon a small platinum disk. When this has been melted, a further supply of powder is allowed to drop gradually into it. Twenty-five years ago this addition of other grains was done by hand, a fact which accounted for the costliness of the operation. In Verneuil's apparatus the powder is contained on a sieve in the oxygen chamber, and an electrically-operated hammer gives the sieve a series of gentle taps, allowing the powder to drop through the sieve at a predetermined rate. This powder is carried along by the mixed gases to the fusion chamber and is made to impinge, in the midst of the flame, upon the platinum disk. The disk is gradually lowered and the melted material upon it, being withdrawn from the zone of fusion, begins to harden. The powder subsequently introduced by the blowpipe is fused upon the hardened mass, and thus slowly and by degrees a large stone is built up. This is called a 'boule', and it is usually pear-shaped. It takes about half-an-hour to produce one weighing from 20 to 30 carats. The old experimenters were doubtful of the value of the stones thus produced, for they expected that their structure would be amorphous, and that they would lack the optical and physical properties of the natural crystal. Mr. Heaton, however, states that these properties are faithfully repro-

duced and that the 'boule' is a single crystalline individual. The only way an expert can differentiate the artificial from the natural is by a study of such gas-bubbles as may be enclosed. In the natural stone these cavities are always found along the planes of crystallization with their axes parallel to the lines of cleavage. Sometimes there are so many of these parallel with each other, in two directions in each plane, as to give the structure technically known as 'silk'. In the artificial stone the cavities filled with occluded gas from the blowpipe retain their spherical shape and are distributed irregularly through the mass.

A great advance in the application of this process took place when Verneuil discovered how to use amorphous corundum instead of the small pieces of natural stone. A pure ammonium alum is prepared and introduced as fine powder just as was the natural powder. The flame decomposes it, by expelling the ammonia and the sulphuric acid, leaving a pure alumina. The stones thus formed are called 'synthetic', as distinguished from 'reconstructed'. In this process the coloring matter has to be considered. If none is introduced the resulting stone is a white sapphire. In order to produce the ruby color, a small proportion of chrome alum is added to the ammonium alum. For a long time the sapphire-blue could not be produced; cobalt was at first used as the base, but it was difficult to form its aluminate. This could be done by adding magnesia, but the presence of the latter resulted in making a spinel, or magnesium aluminate, instead of corundum. Finally it was discovered, quite unexpectedly, that titanium oxide gave the required tint. It will thus be seen that the two most valuable stones are being produced. They are sold at one-tenth of the price demanded for high-class natural stones, and the Tecla firm says that dealers will not buy, and pawnbrokers refuse advances on, any sort of colored stone. Truly an unfortunate circumstance for those who have hoarded that most beautiful, rare, and valuable stone, the pigeon-blood ruby.

The Venterskroon Goldfield

Much that is misleading continues to be published concerning the Venterskroon goldfield, the southern outcrop of the Witswatersrand system, where every geological formation on the Rand is repeated, except the payable reefs themselves. During the last twenty years there has been considerable prospecting by trenching, boring, shaft sinking, and every method of prospecting likely to meet with success, but so far a payable continuous line of reef has not been discovered. Patches of good ore there are in abundance, but they either thin out and disappear in depth, or become faulted and broken off to such an extent that their recovery becomes so expensive as to render mining at a profit impossible. It is this exact repetition of the Witwatersrand goldfield with only the Main Reef Series missing that has proved so seductive as to lead to so much money being spent in prospecting. Almost every geological authority has been enticed into writing encouraging reports at one time or another, but always when followed by prospecting operations the results have without exception proved disappointing. The Consolidated Gold Fields of South Africa, Eckstein & Co., the Free State Banket Development Co., Ltd., have all during the present year been induced to spend considerable sums on different properties in this field, but all have stopped work, on the conviction that it is impossible to find the Main Reef Series within their areas, although they represent a length of outcropping Witwatersrand formation over a distance of about forty miles. To prospect the rest of the area showing outcrops of the Witwatersrand beds another company has recently been floated in London under the title of Free State Rands, Ltd., with a nominal capital of £300,000, and has commenced boring operations. Whether this company will meet with more success than its numerous predecessors in the same field remains to be seen. The fact is that the beds hereabouts are much more disturbed by the elevation of the granite boss than the same beds on the Rand; at the surface where exposed they are generally overtilted, while the Main Reef horizon, where the only payable reefs occur on the Rand, is occupied by huge dikes of diabase, and all attempts to find any conclusive evidence of the presence of the Main Reef Series have hitherto resulted in failure.

The Origin of Rocks

The geologist divides rocks into three general classes—igneous rocks, originating from the molten magma forced upward from the bowels of the earth, such as granite and the various lavas; sedimentary rocks, consisting of disintegrated particles of the igneous rocks which have been reformed into rocks, such as sandstone; and metamorphic rocks, consisting of igneous or sedimentary rocks whose composition has been greatly changed by intense heat, chemical action, or other causes, as for instance, a limestone that has been changed to marble.

Sedimentary rocks, as stated in the geologic atlas of the United States Geological Survey, are usually made up of layers or beds which can be easily separated. These layers are called strata, and rocks deposited in such layers are termed stratified. The surface of the earth is not immovable; over wide regions it very slowly rises or sinks with reference to the sea, and shore lines are thereby changed. As a result of upward movement marine sedimentary rocks may become a part of the land, and most of our land areas are in fact occupied by rocks originally deposited as sediments in the sea.

Sandstone is perhaps the simplest example of a sedimentary rock. Obviously sandstone was once sand, and again each grain of sand was once a part of some older rock. This sand was first eroded and then deposited and either subjected to great pressure by overlying masses, perhaps thousands of feet thick, or cemented together by chemical solutions. Where the stone was formed by simple pressure it contains a large proportion of open spaces, and thus becomes an ideal water-bearer. Some sandstones will carry as much as 350 cu. in. of water to the cubic foot of stone. In other varieties the interstices may have been filled with cementing material so that the rock may be for all practical purposes almost as dense as granite.

Rand Gold Production

The official returns for March issued by the Government Mines Department fully confirm those of the Chamber of Mines, but may be taken as more accurate, inasmuch as they are supposed to include all gold actually produced not declared, as is the case with the Chamber of Mines where it is the general custom for the mines to hold some portion of the actual gold output in reserve. Seeing that the March output was a record one for these fields, it may not be amiss to give the different districts and their contribution to the record yield which were as follows:

	Ounces.	Value.
Witwatersrand	651,366.310	£2,766,828
Klerksdorp	2,340.040	9,939
Ottoshoop	131.130	557
Pretoria	37.464	159
Barberton	7,372.565	31,318
Pilgrim's Rest	12,029.888	51,099
Pietersburg	326.290	1,386
Heidelberg	5,190.040	22,046
	678,793.938	£2,883,332

The above represents the output from 101 mines, of which 64 only were at work on the Rand, the remaining 37 being scattered over the different parts of the Transvaal. It has already been explained that the starting up of a portion of the big mill at Randfontein contributed largely to the March output being a record one, but in the event of labor continuing plentiful even this large output will soon be left behind, and it is predicted that before the end of the present year the gold output of the Transvaal will be materially increased.

Concentrates

Most of these are in reply to questions received by mail. Our readers are invited to ask questions and give information dealing with the practice of mining, milling, and smelting.

GLUE to resist boiling water is made by dissolving separately in water 55 lb. glue and a mixture of 40 lb. bichromate of potash and 5 lb. alum. Mix as wanted.

RUBBER TUBES can be preserved and prevented from drying and becoming brittle by being coated with a 3% aqueous solution of carbolic acid. If they have already turned stiff and brittle, they can be rendered soft and pliant again by being placed in dilute ammonia.

A GOOD CEMENT for iron and marble, which will stand heat, is made by dissolving first one pound of water glass and then one pound of borax in three pounds of water. With the solution make a paste of two pounds of clay and one pound of barytes, first mixed dry.

TO LUBRICATE plug-cocks and prevent them from leaking, use 2 parts of tallow and 1 part of beeswax melted together; stir thoroughly, strain, and cool. Glass stoppers may be made tight by melting together equal parts of glycerine and paraffine, and applying the mixture.

AN INK for writing on glass, celluloid, and metal may be prepared by dissolving 20 parts of rosin in 150 parts alcohol, and adding to this, drop by drop, stirring continuously, a solution of 35 parts borax in 250 parts water. This being accomplished, dissolve in the solution sufficient methylene blue to give it the desired tint.

SCREWS may be prevented from becoming fast by anointing them with a mixture of graphite and soft tallow. They will then remain unrusted and unaltered for years. A screw rusted in may be removed by placing the flat extremity of a red-hot rod of iron on it for two or three minutes. After the screw has heated and cooled it will turn easily.

SHARP and full impressions may be produced on figured patterns if all the deep recesses in deep-figured dies are vented to allow the air to escape when the blow is struck. This will do much to obtain perfect impressions, and requires only half the force that is necessary in unvented dies. This is not known in many shops and consequently this little air costs much in power and worry.

TAILING from mining cannot be allowed to escape into a stream to the detriment of one working below. Mining claims are taken subject to right of way for ditches or canals "constructed by authority of the United States." The fact that débris is deposited on a lower proprietor's land is a clear violation of his rights. In a given case it may become a nuisance and may call for and receive injunctive relief. Priority of location does not enter into the matter.

TO DROP STAMPS at the rate of 90 drops per minute, with an 84-in. pulley on the cam-shaft, a 46¼-in. pulley on the counter-shaft, and a 28-in. pulley on the engine, the fourth pulley must bear the following relation to the speed of the engine:

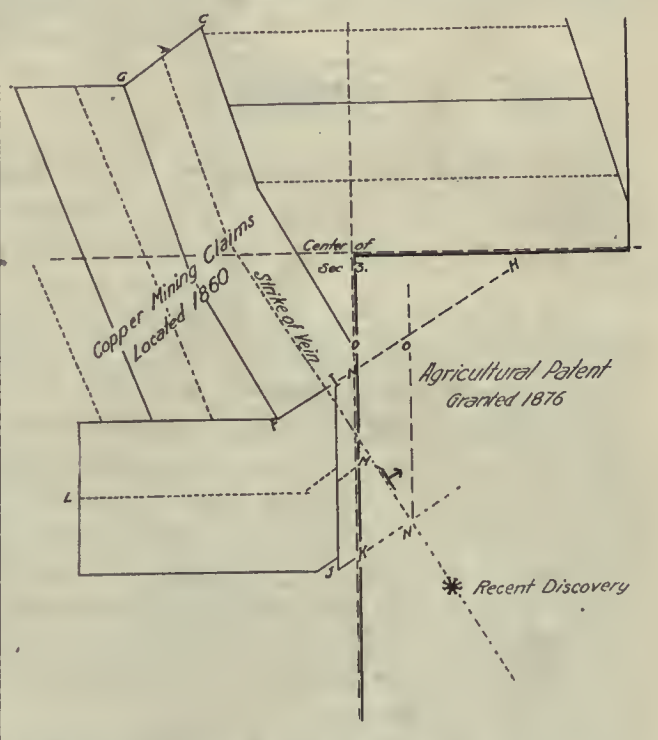
$$\frac{45 \times 84}{46\frac{1}{4}} \times x = \text{speed} \times 28.$$

In other words, the diameter of the fourth pulley in inches is approximately one-third the number of revolutions of the engine per minute.

TO UNITE rubber and leather, roughen both surfaces with a sharp glass edge; apply to both a diluted solution of gutta percha in carbon bisulphide, and let it soak into the material. Then press upon each surface a skin of gutta percha 0.1 in. thick between rolls. The two surfaces are now united in a press, which should be warm but not hot. This method should answer in all cases in which it is applicable. The following prescription covers cases in which a press cannot be used. Cut 30 parts of rubber into small pieces, and dissolve it in 140 parts of carbon bisulphide, the vessel being placed on a water bath at 30°C. (86°F.). Further, melt 10 parts of rubber with 15 of rosin, and add 35 parts of oil of turpentine. When the rubber has been completely dissolved, the two liquids may be mixed. The resulting cement must be kept well corked.

ALUMINUM is used in constantly increasing quantities in the motor-car industry, combining as it does both lightness and stiffness. It is used in making crank cases, gear boxes, carburetors, radiators, and dash-boards, besides in smaller ways. Its use in this comparatively recent industry is of interest, and especially so is its application in the newborn art of aviation, where the same qualities of lightness and stiffness again recommend it. In castings it has been found advantageous to alloy aluminum with copper, zinc, or nickel, which increases its strength and makes it easier to work. The prevailing low prices of ingot aluminum have resulted in a greatly enlarged demand for the metal for such work. The principal demand for such castings has come from automobile builders. The users of brass castings, especially the manufacturers of electrical apparatus, have been gradually changing from brass to aluminum castings, and for some purposes aluminum castings have been substituted for iron castings.

AGRICULTURAL entries on public land are made subject to accrued rights, and consequently the vein of a location older than the agricultural entry or patent may be followed into agricultural land, provided apex rights accrue in regular form. In the case cited below this would not seem to be true on the statement given. The vein A N upon which recent discovery was made could be followed under one corner of the land under rights belonging to the claim C D F G, assuming the dip to be as indicated



by arrow. Extralateral rights are limited by the end line F H projected. Since the claim N I J K was presumably located on another vein L M, and since, though not as drawn, the vein A N crossed both side lines and these hence become end lines, no additional rights under the agricultural land would seem to accrue. If in fact the location prior to agricultural entry extended to N O and beyond, there would be room for claim to work ore in the vein A N under the ground N K O N. It should be remembered that no rights accrue to the old locations unless they have been in fact kept in good standing since before agricultural entry.

Discussion

Readers of the MINING AND SCIENTIFIC PRESS are invited to use this department for the discussion of technical and other matters pertaining to mining and metallurgy. The Editor welcomes the expression of views contrary to his own, believing that careful criticism is more valuable than casual compliment. Insertion of any contribution is determined by its probable interest to the readers of this journal.

Surface Indications of Ore-Shoots in Depth

The Editor:

Sir—The original contribution of W. H. Storms, in the issue of October 22, 1910, on 'Surface Indications of Ore-Shoots in Depth' has drawn out interesting letters from other observers, and much of the evidence presented is confirmatory of the original dictum: that there is an apparent relation between the surface topography and the position of underlying ore-shoots.

The revival of interest in the Comstock Lode by the discovery of an important orebody in depth in the Mexican mine, through prospecting intelligently directed by a capable mining engineer, once more draws attention to the remarkable work of F. von Richthofen, the earliest writer of note, excepting Clarence King, upon the Comstock ore-occurrence. There is given herewith from his 'Conclusions', as stated on page 113 of the book 'Sutro Tunnel, Nevada, 1865', the following paragraphs which bear directly upon Mr. Storms' observations:

"4. In the northern part the vein is, at the levels explored to the present time, invariably poor where it passes a ravine, as in the Ophir, Central, and Mt. Davidson ravines, and the one which divides Mt. Davidson from Mt. Butler. But in the southern part the ore continues in the ravines. (Kentuck and Seg. Belcher mines.)

"5. The richest portions are south of each ravine crossed by the vein."

The exceptions to the rule noted in 4, where it is stated that the ore was continuous in the ravines in the Kentuck and Seg. Belcher mines, proved to be the only exceptions to the rule in the South End mines, and of these only the Kentuck body proved to be of magnitude.

The sketches herewith, illustrating this, were made from sketches by John and Charles Hoffman, in 1865, and in 1870. The typical section through the Comstock Lode, and the plan of the faulting of the district, are from J. A. Reid's paper, referred to subsequently.

Von Richthofen's observations and deductions were as of 1865, when no mine opening on the Lode was deeper than 900 ft., when the east-dipping character of the Lode had not yet been determined, and when only the distinctly surface bonanzas had been mined. And while his remarkable predictions as to the existence and position of deeper-lying bodies under different conditions were fulfilled later, these subsequently found bodies have no relation to the surface ores, and their position with respect to the ravines cannot be closely followed because of being one and one-half miles eastward in lateral position. Von Richthofen's prediction as to the deeper ore was in these words:

"* * * it is also probable that repeatedly in following the Lode downward branches will be found rising from its main body vertically into the hanging wall * * * such eastern bodies might carry richer ores than the average of the main portion of the vein."

From the foregoing it is apparent that the idea of a relation between ore position and surface topography is not a new conception, but is a generalization deduced in this instance 46 years ago. Mr. Ransome, in his letter in this discussion published in the issue of May 20, states that the conditions involved in sizing up ore deposits generally make it a complex problem, and to establish an invariable rule for the guidance of prospecting is out of the question. He instances notable exceptions to Mr. Storms' hypothesis. It is believed, however, that sufficient consonance does exist in the facts reported to make generalizations safe, particularly where the conditions are parallel.

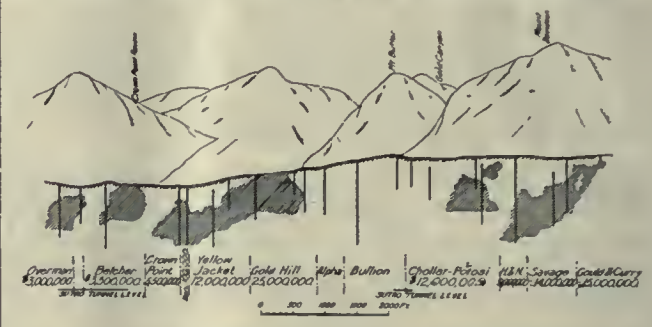


FIG. 1. ORE STOPED TO 1870, COMSTOCK LODE.

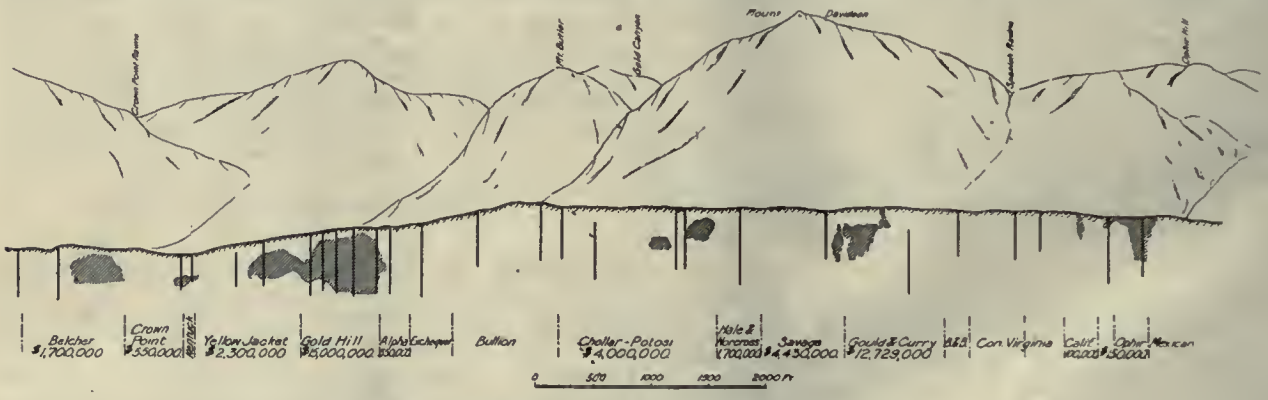


FIG. 2. STOPES OPEN PRIOR TO 1866, COMSTOCK LODE.

In the instance of the Comstock, J. A. Reid has shown (Bulletin 10, Vol. 4, Dept. Geology, Univ. Cal.) that the ravines coursing the east face of the Virginia Range in the immediate vicinity of Mt. Davidson, against which the Lode, occupying the great fault-fissure, lies, are the axes of cross faults, illustrated in Fig. 3. He has demonstrated this beyond questioning, and demonstrated also that the surface erosion along the small streams occupying these ravines has been negligible in amount, hence could not have torn away the portion of possible pay-ore which might have occupied the vein in the ravine site. On the allowable assumption that, in the secondary or commercial-ore forming period, the mineral-bearing solutions coursed upward through the cross-faults, the depositing of the minerals out of these solutions (the ore-making) must actually have occurred in the main fault-fissure, or the Lode proper where the conditions favorable and necessary for such occurrence were met. All writers have recognized that there were two distinct periods of vein-forming in the Comstock; the first filled the fissure with the great masses of low-grade, or of barren, quartz, which are encountered in every mine on the Lode; the second period marked the fissuring of these quartz masses and the deposition within same of the commercial ore. The cross-faulting was evidently subsequent to the first or quartz-forming period, owing to the small amount of displacement of the walls.

excepting in Bullion ravine, where the diorite mass of Mt. Davidson was thrown in juxtaposition with the andesite mass to the south, and to the fact that there was no measurable displacement of the main lode. Reid has shown that the hot mine waters in circulation in depth at this time (samples from 2250-ft. level, C. & C. shaft, and temperatures from 116° to 170°F.) are highly alkaline and carry gold and silver to the extent of 0.298 mg. and 2.92 mg., respectively, per ton of solution, while the surface waters issuing from the Central Tunnel (an old adit pene-

FIG. 3. PLAN OF COMSTOCK LODE, SHOWING FAULTS.

trating the croppings at some 300-ft. depth) carry the same minerals to the extent of gold, 4.15 mg., and silver, 188 mg., per ton of solution. This statement of fact indicates, though it does not necessarily prove, the genesis of the ore deposit, and the origin of the solutions is in all likelihood in the cross-faults.

If the steps for establishing an hypothesis as a scientific

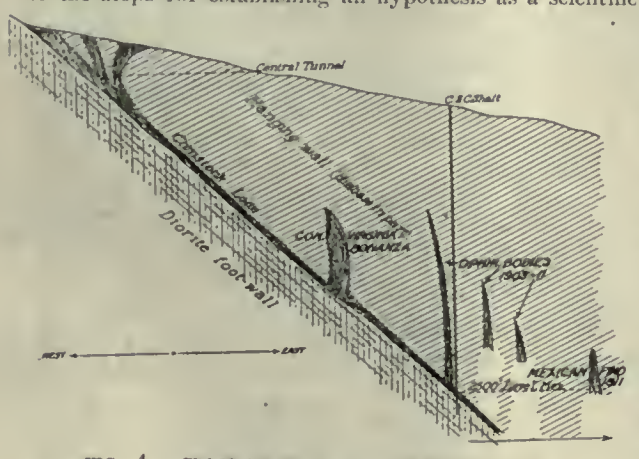


FIG. 4. CROSS-SECTION OF COMSTOCK LODE.

truth be the process of working outwardly from a single fact, accurately established, to a wider generalization, there is more to be gained by moving in the direction of working out concrete examples. Types of deposits admittedly exist, and if a generalization can be applied to a distinct type, so much will have been gained. The argument, then, is to multiply the concrete examples which fit this particular hypothesis, and additional light will be unfolded in due course.

J. H. G. WOLF.

San Francisco, May 22.

The Editor:

Sir—I am very much interested in the discussion of 'Surface Indications of Ore-Shoots', having made this subject a special study for over twenty years. In a personal examination of the surface indications of over 500 ore-shoots in the United States, Alaska, Mexico, Australia, and Tasmania I have found that by far the greatest number, especially bonanza ore-shoots, outcrop along the strike of the vein on hills or rising ground, rather than in gulches. The reason in general, I think, is that the enclosing rock of ore-shoots is harder than the barren portions of the vein, and has resisted erosion more than the softer part.

M. K. RODGERS.

Seattle, June 5.

Secondary Enrichment of Gold Deposits

The Editor:

Sir—In the June 3 issue of the *Mining and Scientific Press* there is an article on the secondary enrichment of gold deposits. I would like to call attention to what I would call second deposits. All through the San Juan section of Colorado there are a great many large veins in which the vein filling is largely rhodonite. This rock when broken in the mine is often very attractive looking, but I do not know of one case in which the rhodonite contains valuable metal, yet some of the most profitable mines in the district are in these veins. These ore deposits I would call second deposits; in distinction from the deposits made valuable by secondary enrichment, for this reason: There is nothing in the appearance of the vein rock to indicate that the primary deposit has been enriched. The pay ore ore seems to be deposited alongside of the rhodonite, but easily separated from it, as if the primary vein had been opened along one wall by faulting, thus giving an opening for a second deposit. In some cases the primary vein has been shattered in places, which has allowed the formation of the second deposit within the primary vein instead of along the wall. This second deposit is sometimes gold ore and sometimes silver. When the second deposit is silver ore it is almost always in the form of ruby or brittle silver.

One of the best examples of this kind of deposit is what is known as the Smuggler-Union in San Miguel county. This vein was originally a rhodonite vein and extended through the Bullion location. It was faulted by the Memphis vein which crossed it nearly at right angles, the fault throwing the Bullion end of the vein about 50 ft. to the west. From the Memphis north through the Union, Smuggler, Sheridan, and Mendota locations to the top of the range, the vein has the second deposit, while from the Memphis south through the Bullion and other locations, there is only the primary or rhodonite vein.

The largest vein in San Miguel county is, I think, the one formerly called the Big Elephant vein. The Montana mine is at the northwest end of this vein, and the Argentine and Red Cloud (now owned by the Tomboy M. Co.) are on the southeast end. In places in this vein on the Shamrock location I have measured 16 ft. in width of rhodonite. The large veins that cross Mineral Point and Poughkeepsie gulch in San Juan county belong to this class, and pay deposits should be looked for in these veins where the primary vein has been faulted or shattered. I am not familiar with the late workings of the Camp Bird in Ouray county, but am inclined to think that there is reason to class this as a second deposit. Secondary enriched deposits usually have the surface metals leached out and re-deposited below. What I call second deposits have their richest ore on top, and the rich ore does not usually extend to a greater depth than 1000 ft. These second deposits are always in or along manganese or rhodonite veins. The rhodonite which forms the vein filling of these veins is close-grained and massive, and the valuable metals do not always appear to have been leached out, yet it seems to have been influential in causing these deposits, because the richest second deposits occur in those veins in which the primary deposit of rhodonite is the largest. I am not prepared at present to present any theory explaining these phenomena, but submit the facts for discussion.

H. W. REED.

Salt Lake City, June 9.

RHODONITE is a silicate of manganese, $MnSiO_3$, but the manganese is often partly replaced by Fe, Zn, or Ca. It is a brownish to bright red mineral, occurring in fine-grained or cleavable masses and disseminated grains, often coated with a black oxide.

Special Correspondence

JOHANNESBURG, TRANSVAAL

East Rand Prop. Meeting.—Profits for Year.—Decrease of Yield.—Improvements in Methods of Working.—Second-Stage Hoisting.

The principal feature of interest during the week has been the East Rand Proprietary Mines meeting, adjourned several times to enable the chairman of the company, Sir George Farrar, to attend. The East Rand Proprietary Mines was the first important amalgamation on the Rand in which the outcrop mines joined with the extensive deep-level properties containing the Main Reef Series. Since this amalgamation several others have been arranged, notably the Crown Mines Ltd., which in March succeeded in displacing the E. R. P. M. from its proud position at the head of the gold producers of the world, which it had occupied ever since the amalgamation took place.

The chairman announced at this meeting that the profits for the year were £1,249,357, being £9700 less than the preceding year, but the usual dividend of 40% had been paid, and moreover the finances of the amalgamated concern had been put on a sound footing by the increased issue of debenture capital during the year. To procure these results no less than 2,126,334 tons of 7-dwt. ore by assay has been crushed, the actual recovery being 6.5 dwt. per ton, which made the total yield 691,860 oz. of fine gold. Broadly speaking, they had recovered 27s. 3d. per ton at a cost of 15s. 6d. per ton, so that their profit was 11s. 9d. per ton. Some idea of the extent of the underground workings may be gathered from the fact that they reach over 6000 ft. on the dip; the vertical shafts of the Angelo Deep mine connect with the deepest points of the workings, ensuring a perfect system of ventilation. The results of the year's operations, however satisfactory, do not appear to have come up to anticipations, so far as profits and dividends are concerned, and it will be remembered that a similar experience was had at the Crown Mines, a similarly amalgamated concern. At the East Rand Proprietary Mines, a falling off in grade in the Cason section, and the absorption of gold by a new recovery plant are blamed for this disappointment; and seeing that the tonnage crushed during the year has increased from 157,000 to over 200,000 for somewhat less profits, it is clear that the yield has fallen. The actual recovery was 92.85%, obtained from the different sources in the following proportions: Mill, 53.97%; sand, 31.32; slime, 13.51; and from by-products, 1.20%. Out of £17,000,000 total value of gold produced by the East Rand Proprietary Mines, $5,000,000 has been distributed to shareholders, and as the scale of operations increases it appears probable that the dividends payable to the shareholders will also increase.

Although the amalgamation of different small producing mines, as in the case of the East Rand Proprietary Mines and the Crown Mines does not seem to have immediately produced the anticipated improvement in the working results, there can be no doubt that better results must eventually follow. Last year's experience at the East Rand Proprietary Mines goes to show that where ore values vary as they do on the Rand, small single mines are bound sooner or later to get into trouble, but by being amalgamated can draw on other sections of the amalgamated concern and so spread the risks over larger areas and in the end produce uniform results. Another interesting feature arising from these amalgamations is that of large-scale working, and the eventual reduction of working costs to the lowest limit that must follow; without which it will become impossible to work some of the very deep sections of the Rand goldfield. Both the East Rand Proprietary Mines and the Crown Mines, especially the latter, extend to where the reef series lie very deep, and both are preparing to tackle these deeper areas in a workmanlike manner. For instance, large dimensioned levels are being constructed underground fitted with modern systems of haulage, and conveyance of ore to the shafts will be concentrated so as to be carried out in the most economical manner. The methods of handling large quantities of ore on the Rand have been much discussed of late, and it seems likely that this method will be generally adopted. At the East Rand Proprietary Mines the idea seems to be to construct this main level right across the property from east to west at a point something like 4000 ft. deep on the incline, where hauling can be most efficiently and economically carried out as a first-stage hoisting. Of course all the ore above this level will be dropped to that level at convenient points; the lower ore will be hoisted to that level, so constituting a system of second-stage hoisting. Other deeper main levels will also be constructed and equipped, and it is hoped thus to overcome the present hoisting and mining difficulties on the Rand.

MEXICO

Repair of Railroad Lines.—Conditions in Guanajuato. Suspension of Work at Cinco Minas.—Option on the Alvarado M. & M. Co.—Report of Mexican Light & Power Company.

Now that hostilities in Mexico have ceased, the railroad lines damaged by the revolutionists are being rapidly repaired, and normal traffic conditions are expected shortly. The revolutionists stopped train service on nearly 4000 kilometres of the Government merger system, and in addition cut the Southern Pacific lines in Sonora and Sinaloa, the Mexico Northwestern lines in Chihuahua, and the Mexican Railway between Mexico City and Veracruz. The re-establishment of railroad traffic will do much toward restoring the mining industry to its former basis. It is probable that strong measures will have to be taken to stop bandit raids, as brigandage has been a natural development of the disturbed conditions, and some bands undoubtedly will attempt to continue operations. The theft of bullion worth ₱35,000 from the San Jose de Garcia camp in Sinaloa was recently reported. The suppression of brigandage is receiving the attention of the provisional government, and it is planned to organize rural forces from the ranks of the revolutionists, and to entrust to them the work of wiping out the plundering bands. It will not be surprising if the mining investments checked by the political upheaval in Mexico will now wait on the coming elections. The triumph of the Madero revolution and the end of the Diaz government has left the Mexican people facing many new problems, and they will be required to prove their ability to handle them.

George W. Bryant, prominently identified with several Guanajuato enterprises, states that operators in the Guanajuato district have been interfered with but little. When the revolutionists became active in that state the labor supply was affected to some extent, but only for a short period. When the Mexican Express Co. declined to assume any risk in the handling of bullion, the Guanajuato companies sending out bullion insured the shipments with an American concern. None of the bullion shipped was lost. In the Zacualpan district of the State of Mexico disturbed conditions resulted in the shutting down of practically all the mines. The Seguranza Mining Co., the most important concern of the district, suspended all mining and milling operations. The managers of the principal mining companies of the Pachuca district have signed a letter highly complimenting and thanking Col. Gabriel Hernandez, the commander of the Madero forces in the State of Hidalgo, for his energetic suppression of lawlessness in Pachuca. Operations in that district have been but slightly affected.

According to late reports, more than 30 men were killed in an attack on the smelter of the American Smelters Securities Co., at Matehuala, State of San Luis Potosi. The smelter employees made a demand for higher wages and shorter hours, and when the management refused to accede to the demand an attack on the smelter was organized. The arrival of a Maderista leader at the head of an armed force is believed to have prevented serious damage to the plant and the looting of the town. Order was finally restored.

The Cinco Minas Co., of New York, has suspended work at the Old Cinco Minas in the Hostotipaquillo district of Jalisco. Control of these properties may change hands, negotiations to that end having been recently opened. The Cinco Minas were purchased by the Marcus Daly interests early in 1910, after a period of development under an option, and have been controlled by them since that time. The Magistral-Ameca Copper Co., a Los Angeles organization owning the Magistral mines and concentrating plant in the Ameca district of Jalisco, will be able to resume shortly, it is stated. Several months ago the company arranged to place a large block of stock with French and Mexican capitalists, the money to be used in enlarging the concentrating plant and carrying on extensive development. The revolution interfered with the plans, and operations were suspended. Now it is said that more money than originally arranged for is ready for the enterprise. The new capital will be principally French.

Representatives of strong financial interests have asked for an option to purchase 450,000 shares of the Alvarado Mining & Milling Co., operating in the Parral district of Chihuahua, at $5 per share. It is stated that the option probably will be granted, and that each stockholder will be given an opportunity to participate in the sale to the extent of one-half of his holdings. The Mexican Light & Power Co., the Canadian concern owning the big Necaxa

CINCO MINAS, JALISCO, MEXICO.

power enterprise, and furnishing current to Mexico City and the El Oro and Pachuca mining districts, shows gross earnings for the first four months of this year of ₱2,710,255, an increase of ₱616,109 compared with the same period of 1910. However, the operating expenses, ₱956,605, represented an increase of ₱454,153. The net earnings were ₱1,753,650, an increase of ₱161,956.

NEW YORK

EFFECT OF DECISION.—THE COPPER MERGER.—STRENGTHENING OF MARKET.—ANNUAL MEETING OF OHIO COPPER.—ANNUAL REPORTS OF COPPER PRODUCERS.—PRICE OF TIN.

Broadly speaking, the prevailing feeling in the Street is one of disappointment. The Supreme Court decision had, for many months, served as an excuse for the absence of the public. It was only logical, therefore, that every effort should be made to construe the decisions as encouragingly as possible. The feast was spread and the public bidden, but the occasion was not a success. Perhaps the most significant and most important utterance concerning the situation is that of E. H. Gary, chairman of the board of the U. S. Steel Corporation. Socialists and radicals of all degrees have been clamoring for governmental control of the large corporations. It is therefore a startling instance of the meeting of extremes, when the head of the Steel Trust declares that governmental regulation of prices is necessary and, from the view-point of the corporation, desirable. The testimony of Mr. Gary will play a large part in the coming political campaigns and 'willy nilly' the regulation of the big combinations is to be the real issue.

The copper merger must be considered as definitely sidetracked for the time being. There could hardly be found now any legal talent bold enough to attempt the creation of the long-talked-of combination. For the present, and apparently for some time to come, the factors in the copper metal market must content themselves with such coöperation as they can secure one from the other. This spells hard sledding for some of the high-cost producers and possibly suspension of dividends by some that have been running close to the line between profit and loss.

The metal market has been firm for the past few days, in expectation of the fairly good report which was given out by the Producers Association on June 8. Production in May was 126,962,544 lb., being an increase in output (in round numbers) of 9,000,000 lb., larger than any month of the current year save March, when the total production was 130,532,080 lb. The encouraging feature during May was the increase in domestic deliveries from 52,407,650 lb. in April to 64,543,963 lb. in March. Export deliveries for May were 61,978,557 lb., as against 62,129,599 lb. in April, a slight decline. The selling agencies have inquiries now in hand that apparently insure increased demand for home consumption for the next sixty days, while, on the other hand, no further increase in output is anticipated. This improved condition, present and prospective, has stiffened the price of copper metal to 12½c., with a rising tone. Copper shares are neglected market wise. Several of the most active traders have changed from the outside market to the floor of the Stock Exchange, and have in each instance lost in activity by the transition.

Contrary to expectation, the annual meeting of the Ohio Copper Co., instead of marking the end of the Heinze control, was the occasion for the apparently complete extinguishment of all opposition to Mr. Heinze. Three new members of the board chosen are all Heinze adherents. The financial statement in which the Eastern market is somewhat interested was postponed, awaiting, it is said, the completion of the sale of the rest of the bond issue. That is one thing that is spared to Heinze stockholders, they are not forced to analyze long financial statements—or short ones either, for that matter. The meeting of the United Copper Co. which was to have been held this week has been postponed. Mason Valley, the Gunn-Thompson property at Yerington, Nevada, is one of the copper issues which is about to forsake the open market for the shelter of the Stock Exchange. The property is being equipped and developed as rapidly as possible.

The annual reports of the Amalgamated, Anaconda, United Metals, and the International Smelting & Refining companies have come in for a great deal of keen analysis. The market position of Amalgamated, paying $2 per year and selling for $67 per share, invites constant attention. The weakness from the income point of view is obvious. This is offset somewhat by the accumulation of surplus. Amalgamated receives $2 per share on 3,045,000 of Anaconda, and pays out $2 per share on 1,538,879 shares of its own stock. This resulted in a net surplus for the year ending April 30, 1911, of $2,971,000. Ordinarily an increase in dividends might be expected, but Amalgamated has outstanding some $5,000,000 in notes issued in the pur-

chase of the Clarke properties, and also some $12,500,000 in notes issued in connection with the purchase of the United Metals Selling. Both the mining properties and the Selling company show net returns above expenses and carrying charges on the notes, but these requirements will probably absorb the surplus for the next eighteen months unless these obligations are in some way refunded, or there is a radical improvement in the copper market.

Greene-Cananea was evidently undisturbed by the latest unpleasantness in Mexico; the production for May was larger than for any month of the current year, being 4,098,000 lb. of copper, 119,900 oz. of silver, and 552 oz. of gold. The reports of the Butte Coalition will hereafter be very short. It will, upon the dissolution of the Alice Gold & Silver, hold 517,566 shares of the Anaconda, 3000 shares of International Smelting & Refining, and has some $3,840,000 cash on hand, making a book total of $15,140,000. The smelting stock is carried at par, whereas the market is $130, Anaconda at a little above $21. The grip of the English operators who have engineered a corner in tin is tightening. Spot tin is quoted around $1040 per ton, which is very close to a record price for the metal. The market situation is stimulating production, and increased output is expected.

VALDEZ, ALASKA

THE CLIFF MINE.—HIGH-GRADE ORE.—DEVELOPMENTS OF THE VALDEZ M. CO.—RICH ORE IN WILLIAMS-GENTZLER.—OTHER PROPERTIES.

The Cliff mine was first opened up in 1910, a small mill was installed in July. It is considered to be the best mine in the camp by reason of the fact that it is on a producing and dividend paying basis. The work consists of about 2000 ft. of shafts, drifts, cross-cuts, and tunnels. The ore is extremely rich, and the mine has paid up to date $160,000 in dividends taken out in less than a year. The mine is developed by three tunnels, and a shaft from tunnel No. 2, the depth attained being about 600 ft. below the back of the mountain, and about 120 ft. below the water-level. The ore has been found on all the levels, varying in width from a foot to as much as six feet. The ore below the water-level carries sulphides and is extremely rich. The mine is a veritable jewelry shop, as rock showing abundant free gold can be found in many portions of it. In the raise between adit No. 2 and adit No. 3, there is a body of ore 6 ft. in width, which, it is stated, runs $433 per ton, on an average. This is phenomenal, but as specimen rock could be picked up from almost any portion of the face, the sampling is no doubt correct. Quite a little jewelry has been made from this ore, it being adapted for this purpose, as the broad bands and seams of gold contrast well with the pure white quartz.

The estate of the Valdez Mining Co. has been developed by means of a tunnel along the foot-wall of the vein for a distance of 200 ft., and the vein has been cross-cut every 20 ft. The vein is from 7 to 15 ft. wide, and has been proved continuous, so far as developed. The entire body is of a shipping grade, and average values of $40 per ton have been obtained. Rock showing free gold is a common occurrence in the mine. Some of the most spectacular ore ever found in the district comes from the Williams-Gentzler property on Mineral creek. The vein is about 2½ ft. wide, and for 45 ft. in length where it has been opened up pieces of rock liberally sprinkled and cobwebbed with gold can be taken from almost any portion of it. Some of the rock assays as high as $10 per pound. This property was recently sold to J. M. Hall, former mining partner of ex-President Zelaya, of Nicaragua, for a consideration stated to be in the neighborhood of $100,000.

The Mineral Creek mine on upper Mineral creek was purchased last fall by the owners of the Cliff mine. The vein is about 3½ ft. wide, and it is estimated that there is over $50,000 worth of ore in sight, although little work has as yet been done. The plans of the company contemplate active development work and the erection of a mill. The Seely-Davis mine is situated over the hill from the Cliff mine, and is said to have the extension of the Cliff lead. The property is developed by adits, and the vein varies from 2 to 3½ ft. Some showy specimens have been obtained from this mine. There are a number of other properties on which work is progressing and which have made rich discoveries, such as the Vancouver-Valdez, High Grade group, Black Diamond, Palmer group, Suessdorf-Devinney, Martin property, and others. There are about 300 men at work in the district.

COBALT, ONTARIO

ACTIVITY AT COBALT.—RECENT FINDS.—DEVELOPMENTS IN GOWGANDA DISTRICT.—CLOSE OF LITIGATION.—SHIPMENTS FROM COBALT.—PROGRESS AT THE MINES.

At Cobalt activity has been fairly resumed and shipments are increasing. Another good find has been made at the Beaver at 350 ft. in the main vein, which shows 8 in. of high-grade ore. This is regarded as proving high silver content through four levels to the surface. The Ophir has excellent showings on the 200 and 300-ft. levels in addition to an orebody from which considerable high-grade ore has lately been taken at the 100-ft. level. A shaft is to be put down on the big smaltite vein recently uncovered on the south end of the property. The Green-Meehan is again on the list of shipping mines, having sent out a car of high-grade ore taken from the 100-ft. level. Several new finds have recently been made and good ore is being taken out below 150 ft. The rehabilitation of the mine will probably stimulate other enterprises in the North Cobalt district. The Cobalt Lake is making good progress in the installation of the 20-stamp mill, which is expected to be in operation by August. The management states that a two-year supply of ore is in sight.

The Millerett and Miller-Lake O'Brien mines in the Gowganda district will make shipments this summer notwithstanding the bad condition of the roads, by which mining industry in that district is badly handicapped. The Millerett mill will be completed in July, enabling the company to ship concentrates as well as high-grade ore. The Boyd-Gordon in the same district has found on the 75-ft. level a vein 2 in. wide which yielded high-grade ore at the 40-ft. level.

The three-year litigation over the ownership of the Sterling mines, embracing three or four hundred acres in the Cobalt area, has been brought to a close by a decision of the Imperial Privy Council confirming the judgment of the Canadian courts in favor of William Marshall of Toronto and the Grey's Siding Development Co., and dismissing the appeal of the Drummond Mines Ltd. and the Montreal Trust Co. The property was bought by Marshall from Robert Gilmour of Sudbury, who subsequently sold it again to the Drummond Mines, claiming that the terms of his agreement with Marshall had not been fulfilled.

Shipments from Cobalt are increasing, the output for May being 1950 tons. There is a noticeable decrease as compared with last year's shipments, partly on account of the power shortage during the earlier months of the year, and partly owing to the increased output in the form of concentrate and bullion. Arrangements have been completed for the treatment of ore from the Crown Reserve and Kerr Lake mines at the Nova Scotia mill, which is the only one in Cobalt using the cyanide process. The capacity of the mill is being nearly doubled, so as to permit of the treatment of 200 tons of ore per day. The contract for an aerial tramway for the conveyance of the ore has been let to an American firm for about $15,000. Operations are to be resumed at the Waldman on the Gillies Limit, where the shaft is being unwatered. Trenching is being carried on in the hope of finding new veins. The Nipissing will put down a shaft to the depth of 1000 ft. on the No. 64 vein to solve the much-discussed question as to the persistence of the ore at depth. The Kerry mine has been unwatered and operations resumed at the 350-ft. level. A fire on June 1 destroyed the power plant of the Nancy Helen, causing a loss of $16,000. The mine has been closed down for some time. La Rose is opening up a third level in its main shaft

at a depth of 270 ft., the deepest point attained in the workings. The Beaver shaft is down to 420 ft. and a station has been cut at 400 ft. The vein on the 300-ft. level runs from 6 to 8 in. of high-grade ore. The steady increase in the price of Beaver stock is in marked contrast to the dullness in most of the Cobalt issues—largely due to the Porcupine boom. The Rochester will put down its main shaft to 400 feet.

BUTTE, MONTANA

COMPRESSED-AIR HOIST IN USE AT MOUNTAIN VIEW MINE.—THREE ELECTRIC-DRIVEN AIR-COMPRESSORS.—OTHER SHAFTS BEING SIMILARLY EQUIPPED.—MAY PRODUCTION OF THE ANACONDA.

With an expenditure of over $3,000,000, the Anaconda Copper Co. has demonstrated the feasibility of hoisting ore by compressed air supplied from electric-driven compressors. Over two years ago the company had plans and specifications prepared with the view of putting the plan into practice, and a few days ago it had the satisfaction of seeing the change accomplished. This undoubtedly will result in greatly reducing the cost of production of copper. Those who have been making a study of the subject declare that when compressed air has completely taken the place of steam it will mean a lessening of the cost over one cent per pound. After John D. Ryan, president of the Amalgamated, and some of his officials had worked out their plans, the Nordberg Manufacturing Co. people were called into consultation, and they undertook to construct a plant which would carry out the ideas outlined by Mr. Ryan. To start with, it was necessary to bring electricity from Great Falls, a distance of some 150 miles, to operate the plant, and it was therefore decided to construct a pole-line to this city. No time was lost, and the work was finished last summer. In the construction of this line the greatest care was taken to prevent lightning interfering with the transmission, and the latest inventions along this line were brought into use. While this line was being built skilled men were at work in the Nordberg factory constructing the operating machinery, and others were erecting concrete and steel buildings and tanks for the storage of the machinery and the proper operating of the plant at Butte. Last July everything was in readiness for the installation, and piece by piece the Nordberg company delivered the equipment; and about one month ago everything was in place. Bruno Nordberg, who visited the city several times during the construction, finally came to witness the testing of the compressors. At first some little changes were required, as is usual in the starting of new machinery, and a few days ago the tests were all pronounced satisfactory and the hoisting of ore was commenced. Not a hitch occurred, and today, at the Mountain View mine, ore is being hoisted by the new system with the same ease as when steam was the motive power.

The substitution of air for steam in hoisting operations on a large scale is a new departure in copper mining, and the Anaconda Copper M. Co. should have the credit for starting the system. Ever since work was first started on the plant, mining people all over the country have been watching the progress of the experiment, for an experiment it was considered, even by many who believed in it. That today it is a complete success, and that the Mountain View is hoisting all the ore required, is a source of pleasure and pride to the originators of the system. It means that eventually electricity will play an important part in lowering the cost of the operation of mines, not only in this district, but throughout the country.

The Diamond mine is now being equipped with the same system, and after it is in successful operation, hoisting at the High Ore shaft will be changed from steam to air. The Anaconda company contemplates the using of compressed air for hoisting and electricity for all its mines, pumps, and underground haulage. The fact that all steam boilers will be done away with, and a yearly expenditure of over $2,000,000 for coal will be saved to the company affords some idea of the economy of the change. The plant consists of three compressors, each with a capacity of 7500 cu. ft. of free air per minute. When operated at full capacity the power required to drive the three compressors is 3600 horse-power.

VIEW OF WALKERVILLE, BUTTE, MONTANA.

The Anaconda Copper Co. produced 21,700,000 lb. of copper during May, 200,000 lb. more than the production of April. While it would appear on the face of it that there was an increase of production, investigation shows that there was really a decline of something like 100,000 lb., as the Tuolumne output is included in the Anaconda production, as well as that of the North Butte. In April the Tuolumne had a production of 500,000 lb., and in May a production of about 750,000 lb. The North Butte, which was credited with 2,000,000 lb., had at least 100,000 lb. over that amount in May. It may be stated that while the North Butte and Tuolumne companies are independent concerns, their production is included in the figures given out by the Anaconda company, for the reason that the ore from both companies is treated at the Anaconda smelter.

General Mining News

ALASKA

Juneau District

The Alaska Treadwell Gold M. Co., for the month ended May 15, reports having crushed 72,968 tons of ore in the 240 and 300-stamp mills, and the production of 1436 tons of concentrate. The estimated gross value of free gold recovered was $81,614; value of concentrate, $63,309; estimated total realizable value of product, $140,127. Operating expenses, $88,342; net operating profit, $51,785; construction, $16,318. Yield of ore milled, $1.99 per ton. Stock of ore broken, 13,451 tons; development, 920 feet.

Ketchikan District

The Santa Fe group of claims, at Dolomi, Prince of Wales island, is to be developed this season by A. Adkins, H. Z. Burkhart, and Willis Bryant, the owners. Work previously done resulted in exposing gold ore of high grade.

Prince William Sound

The Seattle Alaska Copper Co. is building a concentrating mill at its mine, on Latouche island. The mine is said to contain a large tonnage of ore assaying 3% copper, and this is to be concentrated in the ratio of 8 to 1. The company has developed water-power.

There is activity in the district lying between Valdez and the Cliff mine, and it is asserted that some development is in progress on most of the claims located. The snow disappeared from this locality about June 1. There is much prospecting along the beach. Valdez-Liscum, Black Diamond, and others are being developed, and each has some ore.

(Special Correspondence.)—The Hemple Copper M. Co. is to drive a raise in ore from the 700 to the 350-ft. adit levels. This will result in opening the mine so that it may be productive. As soon as this work is accomplished the company may build a concentrating mill similar to the one being built on Montgomery bay, Latouche island, as the ores of the two properties are similar.

Valdez, June 1.

ARIZONA

Cochise County

(Special Correspondence.)—The Commonwealth M. & M. Co., owner of the Commonwealth mine at Pearce, has recently completed a plant for the treatment of slime from the tailing pond, but has not placed it in operation, because it was decided to do further work in the mine with the view of developing sufficient ore for a 200-ton mill, instead of a plant of 100 tons, as first decided upon. Having the mill running on ore from the mine, will materially cut down the average cost of the treatment of the tailing as well as the treatment of the ore. In other words, a large tonnage can be handled much cheaper than a small tonnage. Development work up to the present time has resulted more favorably than had been anticipated. It is therefore almost certain that the capacity of the new mill will be sufficient to treat 200 tons of ore from the mine and 100 tons from the tailing pond.

MAP OF ARIZONA.

Pearce, June 10.

CALIFORNIA

Butte County

The Kidd mine, situated at Nimshew, primarily a gold mine, has a body of silver ore, assays of which show $21 per ton. It was discovered in driving a cross-cut to open an ancient creek channel, which is believed to be rich in gold. The silver ore will be mined later. R. P. Holmes and L. Mitchell, of Sacramento, are among the stockholders in the company that owns the mine.

The El Oro Dredging Co., for which W. S. Noyes of San Francisco is manager, is operating two dredges, each having 5-cu. ft. buckets, in Oroville district. The chain of buckets on both dredges is digging to a depth of about 30 feet.

Calaveras County

The Lightner Gold Mining Co., operating at Angels Camp, now has 40 stamps crushing ore, 20 stamps having been started June 1. It is probable that the entire mill of 60 stamps will be in operation before July 1. During May there was hoisted from the mine 2979 tons of ore, and 2802 tons of waste. With 40 stamps dropping, the mill is crushing about 220 tons per 24 hours, the battery screens being 30 mesh. Of the total saving made, about 50% is recovered by amalgamation inside the mortars, 25% on the plates, and the remaining 25% by concentrating tables. The concentrate product is equal to 1½ to 2% of the tonnage of ore milled, and samples about $45 per ton. It is understood that the mill tailing contains 21 to 32c. per ton. Electric power for all purposes is purchased from the Pacific Gas & Electric Co., at $4.50 per horse-power month. The May consumption of power was 25.7 hp. for the mill with 20 stamps operating, and 62.66 hp. for the hoist, air-compressor, surface tramway, and machine-shop. The mine timbers required amount to over 1½ million feet per annum. The vein occurs between a schist hanging wall and a slate foot-wall, and has a dip of about 70°. The mill work is in charge of Jack Mallett, and Caesar Sciaroni is mine foreman. A. M. Younge, secretary for the company, states that other mines at Angels Camp are quite active.

LIGHTNER MILL AND MINE, ANGELS CAMP, CALIFORNIA.

Inyo County

The Arondo mine, in Argus mountains, with a force of 65 men, has a daily output of about 80 tons of ore, which is being crushed and cyanided. Charles E. Anderson is in charge of the work.

Nevada County

The Eagle Bird mine, near Washington, was sold to San

Francisco men, recently, who are to provide new equipment and resume operations. The former owner and vendor was W. M. Wilson, who lost by fire his surface equipment, including a 20-stamp mill, two years ago, since which time the property has been idle. The mine was active and profitable 20 years ago, the workings having attained a depth of 700 ft. The workings are to be unwatered, the shaft is to be sunk deeper, and a mill may be built.

A number of hydraulic miners of this county have been enjoined against operating their mines, after inspection by agents of the Anti-Débris Association. Restraining dams and settling reservoirs, which were built at You Bet in accordance with the provisions of law and under permit of the Anti-Débris Association, after two years trial have failed to satisfy the farmers and fruit growers in that vicinity, who allege damage to growing vegetation as the result of hydraulic mining.

(Special Correspondence.)—The Delhi Mining Co., of San Juan district, expects to shut down its 20-stamp mill and mine for a year, during which time a flume and ditch will be built for power purposes to supply the mine and mill. The Delhi mine is on the south fork of the Yuba river, H. Eddie being superintendent.

Grass Valley, June 8.

Placer County

(Special Correspondence.)—The Orpheum mine has a new shoot of ore on the 300-ft. level. The operation of the new 10-stamp mill results in saving about $8 per ton on the plates. C. Peach is superintendent.

Auburn, June 10.

Plumas County

Hewitt Brothers are reported as intending to build a 5-stamp mill at their mine on Hopkins creek. It is claimed they have a big body of ore which has been opened by an adit.

Shasta County

The Balaklala Con. Copper Co. has been cited to appear in the United States Circuit Court, at San Francisco, June 19, to answer the charge of the Shasta county farmers of violating the court's decree of July 8, 1910, relative to the elimination of noxious fumes from the smoke emitted from its copper furnaces. The complainants allege non-elimination of free sulphuric acid from the smoke; that by the Cottrell process all the solid particles are not removed from the smoke; that more than 0.75% of sulphur dioxide by volume is permitted to pass into the atmosphere, and that such sulphur dioxide is injuring vegetation.

Sierra County

The Irelan mine, near Alleghany, is being operated by Fred Clark, who has the property bonded. The work is in charge of George Hegarty, who recently opened a shoot of ore through which free gold is disseminated; there is also some arseno-pyrite containing gold. The shoot was opened by a cross-cut at 200 ft. below the surface. A raise is being driven on the ore so that stopes may be opened. The Independence G. M. Co., operating at Alleghany, is erecting a 5-stamp mill. A carload of machinery for a mill to be built at the San Luis mine, near Sierra City, is to be hauled to the property the last of this month. Homer Gould and Ed Poggi have a bond on the Rosasco & Danero quartz mine, 3 miles west of Downieville. They expect to extend the adit that was driven by a former operator.

Trinity County

The La Grange hydraulic mine, near Weaverville, has a 3000-ft. sluiceway, riffled with 6-ft. steel rails, 300 tons of which were recently shipped to Redding and hauled to the mine to replace worn-out riffles. Last year 150 tons of similar rails were required for this purpose.

Tuolumne County

The Black Oak mine, situated in the vicinity of Soulsbyville, is being operated by the Black Oak Development Co., which took possession of the property in January 1909, under a lease and bond. This company is composed of Charles E. Knox, president of the Montana-Tonopah M. Co., John Bryant of Kansas City, and S. A. Knapp of San Francisco. The Black Oak, which is on the east belt, in a grano-diorite country, was operated during a number of years by former owners, who sank a 1300-ft. incline to conform to the dip of the vein, which is about 70°, and from this incline 15 levels were driven on the vein. It is claimed the value of the ore mined under the old regime was close to $2,000,000. In driving north of the shaft the former operators ascertained that the orebody was cut off by a fault, beyond which the ground was much broken, with no defined vein. When the company now in control took charge, the workings were unwatered, the shaft was sunk 120 ft. deeper, and the sixteenth level was established. It was found that the disturbed condition was within 100 ft. of the shaft on the north, at the sixteenth level; and by cross-cutting 98 ft. west on the fifteenth level the vein was opened on the opposite side of the fault, where it proved to be 5 ft. in width, the ore therein assaying about $40 per ton. Drifts are being driven on the vein in opposite directions on the fifteenth level. This part of the vein, beyond the fault, is to be opened by cross-cuts on all levels from the sixteenth to the seventh, a distance of about 1000 ft. on the dip. The surface indications are such as to lead to the opinion that this orebody extends to the surface. Shipments of the higher-grade ore, amounting to 100 tons per week, are being made to smelters, while the 40-stamp mill is being operated on that of lower grade. Important changes will be made in the mill, to provide for fine crushing and cyanidation. Roger C. Knox is superintendent.

COLORADO

Gilpin County

The London group of claims in Twelve Mile district, near Apex, is under lease and bond to A. Bergeron, George Potvin, and A. T. Holman, all of whom are Cripple Creek operators. The property has some development, by which a 6-ft. vein of ore assaying $12 per ton has been opened.

Routt County

The Royal Flush mine, situated at Hahn's peak, thirty miles north of Steamboat Springs, has been opened by means of a 2000-ft. cross-cut, whereby a number of veins containing milling ore have been interseeted. Some drifts in ore have been driven on several veins, one of the latter being 9 ft. wide. The ore contains gold, silver, and copper. The property is controlled by H. O. Granberg and associates, who are erecting at the mine a 100-ton concentrator.

San Juan County

The Iowa-Tiger Leasing Co. is mining and concentrating 2500 tons of ore per month, the product of which is 400 tons of concentrate worth $40 per ton net. This company is operating the Iowa and Royal Tiger mines in Silver Lake basin, at an altitude of about 12,000 ft. The 1½-mile tramway leads to the mill, which is 2000 ft. lower.

The Gold King mine and mill, on Cement creek, near Silverton, are now being operated under the management of J. O. Campbell. The mill is crushing 250 tons per day with 80 stamps, producing 55 tons of concentrate. The Hercules mine, near Silverton, has been sampled and may be operated again under direction of Thomas Kane.

San Miguel County

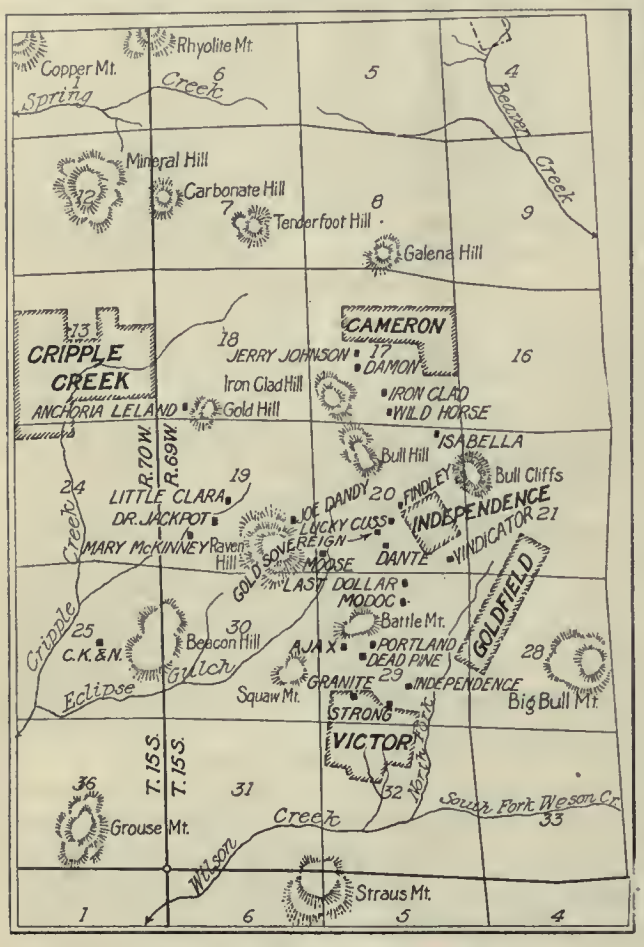
The Telluride *Journal* announces that the Ballard mine, situated in the centre of the San Juan country, is to be reopened by J. C. Weller and associates. The Ballard was productive in earlier days. The San Bernardino mine, near Trout lake, is being further developed under the superintendence of H. Olson. The property was examined recently by E. E. Rowe. There is said to be a considerable amount of ore in sight.

Teller County (Cripple Creek)

The Spur-Daisy G. M. Co., operating as lessee on the Oro lode of the Colorado Springs G. M. Co., Ironclad hill, discovered a vein at the 100-ft. level, the ore in which assayed $25 to $30 per ton. A steam plant has been put in position, and arrangements are being made to operate air-drills. A shipment of the ore is to be made. J. F. Reynolds and T. F. Buckley, having a lease and option on part of the Bogart

claim between Raven and Bull hills, made a shipment of ore that sampled about $25 per ton. Hills & Co., operating the Amanda mine under lease, situated at Windy point, have shipped 9 cars of ore from the Flag Staff shaft. The ore samples about $20 per ton. G. C. Blakey has shipped a car of ore from the Katie Hollis mine, which adjoins the Amanda.

The American Eagle mine, Bull hill, located by W. S. Stratton in 1890, is under lease to the Colorado Mines Investment Co., and under this lease there are 12 sub-lessees, 8 of whom are shipping ore. One of the latter is Mathison & Co., who have mined and sacked ore on the Porcupine vein, at the 100-ft. level, 500 lb. of which brought $2104 per pound. This is as high-grade ore as has been found in the history of the district. J. A. Jones, another sub-lessee, mined and sold 25 tons of ore at $72.40 per ton. The South Burns M. Co., working as lessee at the Burns shaft of the Acacia G. M. Co., last week shipped 50 tons of ore which



MAP OF CRIPPLE CREEK DISTRICT.

sampled $31.60 per ton. Operators under the Cookerly lease on the Prince Albert claim, Beacon hill, sold 30 tons of ore, the gross returns of which were $43.60 per ton. The ore was taken from the shoot developed by lessees, and lies south of the old shaft. The Modoc M. & M. Co. hoisted and shipped 5 cars of ore from the 950-ft. level of its Ocean Wave mine during May, which yielded $60 to $100 per ton. Lessees, working on the higher levels of the same mine, produced 175 tons of ore during May that brought $30 to $50 per ton. Melville Rapp, lessee at the Dante No. 2 shaft, mined and marketed 350 tons of ore in the month of May which sampled $20 to $30 per ton. The Dante company is sinking its No. 1 shaft. The Midget and Bonanza Queen claims, Gold hill, are being subdivided for convenience in letting leases. The Lucky Corner M. & L. Co., operating on ground owned by the Doctor-Jack Pot M. Co., between Raven and Gold hills, made a 2-car shipment of ore running $40 per ton. The ore was taken from the vertical vein of the Lucky Corner mine. Two cars of ore were recently marketed by William McGee and associates, who are operating under lease the Half Moon mine, on Gold hill. The mine belongs to the Matoa Gold M. Co. The main shaft of the Vindicator mine is being sunk below the 1500-ft. station. The Hull City shaft of the Vindicator company also is to be sunk deeper. Ore of good grade is being hoisted from the 1300-ft. level of the main shaft. The Union Leasing Co., operating at the Vindicator's Husted shaft, has opened a 7-ft. body of ore that assays $30 per ton, and about 30 cars of ore per month are being hoisted from the fourth and fifth levels. The shipments from the El Paso mine, Beacon hill, are averaging about 4 carloads per day.

IDAHO

Boise County

(Special Correspondence.)—The White Quartz Mining Co., operating the Woodburn placers, and the Mann & Hanson ground, employs 35 men. Four Hendy giants are in active use, and during the season, which is expected to end July 10, it is estimated that 600,000 cu. yd. will be sluiced. The values for this year are not definitely known, but last season on the same hill the ground averaged 22c. per cubic yard. On the one hill, where present operations are concentrated, the available ground is estimated at 40,000,000 cu. yd. C. F. Herrick is manager.

Idaho City, June 7.

Idaho County

The Last Chance group of five claims is situated within two miles of Elk City, and is owned by James Larsen of that place and Wilson Brothers of Spokane. It has two veins, one of which has been opened by a 370-ft. adit, and the other by a 200-ft. adit. The former vein has a width of 5 ft., within which is a 2-ft. pay-streak assaying about $200 per ton in gold. The latter vein is about 6 ft. wide, and contains a pay-streak of ore assaying about $15 per ton in gold. The two veins are 125 ft. apart.

Lemhi County

The Commodore M. Co., developing the Commodore mine, situated within three miles of the Gilmore & Pittsburg railroad, has a narrow vein of ore said to sample 300 to 1500 oz. silver per ton, and 12% lead. A shipment of the ore will be made to a Salt Lake smelter. The silver is argentite. New hoisting equipment is to be provided.

Shoshone County

(Special Correspondence.)—The interest of Charles H. Reeves in the Hercules mine, amounting to $^{16}/_{256}$ of the whole, was sold recently to Eleanor Day Boyce for $312,500, which is on the basis of $5,000,000 for the property. The ownership in the mine now stands as follows: The Day family, headed by Harry L. Day, $^{116}/_{256}$; August Paulsen, Spokane, $^{66}/_{256}$; the Markwell family, Los Angeles, $^{25}/_{256}$; L. W. Hutton, Spokane, $^{25}/_{256}$; Daniel Cardoner, Spain, $^{16}/_{256}$; F. M. Rothrock, Spokane, $^{8}/_{256}$. Dividends paid during the last 9 years have aggregated about $4,000,000; the amount paid in dividends for the year ended May 1, 1911, was $418,542. For that year there was mined 25,765 tons of ore, the gross value of metals recovered therefrom being $1,249,081. The costs of mining were $142,420; transportation, $178,503; reduction and sale, $195,622; improvements, including the mill at Wallace, $313,992; total, $634,915. There is being concentrated at the new mill about 400 tons of ore per day, and shipments of high-grade ore direct to the smelters amount to about 500 tons per month. The ore-shoot, where it was tapped by the No. 4 adit, has been proved a distance of 300 feet.

Wallace, June 10.

MICHIGAN

Houghton County

The May output of the Mohawk Mining Co. was 589 tons of copper, making 2914 tons for the first five months of this year. The Globe Mining Co. has been incorporated to take over and develop the Globe tract, adjoining the Champion on the south. The incorporators are J. E. Gay, J. R. Stanton, R. D. Rickard, and W. H. Leggett, who own all the stock of the company. The Old Colony company has decided to commence operations. Its group lies directly north of the St. Louis group, and the favorable result of

the work on the amygdaloid lode of the latter was what decided the Old Colony company to renew development.

MONTANA

Jefferson County

(Special Correspondence.)—Julius Barnes and associates, of Duluth, have obtained a lease and bond on the C. & D. mine at Elkhorn, and have incorporated the Elkhorn & Duluth Development Co., by which the mine is to be operated. The property has been developed by means of inclined shafts. The ore contains gold and lead, a large tonnage of which is said to have been opened. It is thought the lead can be taken out by concentration, and the tailing cyanided to extract the gold. The building of a milling plant will not be decided upon until after more development has been done.

Elkhorn, June 7.

Lincoln County

(Special Correspondence.)—The Snowshoe mine, which was purchased within the last six months by the Pacific Coast Smelting-Refining-Mining Co., is situated in the Cabinet range, 20 miles south of Libby, and is at an altitude of 4600 ft. above sea-level. The property has a vertical vein, 15 to 20 ft. wide, between well defined walls. The ore, as an average, samples $2.50 gold and 7 oz. silver per ton, and 8% lead. The mine is worked through a 3-compartment shaft and several adits, the greatest depth being 900 ft. The ore-shoot has been explored for a length of 1100 ft. It is stated that there are 80,000 tons of ore blocked out in the mine. The concentrating mill, of 300 tons daily capacity, which is in operation, was built by former owners about 1904. It is equipped for operating either by water or steam power. The mine workings, the mill, and premises are lighted by electricity. A force of 80 men is engaged at the mine and mill. The ore is concentrated about 8 tons into 1, and the grade of the concentrate shows an extraction of 75 to 80%. The shaft is being sunk to greater depth, and further development is in progress. The Snowshoe was closed down by reason of litigation from 1906 to the date of the purchase by the company now in control. E. H. Wilson, consulting engineer, who is directing operations, states that the railroad of the Libby Lumber Co., which is now within 7 miles of the mine, is to be extended to a place 5 miles closer this season.

Libby, June 9.

NEVADA

Esmeralda County

(Special Correspondence.)—The Atlanta will have a 1500-ft. shaft, to be sunk by the Queen Con. M. Co., which

FLORENCE MILL.

owns ground in the district, and has a lease on the Atlanta, on which it has resumed work. The lessee has been driving to the southeast on the 705-ft. level to explore the ground between the shaft and the boundary line of the Florence. The company has decided to sink to a depth of 1500 ft., and this work will begin within a short time. The Precious Metals Co., another lessee on the Atlanta, is exploring on the 730-ft. level and is now believed to be close to the northern extremity of the great andesite dike which, beginning at the south of the Florence hill, apparently forms the centre of fault displacement, throwing the entire formation far to the east, and beyond which it is hoped to pick up the southern extension of the Florence ore channel, cut off by this dike.

The Florence Goldfield mine has a number of improvements in the surface plant. The April report of Willis Lawrence, superintendent, shows that during that month the company's mill treated 5100 dry tons of ore, an average of 167 tons daily. The extraction was 94%, and costs of operation are given as follows: Mining, $1.10; development, $1.24; milling, $2.47; total, $4.83 per ton. Bullion tax, and incidental expenses, amounting to 12c., bring the total operating costs to about $4.95 per ton, the lowest figure achieved in this district. Some new equipment has been added to the machine-shop, a new electrical shop is being equipped, and a change-room will be built for the use of the miners. The company employs an average of 110 men, 75 of whom are engaged underground, 20 in the mill, and 15 at other work.

In the northern part of Goldfield district, the Goldfield Belmont Co. has exposed ore of good grade in the main drift on the 300-ft. level. This property is controlled by the men who dominate the Tonopah Belmont Development Co., and the work is being carried on under the supervision of that company's manager. Several shipments of ore running $100 per ton were made from the Belmont by lessees last year, the ore having been taken from the 50 and 150-ft. levels. Ore taken from a winze sunk on the 150-ft. level assayed as high as $1400 per ton gold. The 300-ft. drift has been driven for the purpose of getting under this orebody. This is the most northerly point in the Goldfield district at which pay-ore has been found.

Lessees have been shipping ore in small quantity from the Diamondfield Black Butte and Daisy; development on the latter will be extended into the Great Bend, adjoining, where ore was exposed by lessees on the 400-ft. level. The Marquette lessees are devloping on the east side of Vindicator mountain, on the Talmage group. The Sandstorm-Kendall Con. Co. is driving and cross-cutting from the old Kendall shaft and has some good ore, while lessees on the Sandstorm have mined ore of shipping grade. The Florence American Co., working on the Rustler Fraction, adjoining the Florence Goldfield on the southwest, has sunk the shaft to a depth of over 700 ft., and is exploring on the 700-ft. level to find the extension of the Rogers-Syndicate ore-shoot.

Engineers have been examining and sampling the ore of a group of 16 claims, known as the Rea property, situated 20 miles south of Goldfield, at the foot of Jackson mountain. A mill-run has been made of the ore from this group at the Pigeon Springs mill, near Lida. It is understood the property has an excellent showing of high-grade copper ore, accompanied by gold and silver. The 90-ft. shaft was sunk in ore, and the dump material is high grade. An adjoining group of 12 claims recently was examined by representatives of Eastern investors who are considering its development. The latter group is owned by Richard Donnelly and has a surface showing identical with that of the Rea group. The survey of the projected railroad between Cuprite and Lida passes within two miles of these properties and the Lida pipe-line and electric-power line are within a short distance.

Goldfield, June 10.

Humboldt County

Donald Ferguson, of Goldfield, acquired the Ohio mine, on Rebel creek, for Eastern people last year. He has a force of men engaged in prospecting and development. The tonnage of ore of milling grade now exposed is said to be sufficient to warrant the building of a 20-stamp mill, construction work on which may begin in a few weeks. The ore is said to average $17 per ton.

Lyon County

Various small mines at Silver City, including the Midas,

Carson, Underground, Overland, Hayward, Hartford, St. Louis, Justice, Cook & Gray, Buckeye, Kossuth, and Silver Bill, are producing 1000 to 1500 tons of ore per month, all of which is being treated at local mills. The McTigue 15-stamp mill and the Phillips mill work mostly on ore from lessees; the Phillips, Donovan, and Woodbury cyanide plants are running on tailing.

Nye County

The Mercury Mining Co., in which Mark L. Requa and J. H. Mackenzie are interested, has a cinnabar mine situated 80 miles from Tonopah, at which a retorting furnace and other equipment are being provided at an expense of $10,000.

Storey County (Virginia City)

The Mexican G. & S. M. Co. has a force of 43 miners at work. The report of Whitman Symmes, superintendent, for the week ended June 10, shows that three carloads of ore were shipped to the smelters, and that the gross output for the week was valued at $25,100. Mining operations on the 2300-ft. level resulted in extracting 51 mine-cars of ore of an assay-value of $54.48 per ton. There were 39 cars of ore taken from the north drift No. 3, off west cross-cut No. 2, on the 2400-ft. level, which assayed $9.20 per ton; also 21 cars of ore averaging $12.21 per ton, 24 cars running $7.16 per ton, 66 cars at $45.32, and 3 cars assaying $33.90. Extraction of ore at various points on the 2500-ft. level consisted of 76 cars averaging $86.53, 3 cars at $52.20, and 133 cars assaying $87.79 per ton.

OREGON

Baker County

E. P. Spaulding, J. C. Haas, W. H. Turner, and others of Spokane, have taken a bond on the Humboldt and Gorman mines, situated in Mormon basin. The Humboldt is one mile west of the Rainbow, and on the same lode. It has been developed by a 200-ft., 2-compartment shaft, and is equipped with a 10-stamp mill. It was formerly operated by J. A. Howard, Fred R. Mellis, John Arthur, and others of Baker.

UTAH

The International Smelting & Refining Co. now has four reverberatory furnaces in operation at its Tooele plant, and

MAP OF UTAH.

it is understood that the fifth furnace will be constructed this year, which will give the plant a capacity of 1500 tons of charge per day, consisting of calcined copper ore and copper concentrate, together with the fuel required. Blast-furnaces for lead smelting are being built, the foundations for which are being laid. In the meantime lead ores are being purchased and stored in the ore-bins.

The new inclined 3 compartment main winze of the Utah Consolidated, at its Highland Boy mine, Bingham district, has reached a depth of 1000 ft. It starts on the No. 7 haulage level, and is designed to be the means of developing the orebody at greater depth. The shipment of ore from this mine over the aerial tramway to the International smelter amounts to 500 to 600 tons per day. The Utah Copper Co. produced 8,169,248 lb. of copper in April, which is nearly a million pounds more than the March output. The production of the Chief Consolidated mine, at Eureka, from September 1909, to April 30, 1911, was 10,320 tons of ore, the net returns for which amounted to $249,131, an average of $24.19 per ton. The workings extend to a depth of 1675 ft., but most of the present work is on the 1400-ft. level. L. E. Riter, superintendent of the Dragon mine, near Mammoth, is driving a drift at the 800-ft. level on the Iron Blossom fissure, in which there is some galena in quartz. This drift is to be continued northward on the fissure to find an ore-shoot. Driving from the 1000-ft. station toward this fissure is in progress. The Eagle & Blue Bell mine at Eureka, controlled by the Bingham Mines Co., has first-grade ore in the bottom of the shaft, 68 ft. below the 1200-ft. station. Driving in ore at this point is in progress. The shaft of the Yankee Con. M. Co., at the north end of the Tintic range, and in the vicinity of Eureka, has reached a depth of 1820 ft., the intention being to sink to water-level before doing lateral development. B. N. Lehman of Salt Lake City is manager for this company.

The ore shipments for May from the mines of Park City, as reported by the Park *Record*, aggregated 236 carloads, or 9823 tons, distributed as follows: Daly West, 2639 tons; Daly-Judge, 1783; Silver King Coalition, 3349; New York Bonanza, 100; Ontario lessees, 153; Frank Daily, 41; Grasselli company, 480; Hanson company, 44; C. Anderson, 30; E. J. Beggs, 28; zinc ore shipped by Daly West, 532 tons.

CANADA

British Columbia

It is announced that the Granby mines, at Phoenix, and the Granby smelter, at Grand Forks, have begun operating, the latter with six furnaces. Their closing down was due to the inability of the Granby company to obtain its regular supply of coke from Crows Nest, where the coal mines and coke ovens were shut down on account of a labor strike. It is stated that the company is now getting its coke from Pennsylvania.

Yukon Territory

All the dredges in the Dawson district have been in operation since May 1, and several new dredges are being built. Operators of hydraulic plants began work in May, and those who got out winter dumps have been sluicing them. The Consolidated Forty-Mile company has commenced its season's work on Forty-Mile creek: and the Milvain company is operating a dredge in that locality, and may build a new dredge this summer. George J. Milton of Minneapolis has a force of men at work on the Tantalus coal mines, at Five Fingers, on the Yukon. The Coal creek coal mines, situated 35 miles north of Dawson, are being operated, the output being sufficient to supply much of the local demand. Coal produced at the Tantalus mines is used on the steamboats which ply on the Yukon between Whitehorse and Dawson.

MEXICO

Chihuahua

(Special Correspondence.)—The Republica Mining Co., operating a mine and mill at Sanz, some distance from Ocampo, during April crushed 1137 tons of ore, from which silver and gold were extracted, valued at ₱76,975. The operating costs were ₱43,549; construction expenses, ₱6680. This company, while operating far away from the railroads, has managed to work continuously during the period of insurrection.

Ocampo, May 20.

Book Reviews

Any of the books noticed in these columns are for sale by, or can be procured from, the MINING AND SCIENTIFIC PRESS.

DICTIONARY OF ENGLISH AND SPANISH TECHNICAL AND COMMERCIAL TERMS. By William Jackson. Pp. 164. Pocket size. Spon & Chamberlain, New York, 1911. For sale by the *Mining and Scientific Press*. Price, $1.

This little book is designed to answer the needs especially of those engaged in the iron, steel, hardware, and engineering trades. It is particularly valuable in that it includes not only the words for the articles dealt in, but those necessary in ordinary commercial transactions.

THE IRON ORES OF LAKE SUPERIOR. By Crowell and Murray. 186 pp., ill., maps, and charts. Penton Pub Co., Cleveland, 1911. For sale by the *Mining and Scientific Press*. Price, $3.50.

This is an exceedingly useful compilation of scattered information which has already appeared in other forms, and contains brief descriptions of the geology, mining methods, and transportation of these ores, their classification, sampling, analysis, and methods of computing prices from analyses. The most important feature of the book is the gathering in a handy volume of the chief facts concerning each of the more important mines of the Lake Superior district, including those of Canada. A more complete index would add to the very great usefulness of this reference handbook.

WEST AUSTRALIAN MINING PRACTICE. By E. D. Cleland. Pp. 268. Ill. Chamber of Mines, Kalgoorlie, 1911. For sale by the *Mining and Scientific Press*. Price, $8.

This volume, prepared under the auspices of the Chamber of Mines of Western Australia and published by that body, is a comprehensive summary of Western Australian mining practice. The book is based upon a series of articles written by Mr. Cleland for the *Journal* of the Chamber, and published during 1907 and 1908; these have been recast and expanded by a committee of representative engineers, so that no better review of present practice could well be obtained. In the eighteen chapters, all the phases of mining practice are discussed, and illustrated by numerous charts and diagrams. As a reference book of Australian practice, especially for Kalgoorlie, it is unexcelled, and with its companion volume by Gerard Williams upon the metallurgical practice of Western Australia, which is expected to appear in the near future, is likely to be of great value and interest to American engineers.

METALLURGY. By W. Borchers. Authorized translation from the German by William T. Hall and Carle R. Hayward. John Wiley & Sons, New York, and Chapman & Hall, Ltd., London, 1911. For sale by the *Mining and Scientific Press*. Price $3.

This little volume, evidently intended by the author as the syllabus of a course of lectures, should be used with caution by others than students. When it is noted that 23 pages are devoted to the metallurgy of gold and 11 pages to antimony, one feature of the work need not be commented on at greater length. In addition to this lack of balance, the volume is distinctly European in its viewpoint, and in several instances, gold and copper for example, the text needs copious commentary by the instructor to bring it more closely in line with American practice. A good feature of the book is its presentation in brief form of the results of advanced metallurgical study of the last decade; material that could otherwise be gathered only with much labor from the pages of technical journals, most of them French or German. For general brief reference it is likely to prove more convenient than Schnabel's two-volume treatise, and for this reason it will be welcomed as a supplement to texts on the metallurgy of iron, gold, copper, lead, silver, and zinc. Its treatment of the minor metals is much the best of any text now available.

Decisions Relating to Mining

Specially reported for the MINING AND SCIENTIFIC PRESS.

BREACH OF MINING CONTRACT

A person who was in default in the performance of the obligation of a contract to develop a mine was not in a position to sue the other party to the contract for an accounting. And where such developing contract provided that the forfeiture of the stock of the person undertaking to make a dividend-producing mine out of the premises, was the only relief to which the other party was entitled, on failure of the obligor to make the premises a dividend-producing mine, the forfeiture of the stock constituted the entire measure of damages in favor of the other parties to the agreement.

Catterlin *v.* Voney, 177 Federal, 527. March 1910.

FRAUD OF AGENT IN PURCHASE OF MINE.

An agent for another to secure options on mining property and to purchase mines for another is bound to deal fairly with his principal; and where such an agent represented to his principal that a certain mine could not be bought for less than a stipulated sum, when in fact the agent had an agreement with the owner of the mine that he was to receive a certain commission if he sold the mine to his principal for the price represented, which fact he concealed from the principal, was held to be a fraud on the principal, and the amount of the commission received by the agent upon the sale of the property could be recovered by the principal.

Shubart *v.* Federated Mines & Milling Co., (Missouri) 128 Southwestern, 2. May 1910.

LIABILITY OF MINE OWNER FOR DAMAGES TO MINER CAUSED BY THE NEGLIGENCE OF ANOTHER MINER.

The statute of Montana makes a mine operator liable for damages to a miner injured through the negligence of another miner. It also provides that in case of death of the miner from any injury so sustained the right of action shall survive to and may be prosecuted by his heirs. Under this statute in an action by the heirs for the death of a miner caused by the negligence of another miner, the scope of the recovery is the same as his would have been but for his death, including damages for the pain and suffering he endured and for his diminished and lost earning capacity for the period of his natural expectancy. And where such an action was based only on negligence of the engineer in handling the cage, evidence was admissible to show that the cage was without doors, as bearing on the degree of care that the engineer with knowledge of such facts was required to exercise in handling the cage.

Beeler *v.* Butte & London Development Co., (Mont.) 110 Pac., 528. July 1910.

USE OF LAND—INJURY TO ADJOINING LAND.

A landowner is not liable for incidental injuries to an adjoining landowner in the reasonable use of his property. But the use of land by one landowner for profit in such a manner as to practically confiscate or destroy adjacent property is not a reasonable use where such injury can be prevented at an inconsiderable cost. Under this principle of law the owner of land occupied and used for mining purposes, while the adjoining lands were servient to the ordinary surface flowage, and to such surface flowage that was contaminated by deleterious matter by which a reasonable use of such land might impregnate the flowage. Yet such adjacent land was not servient to an unreasonable artificial flowage caused by pumping water largely impregnated with salt and poisonous mineral substances from oil wells on the dominant land, either flowing upon such servient land or collected into artificial channels and cast upon it.

Niagara Oil Co. *v.* Jackson, (Ind.) 91 Northeastern, 825. May 1910.

Personal

Professional men are invited to send news of their engagements and travels. Such news is interesting to friends.

W. L. Saunders is at Denver.

Bertram Hunt has gone to New York.

M. S. MacCarthy is in San Francisco.

W. J. Sharwood is visiting California.

W. W. Mein has been in San Francisco.

C. S. Thomas, Jr., has been at Goldfield.

Carl Hoffman is visiting San Francisco.

Gelasio Caetani has been at Telluride, Colorado.

W. H. Aldridge will he at Los Angeles next week.

Hennen Jennings is in San Francisco this week.

W. A. Knol, of Rotterdam, Holland, has left Denver for New York.

E. M. Rabb is at Denver, after a six weeks' tour of the West and Southwest.

G. I. Adams has returned to Washington, D. C., after some years residence in the Orient.

M. W. Summerhayes has been appointed manager of the Swastika mine at Swastika, Ontario.

R. C. Kline has heen appointed metallurgist for the Farmers Mining Co. at Eureka, Nevada.

Duncan MacVichie, of Salt Lake City, was at the Nevada Douglas mine, near Mason, Nevada, last week.

A. C. Lawson is in Canada, where for six months he will be engaged in work for the Canadian Geological Survey.

C. F. Dike, Jr., of Cripple Creek, has been appointed manager for the Crown Chartered Co., Porcupine, Ontario.

R. B. Lamb has completed a professional trip to Porcupine and South Lorrain, and is now at Swastika, Ontario.

H. P. Henderson, of the firm Mines Management Co., New York, is making an examination at Porcupine, Ontario.

W. D. B. Motter, Jr., has been appointed manager for the Canada Iron Mines, Ltd., with headquarters at Trenton, Ontario.

Marshall D. Draper has gone to Alaska as engineer for the Hubbard-Elliott Copper Co., operating in the Copper River country.

R. W. Raymond and R. H. Richards have been elected to honorary membership in the American Institute of Mining Engineers.

J. S. Austin, president, and W. W. Charles, comptroller, of the Tonopah Mining Co. and other properties, were in San Francisco.

V. F. Marsters, consulting geologist, of Lima, Peru, has returned to New York on professional business. Until August 1 his address will be Substation 84, New York City.

Edwin A. Sperry has accepted the professorship of metallurgy at the Imperial Pei-Yang University, Tientsin, and will sail on June 28. R. Van A. Mills is now professor of mining in this University. N. F. Drake has accepted the associate professorship of economic geology in Leland Stanford, Jr., University.

L. Vogelstein & Co. give the following figures of German consumption of foreign copper for the months of January to April 1911:

	Tons.
Imports of copper	57,849
Exports	2,654
Consumption	55,195

as compared with consumption during the same period in 1910 of 54,663 tons. Of the above quantity 50,261 tons was imported from the United States.

On Monday, June 5, 1911, the Bunker Hill & Sullivan M. & C. Co. paid dividend No. 165, of $65,400. This makes the total amount of dividends paid $12,767,250.

Market Reports

LOCAL METAL PRICES.

San Francisco, June 15.

Antimony	12—12¾c	Quicksilver (flask)	46.50
Electrolytic Copper	14—15¼c	Tin	47—48½c
Pig Lead	4.75—5.70c	Spelter	7—7¾c

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

METAL PRICES.

By wire from New York.

Average daily prices in cents per pound.

Date.	Electrolytic Copper.	Lead.	Spelter.	Silver, per oz.
June 8	12.23	4.39	5.38	53¼
" 9	12.23	4.39	5.38	53
" 10	12.28	4.39	5.38	53
" 11	Sunday.	No market.		
" 12	12.33	4.41	5.26	53⅛
" 13	12.38	4.43	5.28	53⅛
" 14	12.43	4.43	5.28	53⅛

ANGLO-AMERICAN SHARES.

Cabled from London.

	June 8. £ s. d.	June 15. £ s. d.
Camp Bird	1 11 9	1 10 6
El Oro	1 4 8	1 4 6
Esperanza	1 10 7½	1 10 6
Dolores	1 5 0	1 5 0
Oroville Dredging	0 8 9	0 5 9
Mexico Mines	8 5 0	8 10 0
Tomboy	0 15 6	0 15 6

(By courtesy of W. P. Bonbright & Co., 24 Broad St., N. Y.)

MINING STOCK QUOTATIONS—NEW YORK.

(By wire from C. S. Burton & Co., New York.)

	Closing prices, June 15.		Closing prices, June 15.
Amalgamated Copper	$ 70	La Rose	$ 4¼
A. S. & R. Co.	82⅞	Mason Valley	9⅜
Braden Copper	4⅞	Miami Copper	21¾
B. C. Copper Co.	5⅛	Mines Co. of America	5¼
Butte Coalition	19⅜	Nevada Con	21¼
Chino	24	Nevada Utah	¾
Davis Daly	1	Nipissing	10⅜
Dohle	2⅞	Ohio Copper	1½
Dolores	5⅛	Ray Central	1⅜
First National	1¾	Ray Con	18
Foley O'Brien	1	South Utah	⅞
Giroux	7⅛	Superior & Pittsburg	17¾
Goldfield Con.	6⅛	Tenn. Copper	43⅛
Greene-Cananea	7⅜	Trinity	5¼
Guanajuato Con	⅜	Tuolumne Copper	4⅜
Hollinger	15⅞	United Copper	3
Inspiration	9⅛	Utah Copper	51½
Kerr Lake	5⅜	Yukon Gold	3⅞

COPPER SHARES—BOSTON.

	Closing prices, June 15.		Closing prices, June 15.
Adventure	$ 6¾	Mohawk	$ 52
Allouez	32	North Butte	34
Atlantic	6⅜	Old Dominion	46⅝
Calumet & Arizona	62	Osceola	105
Calumet & Hecla	475	Parrot	12
Centennial	12½	Santa Fe	1⅜
Copper Range	62	Shannon	11⅜
Daly West	6	Superior & Pittsburg	17⅞
Franklin	13½	Tamarack	85
Granby	39	Trinity	4⅛
Greene Cananea, ctf.	7⅜	Utah Con.	18¾
Isle Royale	18	Victoria	1¾
La Salle	4	Winona	8⅝
Mass Copper	9¼	Wolverine	116

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

NEVADA STOCKS.

San Francisco, June 15.

Atlanta	$ .10	Mayflower	$ .03
Belcher	.73	Mexican	4.45
Belmont	6.22	Midway	.16
B. & B.	.50	Montana Tonopah	.77
Booth	.07	Nevada Hills	3.12
Chollar	.18	Ophir	2.07
Combination Fraction	.07	Pittsburg Silver Peak	.86
Con. Virginia	1.45	Round Mountain	.58
Florence	1.20	Sandstorm Kendall	.06
Goldfield Con.	6.02	Savage	.28
Gould & Curry	.22	Tonopah Extension	1.00
Jim Butler	.24	Tonopah of Nevada	5.90
Jumbo Extension	.27	Union	1.55
MacNamara	.13	West End	.48

(By courtesy of San Francisco Stock Exchange.)

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EDITORIAL

LONG LIVE GEORGE V, King of England and Emperor of India. British subjects throughout the world joined on Thursday last in celebrating the accession of their sovereign. The pageants, naval and military reviews, balls and social gaieties, by which the occasion was marked, have filled the columns of the daily press and the magazines, and the whole world has read of them with interest, an interest that is also rooted in the same idealism that makes Englishmen, traditional lovers of liberty, celebrate the placing of a king above them. The ideal king is the superman, and in paying him homage his subjects magnify the best that is within themselves. The American people joined in spirit with their British cousins in celebrating the day.

TUNNEL-DRIVING has always attracted much attention in Colorado, and at the Laramie-Poudre tunnel exceptional progress has been made. In May the advance was 635 feet. Up to May 25 the work was driven at a rate which would have given 700 feet for the month, but broken ground being penetrated the average was lower, though still highly creditable.

ABRAHAM GONZALES, governor of Chihuahua, has declared that under the new régimé in Mexico every effort will be made to restrict the operations of 'foreign monopolies' now existing in Chihuahua. Second thoughts are the best, and it is not too much to hope that in the end it will be recognized that the interests of Mexico, as well as of outside nations, are best served by fairness and justice to all.

CLOSING of the smelting plant of the First National Copper Co. at Coram is the most recent chapter of the smelter fume controversy in California. The experimental work done on behalf of the farmers showed that the smelter was not complying with the terms of the injunction granted last year and the company therefore agreed to close down the plant as soon as the ore now on hand is smelted. Plans for the future have not yet been made.

NO MAN is ever hurt by assistance given to others, and the plea which Mr. C. A. Chase makes in his valuable description of practice at the Liberty Bell mill should meet with a generous response. Mining is not a competitive industry, in most cases, and in any event, the benefit which each engineer has received from his fellows lays upon him an obligation to give in return, whenever he can do so without injury to himself or those to whom he is responsible. It is to be regretted that instead of growing, the exhibition of this spirit has seemed recently to decrease.

REDUCTION of the duties upon wool, raw and manufactured, is a signal victory for the advocates of a lower tariff. The consumers of wool, the whole people, will benefit by the change, and it remains to be seen whether the manufacturers will be much injured. One lesson is plain; difficulties may arise when changes are made in the conditions governing an industry. A machine that gives satisfactory service will perhaps run better when some of

its parts are taken out and replaced by lighter ones; but while these are being fitted in place the machine is out of commission. Fix the machine, it needs it; but do not tinker with it, for little good is likely to result from so doing.

CEMENT has entered so largely into construction work of recent years that the domestic production was, until recently, unable to supply the demand. From 1890 to 1900 imports amounted to three or four million dollars worth per year, chiefly from Germany. In 1905 imports and exports nearly balanced and in 1910 the excess of exports over imports was over $3,000,000. Of our exports, nearly all go to Central and South American countries, nearly a million barrels going to Panama last year.

EXTENSION of the deep-drainage adit at Cripple Creek is proposed, and a fund of $50,000 is being raised for that purpose. While the water has not been lowered as rapidly as was anticipated, substantial benefit has already accrued. About fifty feet of water remains in the lowest level of the Portland mine, but it is expected that this will disappear in a few months. Contrary to expectations, mines in the western part of the district are not being drained notably faster than are those farther east.

EMERGENCY shafts, essentially large drill-holes, were discussed by Mr. Edward Rowe in a recent number of the *Scientific American*. No doubt they could often be used to advantage, but the larger use for such drill-holes would seem to be to supply air, food, and information to imprisoned men. At Ely, Nevada, among other points, drill-holes and pipe-lines already have been so used, and rescue chambers connected with the surface by pipe-lines will doubtless in time become regular parts of the equipment of coal mines.

Errors in Mine Sampling

The old story of the accountant who requested a manufacturer of instruments to make for him a glass ruler with a perfectly straight edge is often cited as an instance of the high cost of obtaining great accuracy and the impossibility of its perfect attainment. On another page Mr. Morton Webber calls attention to the errors in the sampling of a mine which seem impossible of avoidance, and draws attention to the curious fact that the error is nearly always in favor of the mine. Numerous cases of this will occur to every engineer. In a certain gold mine, for example, where the quartz vein ranged from 2 to 40 feet in thickness, two capable and careful engineers, in independent examinations, determined the average width of the vein as 9¼ and 9 feet, respectively, with an average content of $8.67 and $8.64 per ton. So close an agreement as this might reasonably be taken to indicate the accuracy of the work, yet two subsequent mill-tests showed $8.10 and $8.20 per ton, or approximately 6 per cent lower than the estimate. In the case of a well known copper mine even a mill-test proved unreliable. A series of mill-tests, made on a large scale, showed the content of the ore to be high enough for profitable working, yet actual work later proved that this was not the case. Probably the unconscious selection of the miners in breaking ore in the stopes introduced the error. In the training of young engineers, research work is often introduced in order to teach the student how subject to error even the most careful work may be, and the necessity for constant attention to this important phase of experimental work. Some years ago R. S. Woodward delivered an address on 'Observation and Experiment' that, though written by a pure scientist, should be read by every engineer who has occasion to make experiments and tests in the course of his professional work.

Mining and Metallurgical Society Problems

When the Mining and Metallurgical Society of America was organized, its sponsors had in mind three departures from the established practice of the older and larger society, the American Institute of Mining Engineers: First, it was thought desirable to bring together, if practicable, a body of the more active and influential members of the profession, and, to that end, to establish somewhat more rigorous qualifications for membership than those of the Institute. Second, it was desired to promote acquaintance and coöperation among the members by more frequent meetings, and with that in view, local sections were established. Third, with this smaller and more closely knit membership, it was believed that it would be both possible and desirable to secure formulation and expression of opinion among engineers regarding matters of public moment concerning the profession as a whole. The attempt was first made to secure such changes in the organization and practice of the Institute as would permit it to serve these functions, but, it being held by the officers of the Institute that this was neither desirable nor feasible, a new society was organized. It has now been in existence three years, and the time is opportune to measure results and raise the question whether continued separate existence is to the best interest of the profession.

As to the first purpose of the new society, allowing frankly for serious mistakes of inclusion and exclusion, a fair measure of success must be conceded. Not all the leaders of the profession have been interested, and by no means all or a majority even of those who are qualified for membership by position and attainments have joined the movement. At the same time the list of members is one which commands respect, and the membership is growing at a comfortable if not a rapid rate. As acquaintance among the members improves, and the scope and purpose of the society becomes better known, it is but fair to anticipate that more of the desirable men will become members. As has been the history of most new societies, an over-exclusiveness prevailed at first, and an unnecessary and regrettable affront was put on several excellent engineers whose applications were rejected; probably because of lack of wide personal acquaintance. Changes in the rules have made this impossible, and past mistakes have been rectified in part. The financial affairs of the Society are in excellent shape. In these particulars, at least, a creditable measure of success must be conceded.

As a means of promoting acquaintance and coöperation among members, the Society has also served a most useful purpose. Indeed, it may be questioned whether its most conspicuous achievement has not been in this direction. Three local sections have been maintained; in New York, Philadelphia, and San Francisco. The meetings have been frequent and informal, and, being preceded usually by a dinner, have taken on the air of social gatherings. The attempt to restrict attendance to members has wisely been abandoned, and the sections are now, practically, convenient units for taking the lead in organizing such meetings and dinners as best fit the local situation. Possibly this phase of the activity has been best developed in San Francisco, where visits of the Directors of the United States Bureau of Mines and of the United States Geological Survey were signalized by complimentary dinners, organized by the local section, but attended by large numbers of engineers who were not members. It is undeniable that a small organization permits development of a bond of union not possible among the thousands who are practically mere subscribers to the *Bulletin* or *Transactions* of the larger Institute.

As to the third purpose of the Society, the formulation and expression of opinion, no results of moment have been accomplished. The Society has endorsed certain general

proposals as to the content of annual reports and has amended its own constitution. Most of the subjects discussed have never come to vote, or were voted on after any action ceased to be significant. It has been extremely difficult to get enough votes cast to either accept or reject a proposal, and at present certain matters about which there is no real division of sentiment, in one case only one negative vote having been cast, have been sent back for a second ballot, in order to secure enough affirmative votes for passage. This difficulty in securing expression of opinion we believe to be due to two causes: the cumbersome method of voting, and the denial of the right to local sections of expressing any opinions whatever. Change in the method of voting has been proposed, and in time will probably be effected. Change in regard to rights of local sections has also been suggested, but there is less hope of this being made.

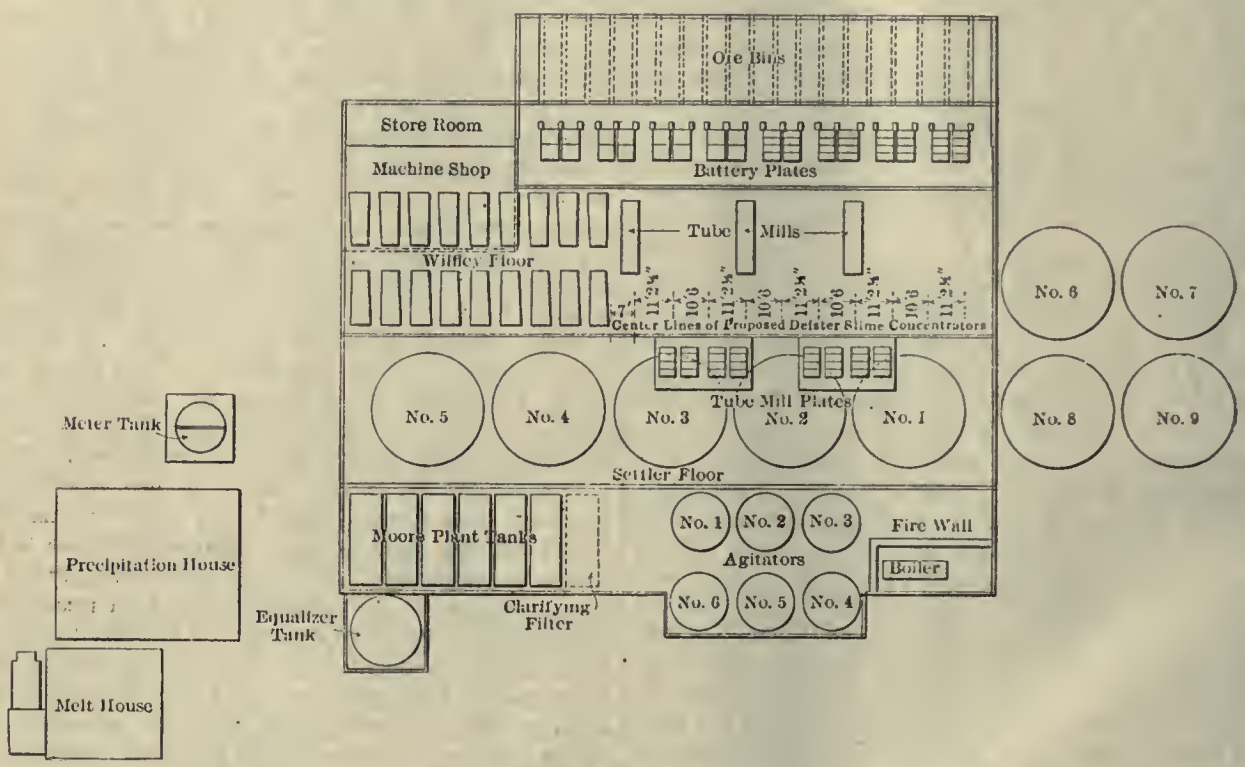
The San Francisco Section recently appointed a committee to consider this matter and to propose some modification of the by-laws. After due deliberation it was proposed that local sections should have the right to make public their conclusions regarding questions of public or professional interest upon which they had acted, provided that due notice of the proposed discussion had been given all members in advance, that the resolution should be adopted by a two-thirds vote, that it should be approved by the members of the council belonging to the Section, and that the conclusions should be published as those of the Section only. This proposal, with others, was considered by a committee of the council of the Society which reported: "We are unable to recommend, however, that any Section shall have the right to make public its conclusions upon any matter under any circumstances." The names signed to this report, those of Messrs. J. Parke Channing, H. M. Chance, and W. R. Ingalls, are such as to give it weight and assurance that the conclusion was not hastily reached. None the less, we venture to differ with the committee as to the conclusion. The reasons assigned for taking such radical ground are: (1) that the membership of the three organized sections is vague, and, in the aggregate, less than a majority of the members of the Society; (2) the Society is national in its scope and aims, and has no concern with local questions; (3) it would be chimerical to expect the general public to discriminate between action by the Society as a whole and action by a local section thereof; (4) since a majority of the members of the Society can never be affiliated with any local section, it would be unfair to commit the name of the Society to anything that the whole membership had not considered. As to the first, it is evident that it would be easy to remove any vagueness that exists as to local membership, but the proposal of the San Francisco members contemplated due notice to all members resident in the area represented by the Section. As to the second objection, it is to be admitted that difficulties may arise as to what is a local matter. When a committee from the New York Section assisted in the admirable work of cleaning up the Curb, there is some question whether that was more local than national in its effect. When, too, by the chance that a majority of the executive committee of the Society resided in New York, Mr. E. G. Spilsbury was duly authorized to act for the Society in protesting against certain legislation pending at Albany, the matter was local, but had national bearings. When, however, an equally important bill relating to mine inspection was pending in California, owing to the accident that a majority of the executive committee do not live in the West, though an equal number of members of the Council are members of the local Section, there was no means of doing the same thing that had been done in New York. If three members of the Council, selected by their associates to form an executive committee, have sufficiently the confidence of the members of the Society to authorize action in regard to New York State legislation—and we wholly approve of the action taken—why should not three other members of the Council, following notice, debate, and approval by three-fourths vote of a local section, be authorized to make public a conclusion regarding a problem regarded by them as local? To deny this right to "any Section" under "any circumstances" is to assume that by process of election the wisest men are always selected for membership in the executive council; a belief that places more faith in elective processes than in democracy. If there is one place where democracy should be supreme, it is within the ranks of a professional society. To the objection that the public would not discriminate between action as a whole and action by a local section, we would reply that we have no such low opinion of the discrimination of the public, provided a fair announcement be made. No one confuses a bill passed by the Senate, with a law, which must pass the Senate and House and be approved by the President. Declaration of California Republicans for progressivism does not seem to have committed the Republican party in Pennsylvania or throughout the Nation; and no one who thinks of the matter at all, supposes it has. The Philadelphia Section of the Mining and Metallurgical Society itself, has formulated and published an admirable code of professional ethics; but its adoption by that Section has not committed the Society as a whole. The futility of the position taken by the committee makes it almost ridiculous. As the matter now stands, any section of the Society can meet, debate, and pass a resolution. In due time it will all be printed in the bulletin of the Society open to the whole world. Suppose some perverse section chances to pass a resolution relative to some matter judged by the executive committee to be local, what is to be done? Shall all reference to the matter be suppressed? If it is not sufficiently national to warrant a place in the bulletin, are the local members to be told they wasted their evening, and are they to be forbidden giving any publicity to what seems to them of first importance? This again assumes a superior intelligence taken on with the vestments of office; an assumption we believe contrary to fact and which the present members of the executive committee would be first to disclaim. The members of the Mining and Metallurgical Society, as we know them, are in all parts of the country able and thoughtful men. They are not men to be content to meet and merely talk, or to assemble and go through motions. They will not waste time over trifles, and the mature conclusion of any dozen of them is worthy of, and should have, the fullest publicity in the form, and at the time, most likely to accomplish good. To grant this in no way commits other members of the Society who may, for the best of reasons, differ as to the conclusion adopted. No one city, no one section of a country as large as ours, can be the centre of things professionally, and best results will be accomplished by giving the widest possible latitude for formulation and expression of local opinion. This in turn will lead to really sound general opinion, but unless the avenues of discussion be kept wide open, the burden of inertia now evident whenever the Society attempts to record a vote, will never be overcome. We have no quarrel with what the Mining and Metallurgical Society has done, but we do protest that it has done little and regret that the form of organization precludes its doing more. Since committees have been appointed to consider the desirability of consolidating the Society and the Institute, we deem the matter of sufficient professional interest to warrant our remarks as well as a discussion next week of the new plans of the American Institute of Mining Engineers.

The Liberty Bell Mill

By Charles A. Chase

*The metallurgical practice here has frequently been described, and I will try not to dwell on well known features. The accompanying flow-sheet and ground-plan need no explanation, showing as they do the proper relations between the following units of equipment:

1. Eighty 850-lb. stamps with suspended Challenge feeders.
2. Sixteen copper amalgamating-tables, each 8 by 4 ft., with three 1-in. drops.
3. Four Richards vortex (hindered settling), 3-spigot classifiers.
4. Eighteen Wilfley tables and 10 Deister No. 3 tables.
5. Three Abbé pattern, 5 by 22-ft. tube-mills, the feed thickened by Dorr classifiers, or diaphragm cones.



PLAN OF LIBERTY BELL MILL.

6. Eight amalgamating-tables, of the size given above.
7. Nine Dorr continuous settlers, 33 by 11 feet.
8. Six Hendryx type agitators, 17 by 11 ft., above the 45° cone.
9. One equalizer vat, 20 by 15 feet.
10. Moore filter-plant, 7 vats, each 9 by 27 ft. in area, and 8½ ft. to the coning.
11. Zinc-shaving precipitation-plant, capacity 1200 cu. ft. of zinc.

The stamp-battery was originally built on wood blocks, with the usual framing and front horizontal drive from clutch-pulleys on the line-shaft. The wood foundations have been replaced by concrete, and the framing is simpler. The post rests on the concrete, only a piece of 6-ply Gandy, or similar, belting intervening. The results have been perfect. Ten stamps have heavy Allis-Chalmers anvil-blocks, the other lighter Denver Engineering Works 'sub-bases'. There is no apparent difference in results, and the lighter construction is cheaper. Globe stem-guides have been reasonably satisfactory through many years, but are now being replaced by the simpler and stronger Pacific guides. Shoes, boss-heads, and tappets are of chrome steel. The cams are of the Allis-Chalmers Blanton pattern. This Blanton fastener is also used for the bull-wheel. Dies are of east iron, from the local foundry, containing a large percentage of steel scrap.

The horizontal battery-drive through clutch-pulleys was unsatisfactory and solid pulleys were substituted, it being cheaper and easier to cut an occasional belt, in case of desiring to stop a 10-stamp section for considerable repairs, than to maintain the clutches. The feeders are operated by the feeder-wheel mechanism, shown in the illustration, a good device, patented by the mill foreman in 1900. Battery screens have recently been of two patterns: 14 by 14 mesh, No. 22 wire, aperture 0.043 in.; and 16 by 3 mesh Ton-cap, 0.039 aperture, which yields a finer product and a larger tonnage than the former, having heavier wire and the same aperture blinded. It seems that the wire must be light enough to spring readily under the impact of the splash. A screen analysis of battery pulp shows: On 40 mesh, 24.4%; on 60 mesh, 10.9%; on 80 mesh, 5.9%; on 100 mesh, 6.3%; on 200 mesh, 9.6%; through 200 mesh, 42.9%. Some 38% of the battery pulp is flocculent. The power charged to the battery amounts to 160 horse-power.

The ore is stamped in cyanide solution. The recovery by amalgamation is materially less than in previous years of water-amalgamation; it is more expensive in both labor and material and requires more skill, and the consumption of copper is considerable. Muntz-metal, which has proved a satisfactory substitute elsewhere, has not been successfully adapted here, taking on a hard, glassy surface. The plates are kept rather wet, and any drip of quick is caught in a trap. From a month's run the results of amalgamation were: from battery-plates, 80% of all amalgam, yielding 29% bullion, 0.408 Au, 0.551 Ag; from tube-mill plates, 20% of all amalgam, yielding 23% bullion, 0.153 Au, 0.825 Ag; the first plates have a grade of 2¼ in. per foot, and the second plates 1⅜ inches.

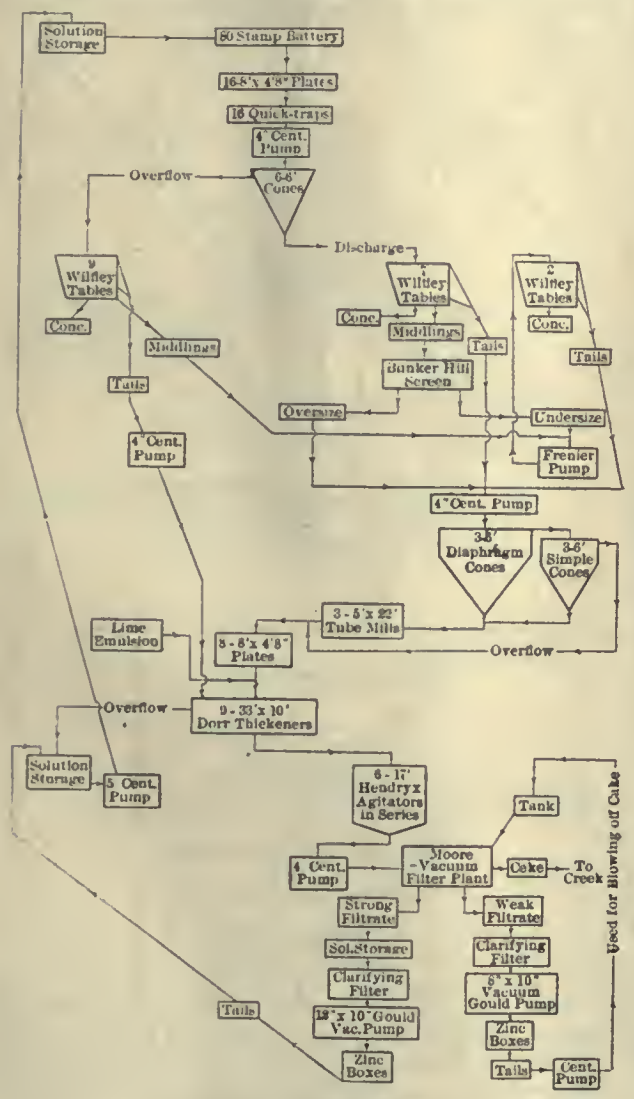
The concentration scheme is only now assuming definite form. Nine Wilfley tables take the underflow from the Richards classifiers, two take the middling, after removing the coarse on a Bunker Hill screen, and seven take the overflow, after thickening in six 6-ft. cones. The 10 Deister tables are to take the reground sand from the tube-mills. Any oversize tailing from these latter tables is returned to the tube-mills.

This arrangement seems to represent a reasonable economic limit. Further expansion of plant would yield returns on the investment relatively slowly. The great im-

*A portion of a paper to be presented at the San Francisco meeting of the American Institute of Mining Engineers.

pediment to perfect work is the argillaceous slime. Coagulated by the alkaline solution, it is exceedingly buoyant and sustains coarse material, both sulphide and sand, until dilution is carried to extreme limits. This scheme represents the lesser of two evils. For three years concentration was applied to the tailing, after filtration and dilution with water. An extensive area of canvas with Wilfleys and vanners gave poor returns, and it was evident that the sulphides, probably concentrating to some extent in the tube-mills, were ground so fine as to be irrecoverable. Moreover, what was caught was so high grade as to suggest re-precipitation of silver on the pyrite. The extraction of gold was comparatively good.

That amalgamating is still carried on has occasioned some adverse comment. It is recognized that the absence of this step would materially cheapen and simplify the milling. Sixty stamps, at most, would be required to crush the full tonnage through the coarser screens that could be

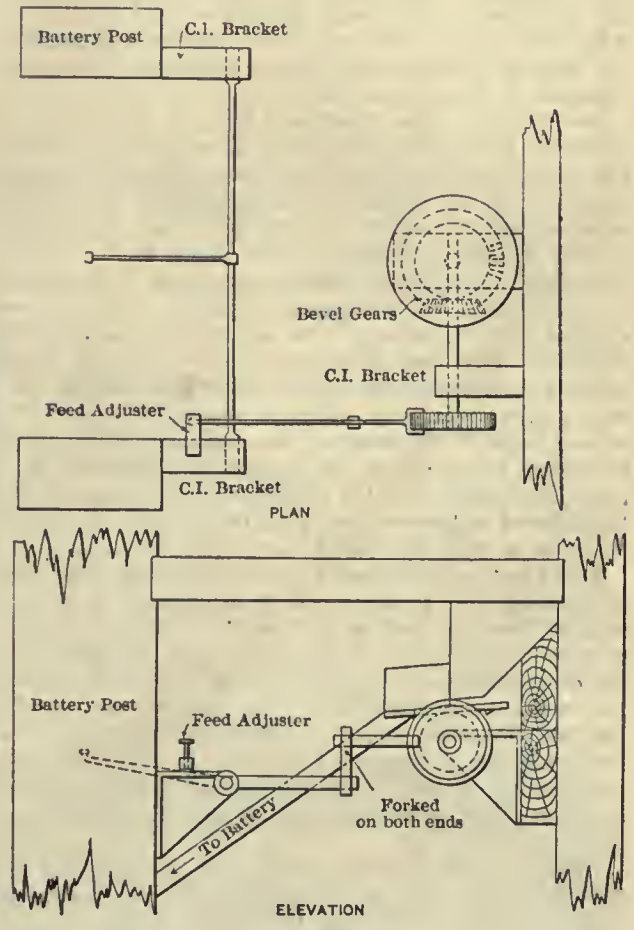


FLOW-SHEET, LIBERTY BELL MILL.

used. It has been stated that the gold occurs irregularly in the ore, and hence is likely to be coarse. This gold would make an unwelcome element in the concentrate, which has not as yet been made amenable to local treatment. A streak of gold on the tables would be a constant source of danger, and the product would be spotted and difficult to sample for sale. Were it feasible to concentrate successfully after regrinding, the battery plates might well be done away with and the coarse gold allowed to go into the tube-mills with assurance that it would be ground and taken into solution; but that concentration after regrinding is not good practice here seems to have been amply demonstrated. The power charged to concentrating is 30 horsepower.

Regrinding.—The tube-mills are of the Abbé type, tire-mounted and with spiral feed. The tire-mountings were designed by the company's engineers, are amply rigid, and also give complete protection against possible end-travel of the tires off the rollers. The tires, both on the mill and on the supporting rollers, are of forged steel and promise indefinite life. The drive is by 50-hp. motors, belted to counter-shafts which in turn drive through heavy friction-clutches to the tube-mill shafts. The mills start readily with the use of the clutch, showing a maximum starting-peak of 78 hp.; the running-load varies from 45 to 48 hp. The lining is of 4-in. silex blocks, set in cement mortar, with the narrow edge to the wear. It gives a year's continuous service. The grinders are 4-in. imported flints, costing $33 per long ton delivered. The ends are lined with local cast iron, and the discharge is through a grating, which will probably give way to the Neal cone-discharge. A typical screen-test is as follows:

Screen Mesh.	Feed. Per cent.	Discharge. Per cent.
On 40	47.1	0.7
On 80	29.4	11.4
On 100	8.2	9.2
On 200	6.4	22.3
Through 200	8.9	55.4



BATTERY FEEDER.

As nearly as it is determined, half of the total tonnage crushed is reground. The efficiency of the regrinding varies with the excellence of the separation of the slime. Failure to remove this gives buoyancy to the pulp within and the grinding is poor. With this object in view, the above screen-test is not satisfactory. The practice is to force a diaphragm-cone and to care for the overflow of sand in a simple cone in series. The discharge from the simple cone carries slime out of all proportion. This is mixed with the discharge from the diaphragm-cone to dilute it to 48% moisture. The result is to lose much of the benefit had from the diaphragm-cone. It will undoubtedly prove better to combine the overflow from the three diaphragm-cones in a single simple cone and confine the hampering effect of the fine material to one mill; or, better, a Dorr classifier at this point would be admirable. The feed

to the other mills, being then diluted with clear solution, the grinding should be good.

The work of this diaphragm-cone in preparing feed for a tube-mill is remarkable, as the following screen-test shows. The completeness of the elimination of fine suggests the benefits of hindered settling. This is a 6-ft. cone with 60° sides. The diaphragm is 13 in. from the point, with a 1½-in. annular space. The discharge is 1¼ in. diameter.

Screen. Mesh.	Cone Feed. Per cent.	Discharge. Per cent.	Overflow. Per cent.
On 40	27.22	58.95	0.19
On 80	24.82	30.66	8.97
On 100	7.55	5.15	7.44
On 200	8.89	3.42	17.00
Through 200	31.52	1.82	66.40
Moisture	.....	30.80	.....

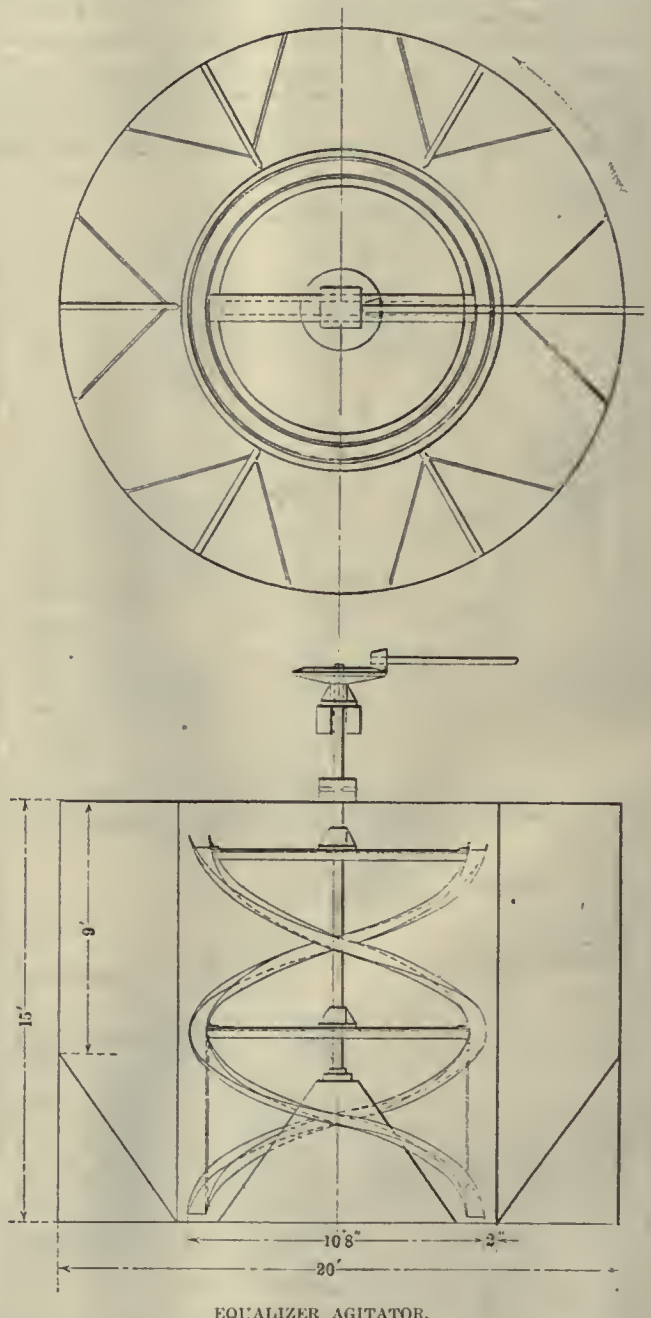
The absence of results from Dorr classifiers is due to the fact that the two machines installed here were the first, after Mr. Dorr's original installation at Terry. They conformed to his pattern neither in area nor in bottom-slope, being built in what space was available, and were overloaded. The results have been good through four years service, but not as good as would have come from the larger machine. The pebbles are fed during the day by the shift-boss, being shoveled into the spiral feed; 135 lb. is the daily charge. The mills are entirely smooth-running, and the cost of maintenance is at a minimum. The power consumed is 43 hp. per unit.

Dorr Settlers.—The latest step of great importance in improving the mill was the change to continuous from intermittent or charge settling in thickening the pulp for agitation. It is not possible to state definitely that certain measured results followed exclusively from this change. Certain definite improvements were shown by the experimental unit, and large improvements have followed the complete change, but at the same time other conditions were changed. The following are the principal advantages thus obtained: First, continuous extraction is obtained where before the solutions were inactive or re-precipitating; second, a given volume of settler space has 25 or 50% increased capacity, operated on the continuous basis; third, extraction going on in the settlers, the addition of a plant for settling has the added value of supplementing the deficient agitator-volume; and, fourth, labor is reduced one man on each of three 8-hour shifts.

This plant, originally of 5 vats, settling the pulp from the ratio of 5:1 to 2.5:1, has been increased to 9 vats, settling from the ratio of 9:1 to 2:1. The increase of solution has come with the addition after the battery of the concentrating-plant, with its great volume of solution for washing and classifying. The four settlers recently installed have been placed out doors, with individual conical roofs and underneath shaft-drive in a conduit, with great saving in cost as against providing the usual mill structure. The power consumed is one-fifth horse-power per unit.

Agitation.—The agitator-capacity was designed with the expectation of using a low-potential electric current to hasten extraction, following the results of extensive experimental work. The plan failed, and, without the current, the provision of space was inadequate. This has been remedied, in large measure, by the addition to the settler-plant, already mentioned. The connecting of all agitators in series for continuous operation was a natural sequence of the adoption of continuous settling. The results appear better, but statistics on which to base exact conclusions as compared with previous charge-agitation are lacking. Some saving in labor of operation and of maintenance is evident. These agitators operate steadily with little attention and very low cost of repairs, but the unit-size is too small for a large-tonnage plant, and the power consumption (6 to 7 hp.) is out of proportion, as compared with Pachuca tank practice or arm-agitation, as carried on at El Oro. No benefit was obtained by spreading the pulp over distributors from the top of the central well, and it is allowed to plunge from the collar of the well. The power consumed is 50 horse-power.

Moore Filter-Plant.—The equalizer, an integral part of the Moore filter-plant, is a simple type of slow-speed agitator (see illustration), efficient for all depths of pulp in the vat and consuming a minimum of power. It has been lately patented and put upon the market as the Gordon agitator. The filter-baskets of 66 leaves, each presenting two surfaces 8 by 6.5 ft. of free filtering-surface, are carried on two 10-in. longitudinal I-beams, which are in turn supported by transverse 6-in. beams which extend to the vat walls. The leaves are of No. 6 (20-oz.) canvas, reinforced on both sides at the bottom of the vertical stitching with a strip 3 in. wide of the same canvas. The



EQUALIZER AGITATOR.

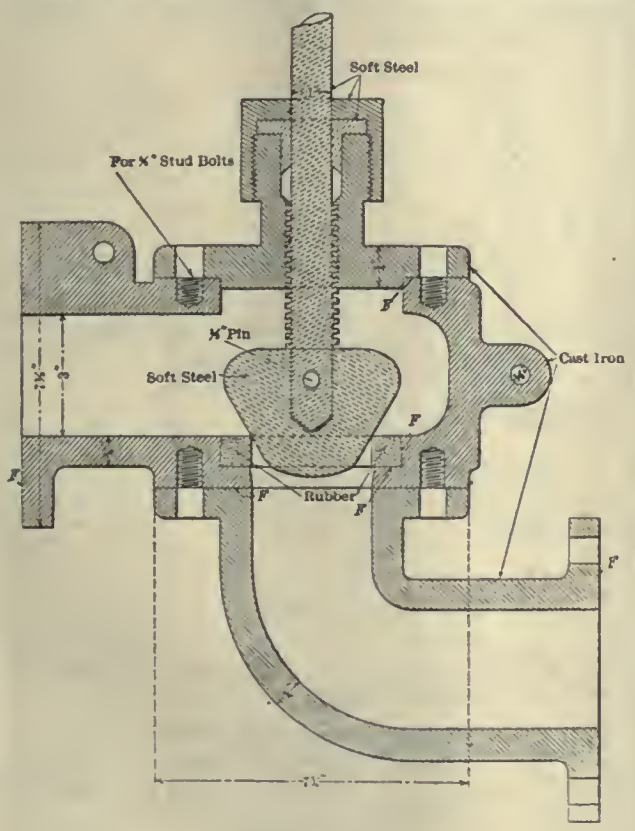
vertical seams are on 2-in. centres, and the wood strips between are ⅜ by ½ in. The frame is of ¾-in. iron pipe on ends and bottom, and the top is of strap and angle-iron. No cocoa-matting or other filter is used.

The leaves are made at the mill, the sewing (No. 4 linen thread, ¼-in. stitches) being by power machine (Singer 7-7), and cost complete $12; new canvas alone in place costing $8. The life of a filter is 18 months. All canvas requires hydrochloric acid treatment at intervals of three months. To do this a wash-water vat is brought to 1.25% HCl (18° B.) and to 140° F., the basket is immersed and the liquor circulated with a wet-vacuum pump. All the canvas in use can be treated within 30 hours. The cost of acid is 0.6 cent per ton of ore.

The lifting of baskets is by hydraulic cranes with cylin-

ders 20 in. by 9 ft., the water at 250 lb. pressure. Connection from the crane to water-main is by a specially reinforced coupling on a short length of metallic hose. The raised basket is held by a safety-catch on the crane, and the transfer is effected by a 10-hp., 3-phase, constant-speed motor, with a 3-armed trolley above. Transmission from motor to crane is through a Dodge multiple-disc friction clutch on the motor shaft. The service is severe, but the clutch does well. The vacuum connection from the basket is through a 3-in. hose to a pipe turning in a stuffing-box, and is maintained throughout the transfer.

The greatest single step in perfecting the plant was the change from the common wet-vacuum pumps to a combined dry-vacuum and wet-vacuum system; all entrained air is taken out at the upper end by a dry-vacuum pump, an 8½ by 10-in. vertical duplex air-compressor, and all solution at the lower end with centrifugal pumps in a sump 23 ft. below the top of the filters. Some leaks in canvas will occur, and sand sufficient in quantity to destroy a positive wet-vacuum pump in a few hours is harmless



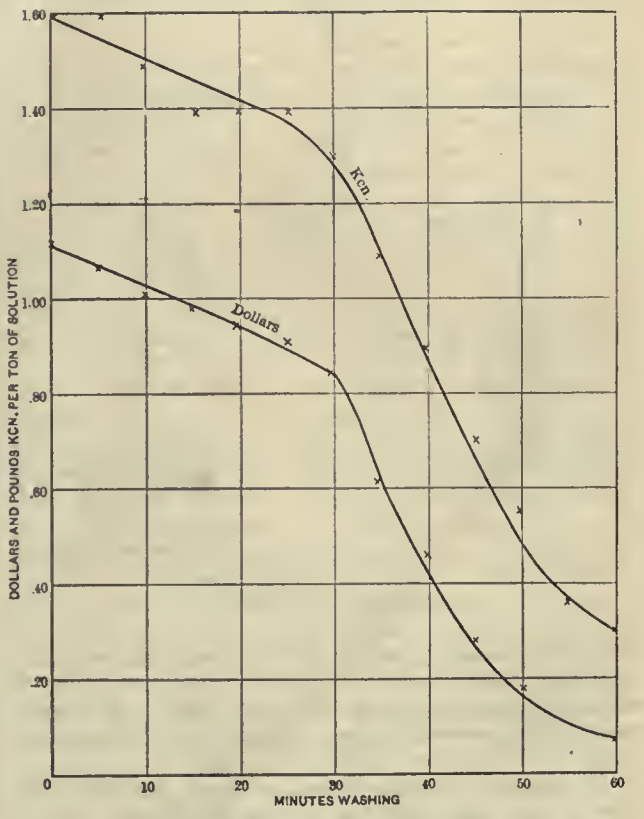
VACUUM-VALVE.

to the centrifugal. Between the dry column at one end and the solution column at the other runs the main for strong solution. Parallel to this and leading from the same dry column runs the weak-solution main, but to a different solution column and pump. Any basket may be connected with either vacuum main, or with the blow-off water-main without disconnecting the hose. The vacuum never fails, being held at 19 to 20 in., near the maximum attainable at the altitude of the mill. To make this possible an excellent valve was designed (see figure). Its appearance is that of a globe valve, and its merit lies in seating an iron cone on a hard-rubber ring of square section. It is quite impossible for sand to lodge on the ring so as to interfere with closing.

Filtration is accomplished in two groups of three vats each, the central one for loading and the two on either side for displacement in water. Basket No. 1 loads in the centre vat and is moved to the wash-water vat at the right. Immediately thereafter basket No. 2 moves from wash-water vat at left to loading vat. The cycle is thus: Loading, 50 min.; transferring and drying, 5 min.; displacing and discharging, 45 to 55 min.; transferring, 5 min. Each load is a ¾-in. cake, weighing 2.75 lb. dry per square foot, or 9 tons per basket-load. This gives a capacity of 108 tons per basket per day, corresponding to 432 tons for the plant. Vertical uniformity of loading is secured by the use of three air-lifts, which elevate pulp from the bottom of the vats and discharge it over the top.

The practice of displacing at once in water, without an intermediate wash of barren weak solution, can be approved ordinarily only on the assumption of good displacement and low-strength solutions. Displacement is efficient, but the solution (1.6 to 1.75 lb. KCN at this point) is higher than was planned when the plant was designed. A factor that enters the special problem here is the 8% of moisture brought to the mill in the ore. Average results in washing are shown by the accompanying curve. The cake, partially dried, contains 33% moisture, not taking into account the solution in the pipes and channels, which is difficult to determine, but which must approximate one ton. The cake and passages thus retain a total of 5.5 tons of solution containing 8.8 lb. cyanide and $6.16 in gold and silver. The rate of displacement is 0.15 ton per minute.

In filtration there are two principal ends to serve: (a) to



WASHING CURVE, MOORE FILTERS.

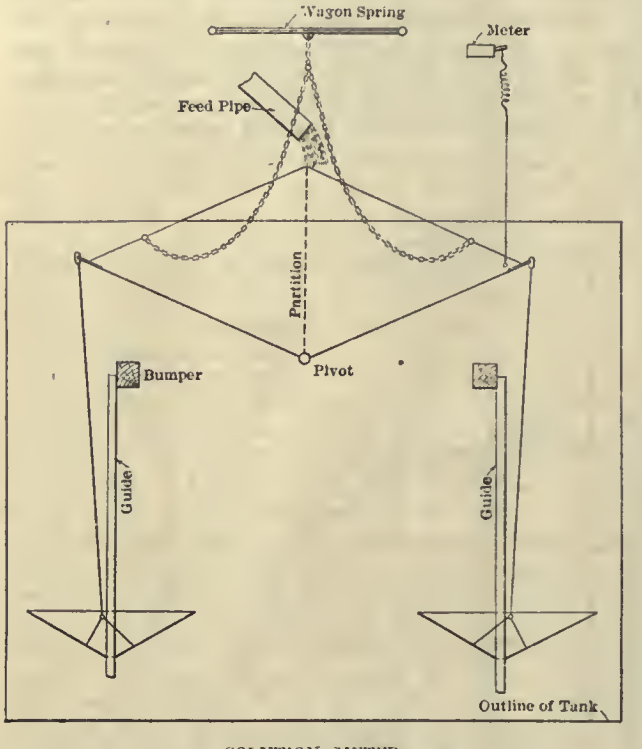
recover enough strong solution to restore the mill stock; (b) to recover the dissolved gold and silver, and that in solution of such strength as to insure precipitation. Were the ore dry on entering the mill, 36 min. filtration would be sufficient. As the solution drawn in this period contains 7.72 lb. KCN, the efficiency of displacement is 87%, measured in cyanide. As it contains $5.08, the efficiency is 82%, measured in metals. It seems fair to accept 84 or 85% efficiency.

The mechanical loss of cyanide by dilution is that which cannot be restored to the mill stock. The fact that 35 tons of water is brought to the mill with the ore makes it impossible to secure the maximum theoretical efficiency given. From each basket-load the solution recoverable is $(5.5 - 0.8 =)$ 4.7 tons, containing 6.48 lb. KCN. The combined mechanical loss is therefore $\frac{8.8 - 6.8}{9} = 0.22$ lb. KCN, or 4.7c. per ton of dry ore.

In 55 min. washing, the recovery of gold and silver is $5.93, the apparent loss being 2½c. per ton of dry ore. This seems to be a maximum figure; washing to 70 min. showing almost complete removal. Regular sampling of the solution in washed cakes is not convenient, but, so far as done, it shows 1 to 2c. The loss in cyanide by dilution being so small and the recovery of dissolved metals being

complete, the only remaining consideration is the low average strength, 0.75 lb. KCN, of the weak solution. Solution at 0.9 lb. KCN precipitates well. The use of a barren wash would insure this strength in the weak solution. On the other hand, 1c. per ton of ore will restore the few tons of weak solution to strength on the infrequent occasions of poor precipitation. It seems that added costs in depreciation, operation, and maintenance would offset any gains from an intermediate wash.

The weak solution after precipitation is used at low pressure, to force the cake from the filter, submerged in wash-water. An advantageous change would probably be to perform this with air and thus return a more nearly dry basket to the loading vat. The removal of tailing is



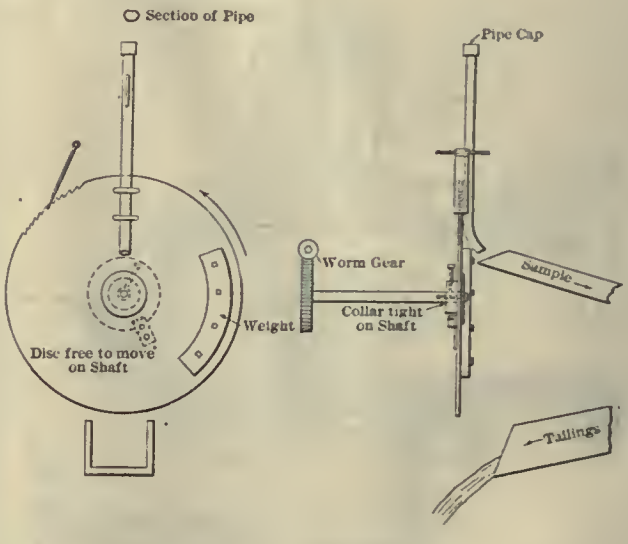
SOLUTION METER.

wholly automatic, by reason of the excess of wash-water available. The vat walls run down to three points, across which discharge single jets of water from ¼-in. nozzles, carrying the descending mud through ½ to ¾-in. orifices in the walls opposite the jets.

The operation of four baskets has been described. The fifth is used as a clarifying filter in the seventh vat. All solution, whether decanted or filtered, though apparently clear, requires clarification to insure clean zinc-boxes. In this service the canvas acquires a remarkably fine impervious and tenacious coating. To remove this the basket is returned to pulp filtration after 10 to 14 days. At times a coat of pulp has been gathered on the canvas before using it to clarify, but this seems an unnecessary refinement, which reduces its capacity. The power consumed is 30 horse-power.

The Zinc Precipitation shows little that is unusual. The results are usually excellent with average heads of $1.25 and tailing of 1 to 2c. The flow of solution is 0.7 ton daily per cubic foot of zinc, and 2.4 tons per ton of ore milled, $^{3}/_{10}$ of the whole mill solution being precipitated. All the solution is metered above the gold-solution vats by a mechanism devised from a common tilting-box tailing-sampler (see illustration). The pans or pipe guides are always submerged, and, in the manner of dash-pots, steady the movement of the box. Being placed over the vats, any splash is accounted for in calibrating. Each cycle is registered by a counter. The zinc-lathe is home-built and has a capacity of 700 lb. to 0.001 in. per 8-hr. shift. As cut the zinc is gathered on revolving arms in skeins which fit the boxes. The sludge is gathered semi-monthly, treated with sulphuric acid, washed, dried, and melted. Always high grade, it has recently reached a maximum of 92% bullion. The drying-furnace is of the cast-iron muffle type, and the melting is in No. 150 B. L. crucibles in coke furnaces. The charge for power is 7 horse-power.

Pumping Plant.—The handling of ore and solution necessitates much pumping. This is done with improved Byron Jackson slime-pumps. The pumping units are in duplicates for pulp. The liners used are ¼ to ⅜-in. cast iron. Manganese steel is to be tried. As it stands, the record shows this to be a good centrifugal pump. The life of the liners varies with the thickness of the pulp and the proportion of clay to sand. The tube-mill feed with nearly clean sand gives the shortest life, and the agitator discharge, very thick and with all the clay, gives the longest. Notwithstanding this good service from the centrifugal pumps, I have been for some years of the opinion that the proper pumping equipment for this mill would be a low-pressure compressor with air-lifts for almost all transfers, and to replace the mechanical agitation. The displacement of motors, belting, and shafting, with their need of skilled supervision, would far outweigh the loss of efficiency in the air-lifts. The milling operations would be characterized by extreme simplicity.



PULP SAMPLER.

Use of Chemicals.—The mill-sheets show this average in cyanide and protective alkalinity:

	Battery Head.	Second Plate Tailing.	Filter Heads.	Consumption.
KCN	1.75	1.64	1.50	1.48
P. A.	2.32	1.44	1.92	.....
CaO	....	....	....	7.5
PbO	....	....	....	0.33

The mixed salt, 99% KCN, is used, no advantage being evident at first in trials of the 130% salt, but a recent concession by the makers has led to further trial with the 130% salt, with better results. The figures given are in pounds per ton of solution. Durango lime is used and the figures are in equivalents of caustic soda. Until September 1909 lead acetate was used, ¼ to $^{3}/_{10}$ lb. per ton of ore being added at the agitators. Since that time litharge, ⅓ lb. per ton, has been added with the tube-mill feed. An apparent improvement of 5% in silver extraction from the charge is based on inadequate tests.

Cost of Operation.—The operating costs for the period from the beginning of operations with the present type of plant are given below. I do not attempt to reproduce more than total department costs. The expense readily chargeable to the various departments is so disposed and the reason for leaving the other items as a general charge I believe is clear. The general charge for power is the cost of pumping between departments. The first two years were marked by many mechanical difficulties. The benefit of the abandonment of the canvas plant and the change to continuous settling was shown during 1909. The increase in freight, treatment, etc., in 1910 is due to the increased tonnage of concentrate. The balance-sheet and

summary of the mill work were given on page 742 of the *Mining and Scientific Press*, May 27.

These figures are given as a service to the public, following the practice of Arthur Winslow in making public his annual reports on the mine. It is hoped that others may derive from them some return for the benefit that the author and his associates have derived from published accounts, letters, and free access to plants elsewhere. Further, it is hoped that the figures may serve as a warning in some cases and a source of encouragement in others. Certainly, one embarking on a new enterprise under similarly hard conditions can get some measure of the obstacles likely to be encountered. On the other hand, the great improvement of the past two years shows what is possible. This result is primarily the culmination of many years working toward the re-treating system and concentration of operations in mining; a result delayed principally by the harassing labor conditions of 1902-1908, and, in part, by the lack of sufficient early development.

	Year.	1906.	1907.	1908.	1909.	1910.	January. 1911.
Tons per year,		92,900	102,105	116,353	125,681	133,881	139,760
Tons monthly average		7,742	8,509	9,696	10,473	11,157	12,480
Labor.							
		Cents.	Cents.	Cents.	Cents.	Cents.	Cents.
Superintendent,		1.47	2.03	1.91	1.98	1.85	1.60
Heating,		0.90	1.33	1.34	1.61	1.40	2.48
Electric plant,		1.30	0.76	1.07	1.05	0.76	0.60
Lubricating,		0.54	0.41	0.24	0.32	0.25	0.26
Accidents,		0.54	1.33				
Pumping plant,		.....	.....	.....	.....	1.65	1.83
Watchman,		0.17	0.13	0.85	1.20	1.03	1.00
Examination and tests,		.....	.....	2.72	0.13	0.30	0.54
Total general labor,		4.93	6.00	8.56	6.27	7.24	8.33
Crushing,		2.48	3.16	2.01	4.50	4.80	5.35
Stamping,		18.04	17.28	16.66	14.31	13.70	10.95
Regrinding,		4.94	1.46	0.76	0.66	1.28	1.22
Settling and agitating,		5.20	4.51	4.70	2.75	2.36	2.03
Filtering,		13.65	7.18	6.18	5.24	4.46	4.00
Concentrating,		12.11	11.57	12.27	7.02	5.40	5.05
Amalgamating,		5.71	5.44	4.63	4.42	4.67	5.30
Precipitating,		6.68	4.43	3.42	2.83	2.05	1.96
Total labor,		73.75	61.03	59.56	48.01	46.04	44.19
		Cents.	Cents.	Cents.	Cents.	Cents.	Cents.
Pipe lines,		0.61	1.81	0.52	0.43	1.80	0.25
Bins,		0.89	0.58	0.05	0.37	0.03	
Building,		3.19	2.36	2.72	3.38	3.73	2.79
Electric plant,		2.79	1.44	1.13	0.86	0.48	0.74
Pumping plant,		1.93	1.53	1.01	2.46	1.97	3.13
Heating plant,		4.97	2.80	2.25	2.55	2.58	5.10
Tools,		1.00	0.68	0.22	0.36	0.47	1.02
Cyanide,		40.72	34.19	37.10	31.29	33.90	30.93
Alkali,		6.83	5.91	6.43	5.71	6.45	4.62
Lead salts,		1.22	3.95	4.09	2.85	2.70	4.18
Power,		2.15	3.80	2.96	2.71	2.51	2.24
Light,		1.10	0.42	1.67	1.73	1.65	1.48
Oil and waste,		0.65	1.15	1.00	1.07	0.61	0.86
Assays and melts,		4.17	5.64	4.91	4.00	4.16	4.08
Examinations and tests,		.....	1.24	1.59	0.26	0.17	0.07
Miscellaneous,		0.23	0.09	0.06	0.04	0.05	0.05
Total general,		71.37	67.79	67.63	60.24	63.	60.77
Crushing,		4.66	4.80	2.90	2.22	1.77	1.06
Stamping,		17.57	16.85	13.00	13.36	17.80	14.25
Regrinding,		14.89	10.58	8.19	7.05	6.58	6.05
Settling and agitating		4.95	3.00	3.54	5.20	4.34	5.74
Filtering,		13.80	10.98	6.00	5.59	7.06	5.88
Concentrating,		3.09	3.30	2.85	4.69	3.00	1.87
Amalgamating,		4.93	5.53	4.77	3.42	4.04	2.06
Precipitating,		7.75	7.76	6.43	5.68	6.43	5.44
All supplies,		143.72	130.41	115.28	107.35	114.00	104.03
All labor,		73.75	61.03	59.56	48.01	46.	44.19
Total operating costs,		217.47	191.41	174.84	155.36	160.	148.22
Depreciation,		16.	16.	13.	11.	13.	13.Est.
Freight, treatment and discounts,		25.	25.	24.	19.	32	32.Est.
Total metallurgical cost,		258.	232.	212.	185.	205.	193.Est.

OPERATING COSTS, LIBERTY BELL MILL.

Inasmuch as this mine is situated in a part of the West noted for its high freight-rates, living-costs, and wage-scales (in this case the mine and mill averaging $3.60 and $3.75, respectively, per 8-hr. shift), it furnishes an interesting comparison with the results secured with the alleged 'cheap' labor of Mexico. This comparison is apt, because in its requirements metallurgically the mine is more nearly comparable with the practice at El Oro and Guanajuato than anything north of the line. I wish in closing to acknowledge the courtesy of Mr. Arthur Winslow in granting me permission to publish the many details given, and the valuable assistance of Messrs. W. H. Staver, M. L. Anderson, W. E. Tracy, and H. G. McClain, all of Telluride, Colorado, in collecting drawings and special information.

Telluride, Nevada

By H. C. Cutler

The new Nevada camp of Telluride is situated in the Battle Mountain range, Lander county, near the head of Willow creek, and some 25 miles from the town of Battle Mountain on the Southern Pacific railroad. There is a good wagon-road to within a mile and a half of the camp, and an excellent trail for the rest of the distance. It is only 16 miles from the railroad by the way of Valmy, and a movement is on foot to construct a wagon-road to this point.

The main property and the only one on which any development work has been done, has recently been incorporated into the Dollar Mining Co. by Thomas Kearns and associates. Some stock has been sold, and prospecting work started on a larger scale. The vein was found in the latter part of 1910 by J. Hutchins, but owing to the heavy snows in that section, little work was done on it, and the discovery was not made public until this spring. The camp is situated at an altitude of about 7500 feet; water is plentiful and wood is scarce.

The neighborhood has been thoroughly staked, and several promising veins, showing fair ore, have been uncovered. With the exception of the main find, little work is being done in the district, the present owners preferring to wait for capital to come in and take the chances. This area was mapped by the Fortieth Parallel Survey as Webber quartzite, and the vein on the Dollar property is apparently a quartzite; in some places altered to a glassy quartz, in others, soft, decomposed, and stained by iron oxides. It shows a width of from 8 to 25 ft. and lies between two belts of slate—a hard black slate on the foot-wall, and a soft, light-colored slate on the hanging wall. The formations dip about 45° to the northwest. A number of cuts have been made on the surface, exposing the vein for 100 ft. In one of these cuts a rock, probably eruptive, was exposed, but its extent and whether it occurs as a flow or as an intrusion, is not now known. It is likely that the ore is due to its presence.

The ore is an altered quartzite carrying free gold, with but little silver and occasional crystals of tetradymite or telluride of bismuth. Frequently free gold is found, imbedded in the crystals, showing that the deposition of the two minerals was simultaneous. Near the surface the tetradymite is more or less oxidized, and the rock shows a greenish stain, which might indicate a trace of copper.

The discovery-shaft was only down some 8 ft. when the present company acquired the property. Since then it has been continued to 30 ft. On the surface, assays ranging from $2 to $500 were obtained, and from present indications it seems quite probable that ore of a fair milling grade will be developed. A townsite has been located, but the necessary elements for a Nevada boom are lacking, and consequently the camp is not growing very rapidly. The now nearly deserted camp of Bannock is only five miles distant. The main things needed in Telluride are money and work.

Nickel is chiefly produced from nickel copper ores. These occur in many places, but the best known desposits are at Sudbury, Ontario. The nickel and copper are separated by smelting with 'salt cake' giving 'top' and 'bottoms,' of which one contains more copper and the other more nickel. The blister copper finally produced contains some nickel and the nickel some copper; their final purification is effected by electrolysis. The nickel and copper together form 'monel metal,' a new valuable alloy.

Unavoidable Errors in Sampling

By Morton Webber

Much has been written recently in regard to unavoidable or latent errors in mine sampling, and also in respect to obvious errors arising from carelessness and ignorance. As to the former, my own digest and corollaries may be of interest, but no attempt will be made to deal with the latter class. Mine sampling, no matter how carefully done, usually indicates a higher metal content than that shown throughout an adequate period of commercial ore treatment, affording data of actual results in mill yield, plus residual contents. In the South African banket, where thoroughness and accuracy of sampling is probably second to none, the mill yield plus tailing content is invariably from 15 to 25% short of the average indicated by sampling. In the premier lead mines of Australia the discrepancy is at least 10%. The results from four well known gold mines show an unaccounted difference of some 12%. These mines are situated respectively in Mexico, Colorado, Australia, and India, and the fluctuation from one to another is not more than 4%; with the above average.

In a mine valuation the conditions will generally fall under one of five classes. I will endeavor to enlarge and explain each respective class; but it should be understood that many mines will belong to a combination of two or more of the classes; and not to any one alone. (1) Mines where the average value is mechanically reduced, but where the unaccounted-for metals may be subsequently recovered; (2) mines where there exists an unrecoverable loss; (3) mines where sampling indicates a fictitious high value; (4) mines where sampling results in an incorrect subnormal value, conclusive proof of these two being afforded by subsequent commercial results; and (5) mines where sampling is of no value. In narrow veins where the breaking of waste rock is necessary, the ore going to the mill will be reduced in grade. Even if sorting is carefully done it is impossible to keep all the waste out of the mill, especially if the enclosing walls are soft; yielding more or less fine. In a narrow vein it is customary to allow for this, but my experience is that such an allowance is generally insufficient. In veins of even normal width it is usually impossible to mine without the inclusion of some waste. In such a case the discrepancy in metallic content may be considerable, owing to the fact that no hand sorting may be employed. This discrepancy will largely adjust itself when the mine or stope is worked out, as the decreased value per ton is compensated for by the greater tonnage crushed. But the valuating engineer will, if he is wise, when computing his factor of loss, largely disregard this; as it will be difficult to explain to those not versed in valuation, that the mill results, while not appearing at the moment up to expectations, will adjust themselves at some future date. In a mine of considerable length of life it would obviously be a patient wait.

In mines where filling is necessary, and also in cases of underground sorting, there is always a loss in the waste, even where boarding is used. This may be a tonnage loss rather than of value per ton, or possibly a combination of both. In either case it is a loss of marketable metals which the mine valuer should be careful to deduct from his estimate. Where the metal contents of ores are in sulphide form, the sulphides are frequently more friable than the gangue. In consequence, the samples will contain an abnormally high proportion of ore. Discrepancies of this class are more usual in copper and the baser metal mines, but in the case of a gold mine, where the gold is associated with friable sulphides, this error should be very carefully considered, as it may result in an estimation out of all proportion to subsequent results. Where there are two sulphides in the same ore, one hard and dense and the other soft and friable, the latter sulphide will break more easily in sampling and will therefore be abnormally represented in the valuation. If the major values are in the hard sulphides the issue is liable to be unfair to the property. I recently examined a large copper mine where the ore was chalcopyrite. There were two distinct types of this ore in the mine, intimately associated. The ore that carried a considerably higher copper content was hard and dense. The lower-grade ore was soft, friable, and easily disintegrated. In this case some allowance would have to be carefully made to compensate the sampling error, which was unfair to the property. There is a class of mine where the valuable minerals occur like currants in a pudding. In this class no confidence can be placed in an assay map, no matter how close a sampling unit may have been chosen. The results will either be high or low; but certainly not correct. Innumerable examples exist where an assay plan would have shown the majority of the samples as unprofitable, yet the commercial results have afforded conclusive proof of undervaluation. This class is not composed only of little-heard-of precious metal mines, such as gold and silver sulphides, for the famous base-metal mines of Missouri and the great copper mines of Lake Superior are a more or less analogous class. The only method of valuation which in this case would appear reliable would be based on authentic records of past yield, in combination with competently selected representative ore-parcel tests of the remaining ore in the mine.

An attempt to tabulate the percentage of error under the relative heads discussed and apply the results to specific cases, would be to mar facts which have taken many years to collate, with the spoofery of the charlatan. In a mine examination the engineer must use his own judgment, and what has been written is intended to enable him to arrive at a conclusion based on sound premises on individual conditions. The most that should be said is that in the great majority of cases sampling will overestimate actual conditions. The amount of error will vary from 5 to 25%, the average being apparently 12%. Cases giving a subnormal result are decidedly in the minority, and before any addition is made to sample returns the facts should be thoroughly understood.

Nature of Permissible Explosives

By Clarence Hall

*The energy developed by the detonation of permissible explosives, like other high explosives, depends on the change of the small solid particles and liquids of the explosives into large volumes of gases, and the rate of detonation or the rapidity with which these gases are formed. To meet the varying coal-mining conditions in this country the manufacturers have formulated explosives varying in rates of detonation from 1447 to 4439 metres (4746 to 14,560 ft.) per second. It is evident that for certain work, where a shattered effect is desired, as in driving through rock, or producing coal for coking purposes, the explosive reaction should be rapid, and permissible explosives should be selected from the list having a high rate of detonation. In a similar manner a suitable permissible explosive for use in soft friable coal, and especially so when lump or steam coal is desired, should be selected, which develops its gases at a slow rate in order that the pressure developed will be more prolonged. I have been informed that the coal operators of West Virginia are overwhelmed with agents of permissible explosives with their various claims of efficiency. To establish their claims it means that demonstrators must conduct a series of experiments over a considerable period of time in the mines. In several instances in mining bituminous coal it has been found that permissible explosives containing only 20% of nitroglycerine have given better results and produced better coal than those made after a similar formula containing 25% of nitroglycerine. The physical tests of explosives, such as in the gallery, rate of detonation, strengths of explosives as determined by lead blocks, gauges, ballistic pendulum, height and duration of flame, will be published as Bulletin No. 15, Bureau of Mines.

*From an address delivered before the West Virginia Mining Institute.

Triangulation Applied to Mines

By E. E. Barker

Most of the engineers of the larger mining properties throughout the country have, for convenience in their work, usually laid out a system of rectilinear coördinates, by which the position of a given point is easily determined. Some have used the scheme of triangulation, while others have depended on the latitude and longitude differences, as calculated from the ordinary traverse. It is my aim, in the discussion that follows, to set forth the facts regarding the condition of claim and section corners as I have found them, and to show why a system of triangulation is almost indispensable on a valuable mining property.

The chief value of such a system is the ease and accuracy with which all the claim corners, and especially the boundary posts, are permanently referenced, that is, tied-in by survey from substantial stations so that in the event of their destruction or temporary removal, their correct position can at once be absolutely determined. In the patent survey of mining claims the office of the Surveyor General now demands that all traverses, including all the exclusions to other claims, and areas formed by the intersection of claim lines with section, county, and State lines, as well as the traverse of the claim itself, close within a maximum limit of one foot in two thousand. In past years such accuracy was not required, and many patents have been issued in our older camps on surveys that would not begin to come within that limit. I have in mind an old patent in the Globe district, Arizona, where the end lines, although parallel in the survey notes, were fully 10° from being so in the field, and one side-line, while supposed to be 1500 ft., measured but 1470. Another requirement in patent proceedings is the tying-in of one of the claim corners to the nearest section or quarter-section corner, and which, in the case of the subsequent destruction of all the corners and their immediate references (if there ever were any), would be the only means by which the position of the claim could be re-determined. The necessity for taking steps to improve the shameful condition of our section and quarter-section corners cannot be too forcibly brought to the attention of the proper government head. Each section corner, in our well developed districts, at least, should be substantially monumented and permitted to assume some of the dignity of the important reference that it is.

Stories have often been told of the manner in which the pioneer 'Knights of the Transit' ran many of their lines; in the case of the subdivision of townships, usually by contract, with the work seldom inspected. Of one it is said that in order to eliminate errors in his estimates he would guess at twice the distance and divide by two. Of another, that he was fond of a certain brand of Havana cigars. Before each day's work he would mark a number of these at regular intervals, previously determined by the distance his mount would travel in a given time. As the ash of the lighted cigar reached each mark in turn—representing a quarter of a mile in distance—he would dismount and establish his quarter-section corner.

While these are exaggerations, the condition of section corners in the older surveyed districts, both as regards accuracy in location and permanency, is deplorable. The location having been once established, it cannot now be changed, but a new point can be re-set in the same position and witnessed by a monument of sufficient size to be easily found. I have spent days at a time searching for a section corner which was my only reference, all trace of which had apparently vanished. After running lines from two or three different corners and looking carefully in the place where it should be, my quest at times was rewarded by the discovery of the point and its reference numerals, chiseled on the face of a rock not six inches square and flush with the surface of the ground, over which I had trampled a score of times. Probably I have failed to find one-quarter of the corners for which I have systematically searched. On some occasions, I have found the corner, usually a block of stone, loose on the surface of the ground with nothing to indicate its proper position, so that for a reference point the corner was worthless. These conditions obtain in all our Western States.

"A pine post 4 ft. long, 4 in. square, set 18 inches in the ground in a mound of stone", is the usual wording of a corner description in the survey notes of a mineral patent. It goes without saying that this means of identification will not last the life of the average mine, and what miner has not tested his corner-stakes to find that more often than otherwise a child could push them over if he were so inclined. In some localities, the timber in the posts will rot in six months time, so that the corner becomes useless, and, if near a road, a passing vehicle sometimes collides with the stake, giving it a helpless appearance, if not taking it out altogether. In contracting for a patent survey, which is the usual procedure, it is well to specify in the terms of the agreement that the posts must be charred or creosoted and set well in the ground in substantial blocks of concrete; and to see to it, by personal inspection, that the scheme is carried out. An even better way is to use a 4-in. pipe 6 ft. long, set 3½ ft. in concrete. The pipe is provided with a metal screw cap, on which is inscribed the survey number and usual markings of the patent corner. It should also be centre-punched, giving the exact position for the bob when a set-up is made over the corner.

Patented claim as well as section corners, should be kept in condition and not allowed to run down. Special inspection once a year would help matters, and, if corners were found in bad shape, the owner should be informed and made to bring them up to the standard. In nearly all controversies relative to patent notes, and the corresponding position of the claim corners, the courts have sustained the position of the monuments on the ground. An instance comes to mind of a case where a deputy mineral surveyor gave the course of his reference tie as northeast when it really was southwest, thus putting the claim in a different section from that in which it really was. The error was overlooked and the notes were accepted, followed by the granting of the patent. The reason for the preference given the monuments over the survey notes in a case of this kind is apparent. Again, there is a claim in the Bisbee district, Arizona, that is 1700 ft. long, the notes calling for 1500. The patent was issued before the error was discovered, and the posts stand as legal corners. Another case in the Ely district, Nevada: On a claim patented no later than 1906, the patent notes call for a 1200-ft. side-line, and all available records show this to be the correct distance, while the posts on the ground measure but 1000 ft. apart, and, therefore, fix the boundaries. In any case, and dozens of similar ones can be cited in every district, should all trace of the corners be lost, then all the data that are available to re-set the posts are the notes of the patent survey. Imagine, then, the tangle in the instance just cited, with a section tie over 8000 ft. long. It is plain to see that complications would arise that could be adjusted only by long and tedious litigation.

A practice which, I regret to say, has been often suspected, is that unscrupulous property holders adjoining valuable mineral claims will move the stakes of these to suit their convenience, and the change, perhaps, will not be noticed for some years; at which time there is nothing to prove the truth of the situation either one way or the other. If these unscrupulous persons have an understanding of the details of engineering and patent proceedings, they can so distort conditions that a re-setting of corners to anything like their original position is altogether out of the question.

There are few mining men, if any, who are not familiar with the red tape and tiresome delay connected with an application to secure a mineral patent. This is especially noticed in pioneer camps which have, perhaps, spent years in oblivion and later come again into active development. There are scores of old patented claims with most of their monuments gone and nothing but the notes to work from, which are usually much in error. As a result, the granting of a patent to adjacent ground will be, perhaps, indefinitely

withheld, as the notes of the new survey when plotted on the maps of the Surveyor General's office will possibly show an encroachment on the prior patent. This overlap probably does not exist in the field, but is due to an error in the field notes. A parallel case to the one just described has occurred in many districts, and it is only after various surveys, and awaiting the convenience of special agents to make investigation, that there is any hope in getting title to the property.

It would be a great advance if the Land Office would institute triangulation in every mining camp of importance, re-determine the correct position of all existing patent and section corners, and give to each post its proper latitude and longitude difference, or, as commonly called, its latitude and departure. Deputy mineral surveyors could then be instructed to lay out new patents from this system, and the standard of accuracy brought from the present allowable error of one in two thousand to something like one in twenty thousand. A fund of information would be accumulated that would be invaluable toward expediting the issue of patents, and the notes on record would then have an actual value. It is truly laughable to read on a patent plat the course of a line as bearing N. 45° 26′ 19″ E., and going in the field, to find that the bearing is incorrect by several degrees. With the arrangement as suggested, all deflections would be made from the same bearing, and there would seldom be any necessity for the tape in the field, the awkward end of which, no doubt, is responsible for many erroneous measurements. The deputy mineral surveyor in good faith, however, is required to make affidavit as to the accuracy of the survey to the best of his knowledge and belief. One great trouble in the present procedure is that there is little or no check on the field work, and the surveyor measuring a line in error calculates other courses and distances from this line, which when figured in a traverse, closes within the required limit. The error passes unnoticed. Particularly is this error noticeable in the section ties in a group of claims. Usually one is measured and all remaining ties calculated from this, so that in the event of an error in the first measurement the entire group is incorrectly located.

Take for example a dividing line between two valuable mining properties. The claim corners have been lost, and when the value of the ground has later been determined, a dispute arises as to the original position of the dividing line. The court decides that a deputy mineral surveyor under heavy bond shall umpire the dispute by re-running the old patent survey. After he finds what he thinks to be the proper section corner or mineral monument to which the claim was tied, he may run his lines with inclined sights and a long tape where the pioneer 'broke chain' and measured what he assumed to be horizontal distances. The engineer re-running the survey will establish the line, perhaps failing to check the old survey by an error of one foot in five hundred, and if the nearest reliable reference was a mile away, his point will be ten feet from the original position of the claim corner. The tendency in measuring distances by 'breaking chain' is to measure short, that is, the line instead of being 1500 ft. long might only be 1495, owing to the impossibility of holding the chain in a truly horizontal position. This difference does not help the desired result, but in the case under consideration one or the other of the companies, since they must abide by the decision, must move its line back 10 ft., making a present to the opposing company of a strip of ground 10 ft. wide and possibly 1500 ft. long. Should this area cover a depth of 300 ft. of 2% copper ore, it would mean a gift of $1,500,000. Should there be closer references and the error of resetting the line be only one foot, the loss still reaches $150,000. Since the work of establishing a triangulation system on a large mining property can be done at odd times, and the cost of instruments and materials is but little over $2000, its relative worth is apparent.

In the best scheme of triangulation there are two systems, a primary and a secondary. The primary embraces the stations on the most conspicuous points that are to the greatest degree intervisible and any combination of which will form well proportioned figures. In other words, the arrangement should be such that a station is determined by two lines intersecting as nearly as possible at right angles. These stations are lettered alphabetically. The secondary system is taken from the first, and embraces all stations of a secondary nature that must be set in less important places to obtain sight of a few minor points, and for which the degree of accuracy need not be so rigid. These stations are usually numbered. Figures 1 and 2 show the arrangement of a good type of station to be used. It consists of a triangular plate (A) ⅝ in. thick with a 3-ft. piece of 1¼-in. pipe (C) screwed in the centre and rigidly set. At each corner of the triangular base a hole (M), Fig. 2, is bored to accommodate ¾-in. bolts 18 in. long (B), Fig. 1, threaded for 6 in. on one end, and on which a nut (G) is placed both above and below the plate. The three bolts are then cemented in ⅞-in. holes, as shown in Fig. 1, spaced and drilled in the rock outcrop, if such be available or, if not, set in a substantial block of concrete. The plate with standing pipe is placed over the bolts and, by means of the nuts, is adjusted to a vertical position, which may be plumbed with an ordinary spirit-level. In cases where the engineer has reason to suspect that blasting or other work might injure or interfere with the station, a ¾-in. bolt, E, 18 in. long, split at the bottom with a steel wedge entered (see Fig. 1) is driven into a ⅞-in. hole, thus binding it firmly against the wall. This bolt is centred directly under the standing pipe of the station. The hole is then filled with liquid cement and the head centre-punched at the exact point, so that if the entire station above be carried away, the point will be left intact. When the base and pipe have been set and adjusted, a 10-ft. piece of 1-in. pipe (D) is placed in the other pipe, into which it telescopes easily and fits just tightly enough to insure adequate resistance against vibration from the wind. The pipe is marked in 1-ft. lengths beginning at the top and painted alternately red and white, as these colors can be seen best from a distance. This arrangement gives a permanent station, and, by removing the 10-ft. rod, a point over which a set-up can be quickly and accurately made by centring the bob in the pipe beneath.

Probably nothing in the entire scheme of triangulation requires the accuracy necessary in laying out the base lines, as the efficiency of the system depends on these measured distances. There should be two lines, one at either side of the property, if the area embraces 1000 acres or more, which should be laid out on as level ground as the country permits and should not be less than 3000 ft. in length. When the position of the base line has been determined, a station is established at each end and hubs driven along the line, carefully centred with small-headed nails, so that a tape may reach from one to the next without interference. Supports must then be erected at intervals of 25 ft. between the hubs to keep the tape in a truly straight line. The tape should be standardized for temperature and 'pull', so that when the line is measured, the corresponding corrections can be made, as without this the work cannot be checked closer than two-tenths of a foot in a line of this length. Precise levels are then run over the hubs, determining the exact elevation of each, the vertical angles calculated and the inclined distances reduced to the horizontal. Under no condition should the line be measured by reading the vertical angles from the instrument, as there is too great a latitude for error. Each line should be thus carefully measured at least six times, and the average taken. When the base lines have been adjusted to the satisfaction of the engineer in charge of the work, the primary stations are set on the various ridges and points of vantage from which a large area of the property can be seen, bearing in mind that the figures be kept as well proportioned as the irregularity of the surface will permit. Two lines making an angle of, say, 50° approach too nearly a parallel condition, making their intersection a much more difficult point to accurately determine than if they crossed at a wider angle. The system is now ready for the first checking.

The instrument best suited for this kind of work is any standard 5 or 10″ theodolite with which angles can be

checked to 5″ by repeating the reading several times, allowing the total angle turned to accumulate on the plate and dividing by the number of times it was read. Having decided on the instrument to be used, solar observations are made with this from each base line to determine its true azimuth, which, when convenient, should be checked by observations on Polaris. From the set-up at each end of the base line, backsighting the other end, the angles are turned as described, always to the right, on each of the stations visible from both ends, and the angles recorded. The process is repeated at the other end of the line, the transit moved to the next station, and so on until the base line at the other end of the property is in sight, and the angles to both ends read from all the stations possible. This will constitute the first set of field notes; the computations are then made, using the azimuth and length of the base line AB and carrying the calculations to the base line CD, which, when computed, should agree with the azimuth and distance originally determined by direct observation and measurement. If the work does not check, a re-measure-

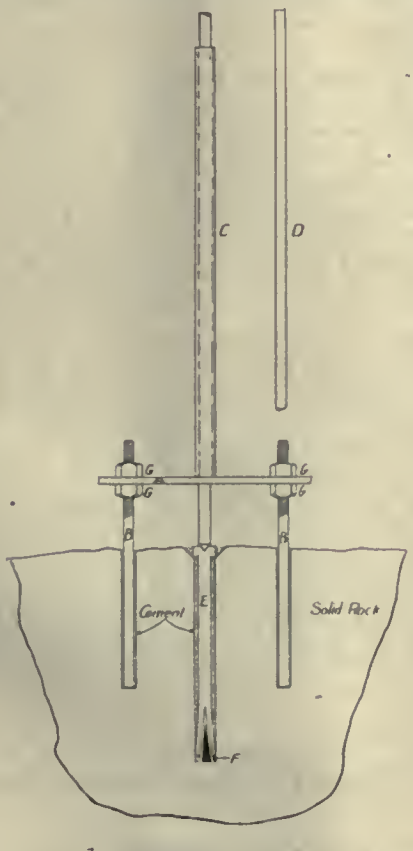


FIG. 1. TRIANGULATION STATION.

ment is necessary and new averages determined on both until the two agree to within a limit to be determined by the engineer, depending wholly on the accuracy of the instruments and the care with which the operations have been performed. Continual checking will be found necessary, lasting over a period of months, until the system is without errors. The stations of the secondary system are then located and set, as required. The fundamental operation is based on the trigonometric rule that in any triangle any two sides bear the same ratio as the sines of their opposite angles. We have the known base from which to start, and the angle from each end to the third point. By application of the above, the other two sides are determined. The operation is continued throughout the series.

In choosing a zero for the system of coördinates, it is always good practice to take a point well to the south and west of the property, so that the latitude and longitude differences for all points will be in the first quadrant—that is, will all be north and east of the zero and possess the same sign, plus. There is no necessity for establishing an actual station at the 00, as there is no occasion to use it. In case the mining companies of an entire district wish to use the same coördinates, which is very convenient and generally very much to be desired, the zero can just as well be in the next county. The reason for insisting on working in the first quadrant is the elimination of a possibility of error by carrying both plus and minus signs. It simplifies the calculations, as latitude and longitude differences are then added and subtracted directly, not algebraically. The lettering of coördinate lines is confusing and should be avoided. If a point is referred to by its coördinates, as for example, $\frac{106950.96}{108576.42}$ it has but one meaning, that is, 9650.96 ft. north and 8576.42 ft. east of the $\frac{100000}{100000}$ intersection. Before the system is used, all claim corners should be put in good condition, and given a

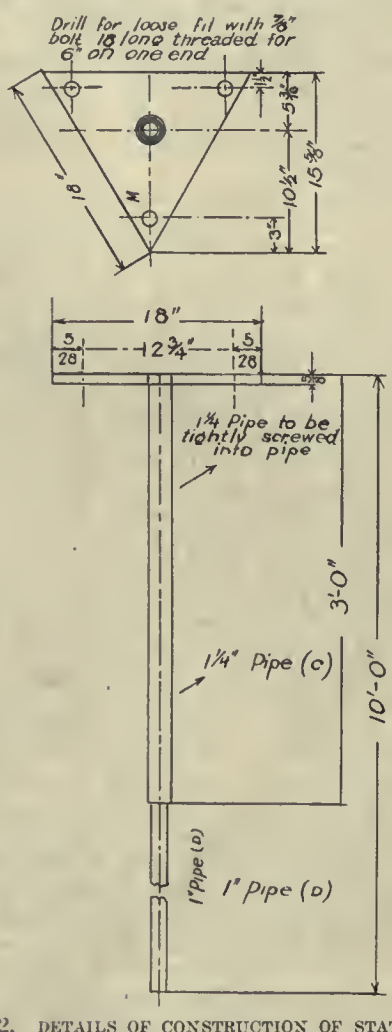


FIG. 2. DETAILS OF CONSTRUCTION OF STATION.

serial number from one up to as high a number as there are posts on the property. The next company can begin with the last number and continue, so that there is but one post with serial number 174, for example, in the district. Two theodolites are then set up on adjacent stations, and a rodman instructed to hold his rod on a post, at the same time showing the men at the instruments, by means of chalk and slate, the serial number of the corner. The point is read by each instrument, the angles repeated a few times to insure against a mistake in reading; the rodman then is signaled 'all right' and moves to the next corner. At no time should a post be read from stations making a triangle with an interior angle greater than 120° nor less than 30°. Our laws as to mineral patents are sadly in need of revision before the members of the mining profession can rely with any degree of certainty that there is absolutely no question as to the correct position of a corner and that there is available information on record that will positively re-determine the position of a post in the event of its removal. I hope these suggestions may be of some use to engineers meeting with similar difficulties, and if others have found the same hopeless conditions, that steps may be taken toward the setting and maintaining of a higher standard of accuracy.

Copper Production in Japan

By T. Haga

The copper production of Japan during 1910 amounted to 83,495,170 kin,* valued at 26,426,320 yen.† It is the principal mineral product of Japan, as its production is the largest, excepting coal which is 25% of the total mineral production. Compared with the previous year, the production shows an increase of 7,173,026 kin in quantity and 1,890,070 yen in value, or 7.7%. The reason for this increase is not the activity in the copper market, but the growth of the mines, as well as the opening of new ones. The Hidachi mine increased its production by 1,560,000 kin; the Ozarizawa, 950,000; the Furokura, 1,010,000; the Besshi, 590,000; the Kamaishi, 430,000; the Kunitomi, 400,000; the Ashio, 370,000 kin. On the contrary, the Kosaka mine showed a decrease of 360,000 kin; the Kano, 430,000; and the Ani, 340,000 kin.

Among the leading copper mines, those which produce over 2,000,000 kin each are the Ashio, owned by Furukawa Mining Co.; the Besshi, owned by Mr. Sumitomo; the Kosaka, owned by Mr. Fujita; the Hidachi, owned by Mr. Kuhara; the Ozarizawa and Furokura mines, owned by the Furukawa Mining Co.; and the Ikuno mine, owned by Mitsu Bishi Co.; they produced in 1910, 11,843,406, 11,132,371, 10,560,501, 8,059,013, 3,634,121, 2,302,595, and 2,259,154 kin respectively. Besides these, the ones which produce over 1,000,000 kin number 9, those which produce 500,000 to 1,000,000 kin are 11, and there are many small mines. The world's copper production for 1909 was 834,940 long tons, of which the output of the United States was 487,020 tons. The remainder, or 347,920 tons, was produced by Mexico and 21 other countries, of which Japan ranks fourth, with a production of 45,000 tons, or less than one-tenth of that of the United States. Nevertheless copper is the leading mineral export, 60,254,246 kin in quantity and 21,176,119 yen in value. The total of mineral exports for 1910 was 42,846,878 yen and imports 68,967,271 yen. The excess of imports over exports was 26,120,393 yen, due chiefly to the importation of steel and kerosene. It is a matter of regret that the exportation of copper and coal cannot counterbalance this. Though copper constitutes 50% of the mineral exports of Japan, yet last year the imports amounted to 538,443 yen in the form of bars, plates, wires, and tubes. But it is a favorable indication that, notwithstanding the demand for these articles yearly increases, there is a tendency for their importation to decrease.

In regard to the destinations of the exports, America, England, and Hongkong lead, and next come Germany, India, and France. Years ago, copper was exported principally to other parts of the Orient, but since 1906 this exportation has decreased, and at the same time the exports to Europe and America have increased. In 1910 the total exports to the Orient constituted 31% of the total, and on the other hand, the total to Europe and America reached 65%, as shown by the following table:

Country.	Quantity. Kin.	Value. Yen.
United States	14,981,023	5,877,576
England	12,740,102	4,444,571
Hongkong	12,447,042	3,791,476
Germany	5,241,109	1,749,703
India	4,580,865	1,614,399
France	4,260,241	1,609,781
China	1,054,978	379,720
Italy	971,194	318,568
Austria	634,119	209,175
Manchuria	186,266	67,405
Korea	97,058	35,842
Straits Settlement	87,610	27,511
Others	2,101,777	679,991
Total	59,383,384	20,805,718

*1 kin = 1⅓ lb.
†1 yen = 49.8c.

Since the Russo-Japanese war, the price of copper has risen, and in 1907 in London standard copper advanced to £107 0s. 8d. and electrolytic copper to over £116. During the reaction the market sagged until it reached £52. Since 1908 various copper mines have suspended or been abandoned until 2600 properties were removed from the producing list. Since then there has not been any notable rise in the market and the larger mines have decreased their cost of production. Both in England and America steps have been taken to regulate the production of copper, with the result that since October last the market has been begun to improve and the Japanese producers are becoming more hopeful.

In my opinion, the staple minerals, especially copper, in Japan are produced at a high cost when compared with Europe and America, not to speak of inferiority in resources, the utilization of machinery, and the application of science. For example, in Japan there are few mines which are great bonanzas like those of the United States. Though the Besshi, Kosaka, and Kune mines have comparatively large veins, yet they are not remarkable. It is true that Japan is now utilizing machinery and the applications of science, but these are still primitive. Only in labor cost is Japan better situated than the countries of Europe and America, but the constitution and character of the labor is inferior. The cost of prevention of damage from fume and mine-waters is high, and accordingly the total cost is greater than in the United States. It is said that in the United States costs range from 7 to 10c. per pound. This being the case, in spite of the business depression, America is not so greatly affected. In Japan apparently the only recourse is to decrease the cost of production.

In conclusion, attention must be drawn to the fact that Japan is encouraging the manufacturing of articles of copper. This is because the authorities are contriving to check the importation of copper wire, tubes, plates, and other articles. At present, the copper production in Europe and America is gradually increasing, and the copper output of Africa will be increased when the railway is completed. This is a question worth the attention of the producers of Japan. The Japanese, on the whole, are lacking in knowledge of mining. Public opinion is hostile to a speculative industry, such as mining. In consequence, the mining industry, in general, has been carried on by persons of no credit and capital. So, although there are many possible mines, they remain unexploited because of the lack of reliable investors.

The History of the Cyanide Process

By J. McCombie

Although the cyanide process was born in Glasgow, it was cradled, reared, and brought to an advanced stage of perfection at Karangahake, where it was in full operation for nearly a year before its adoption anywhere else. To the Crown Mines Co. belongs the credit for introducing this process, in a practical way, to the mining world, early in the year 1889, almost immediately after its development by J. S. McArthur and his colleagues, R. W. and W. Forrest. It was brought about in this way: Thomas Melville, an old Auckland resident, floated the Crown Mines Co. in Glasgow, and some of the ore which he took home for flotation purposes was treated by the embryo cyanide process with highly satisfactory results. Arrangements were then entered into with the McArthur-Forrest company to built a plant and treat Crown ore at the mine. Pursuant to certain conditions a staff of hands was sent direct to the mine from the experimental plant, Glasgow. The members were: John McConnell, manager; Frederick Smeaton, assayer; James Tegart, cyanider; William Dempster, engineer; and Peter McFarlane, carpenter.

I give the names of these men here because there is a strong disposition on the goldfields of the Auckland province to belittle the pioneers in every branch of the gold-mining industry, and to relegate such men to obscurity. Owing

chiefly to want of good accommodation for the transport of machinery, there was a long delay attendant upon the completion of the treatment plant at the Crown mine, and a small plant was erected in the Woodstock furnace-house, in consequence. This plant comprised one breaker, one Lamberton mill—dry-crushing—two vats, fitted with mechanical agitators, one stock solution vat, one sump vat, one filter-press, and four small barrel towers, for precipitation purposes.

Briefly, the process was fine grinding, agitation, filter-pressing, and precipitation on zinc shavings. The first parcel of ore dealt with was taken from the Maria vein in the Kenilworth mine, of which I was then part owner, and manager, and which is now included in the Talisman company's property. The plant was started early in the month of June 1889, and I have now before me a copy of the first treatment sheet:

VALUE OF ORE BEFORE TREATMENT.

Gold	£4 0s. 0d.	per ton.
Silver	£1 19s. 0d.	" "
Total value	£5 19s. 0d.	" "
Recovery, gold	89.2	per cent.
Recovery, silver	70.9	" "

The strength of solution used was 0.5%, and the consumption of cyanide was 4 lb. per ton of ore treated.

After a series of experiments with both wet and dry-crushing, dry-crushing in Lamberton mills was decided upon, and the ore was treated by upward percolation, with subsequent water washes, pulled through each charge by means of vacuum pumps. This simple process more than realized expectations in the case of the Crown ore, and it was generally adopted throughout the Dominion, where it remained in use in a good many mills for several years. As depth was attained in the mines the ore became more refractory, resulting in a high percentage of soluble sulphates being formed in the drying furnaces, or kilns, and the consumption of cyanide became a serious item in the cost treatment. Then mill after mill went in for wet-crushing, with dilute solution of cyanide in the mortar-boxes, and the first man to give the new departure a practical test, with 20 stamps, was H. H. Adams, at Waiorongamai. Except in the case of the Crown Mines the system was not continued, and the process gradually veered round to ordinary wet-crushing, amalgamation, concentration, and hydraulic classification, in the order named, followed by percolation for the sand, with agitation and decantation for the slime.

This brings the history of ore treatment by the cyanide process up to date, when decantation is being rapidly superseded by filter-pressing, and a good many New Zealand mills now hold a front rank position in the matter of ore treatment. It seems strange, however, after trying so many variations of the cyanide process, that all have found it necessary to return to the starting point, by adopting the system first introduced at Karangahake, in the year 1889, by the patentees. Today the tendency is in the direction of abolishing amalgamation and concentration, and in the mill of the future there will only be one system of treatment, which will be confined to the cyanide process throughout, regardless of the character of the ore, provided it is all ground to an impalpable paste and dealt with subsequently by agitation and filter-pressing.—*Auckland Herald.*

Hidden Creek Mines

The Granby Consolidated Mining & Power Co. secured an option on 75% of the stock of the Hidden Creek Copper Co. last year, at $400,000, paying $25,000 at the time the option was taken. At a meeting held in Boston, June 15, it was decided to carry out the terms of the option, and in accordance therewith an additional payment of $175,000 was made June 16. The final payment of $200,000 is to be made on December 15 of this year. M. K. Rodgers, of Seattle, and associates, who had developed the mine to a considerable extent, were the vendors. Since the date of the option the Granby company has performed a large amount of work on the property for the purpose of exploration and development, and some of its engineers have estimated 6,000,000 tons of ore developed that will average 2% copper, 30% iron, 35% sulphur, 28% silica, 9% lime, and 75c. to $1 per ton in gold and silver. The mine is situated in British Columbia, on Observatory inlet, about 100 miles north of Prince Rupert. The Granby company now has 80% of the Hidden Creek stock, 5% of it having been acquired by private purchase.

American Institute Meeting

The American Institute of Mining Engineers signalized its fortieth anniversary and its one hundredth meeting by convening at Glen Summit, in the heart of the anthracite region, where the little group of pioneers first met and formed the society. The three days technical session from June 6 to 9 was spent in visiting the plants of nearby mining and manufacturing companies during the day, while the evenings were devoted to discussion of papers and social gatherings. Some forty papers were presented and gave rise to interesting discussions.

Cuban iron ores were discussed in a number of papers that have already been printed and distributed. These included: 'The Iron Ore Deposits of the Moa District, Oriente Province, Island of Cubt,' by Jennings S. Cox, Jr.; 'Exploration of Cuban Iron Ore Deposits,' by Dwight E. Woodbridge; 'Characteristics and Origin of the Brown Iron Ores of Camaguey and Moa, Cuba,' by Willard L. Cumings and Benjamin L. Miller; 'Origin of the Iron Ores of Central and Northeastern Cuba,' by C. K. Leith and W. J. Mead; 'Occurrence, Origin, and Character of the Surficial Iron Ores of Camaguey and Oriente Provinces, Cuba,' by Arthur C. Spencer; 'The Mayari and Moa Iron Ore Deposits in Cuba,' by C. Willard Hayes. Collectively these papers form a symposium discussing many phases of the great iron ore deposits that have recently been upsetting all calculations of iron ore reserves. These papers exemplify the excellent work that the Institute is occasionally able to do in bringing together a number of articles on the same topic for discussion where a particularly well informed audience is available. Oil and gas were represented by the paper on 'The Caddo Oil and Gas Field, Louisiana,' by Walter E. Hooper, already published in the *Bulletin* of the Institute. This paper is a brief but particularly comprehensive account of the field near Shreveport which has attracted so much attention for the last two years. When arrangements now under way for piping gas through Arkansas and to St. Louis are completed, 125,000,000 cu. ft. per day will be utilized.

Anthracite coal mining naturally came in for considerable attention. The papers presented were: 'The Preparation of Anthracite,' by Paul Stirling; 'The Storage of Anthracite Coal,' by R. V. Norris; 'The Anthracite Board of Conciliation,' by Samuel D. Warriner; 'Chamber Pillars in Deep Anthracite Mines.' Anthracite mining is so special an industry that to metal miners these papers have only a general interest. Much useful data bearing on handling and storing material in general is embodied in the paper by Mr. Norris, and the problems of labor taken up by Mr. Warriner are of universal interest. The success of the Anthracite Board of Conciliation has been notable and the plan evolved in that district is worthy of careful study everywhere.

The iron industry and its development from 1871 to 1911 formed the topic of an interesting summary of forty years progress by John Birkinbine. The sintering of the fine iron ores in the Dwight & Lloyd machine was described by James Gayley, and J. J. Porter presented an admirable study of the quantitative relation between the various factors affecting fuel economy in the blast-furnace. The discussion of W. H. Emmons' paper on the effect of manganese on secondary enrichment was continued by several members; C. R. Keyes contributed a notable paper on the origin of certain bonanza silver ores, and R. E. Hore discussed the geology of the Cobalt district from recent studies.

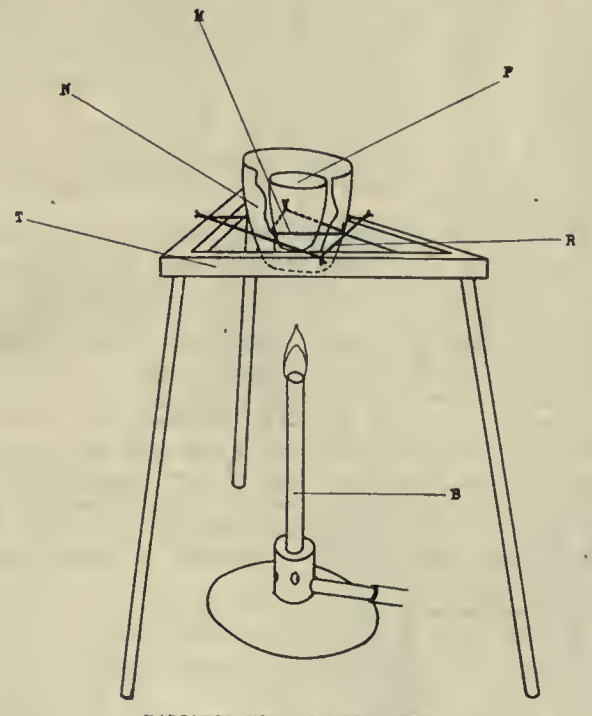
J. J. Brown described a method of smelting in the lead-

ore hearth which permits lowering of costs at the expense of slightly decreased initial extraction, and C. R. Keyes described methods employed in the assay of ores high in silver, while Edward Keller added to the discussion of the sampling of anode copper. The mining costs in certain of the mines at Park City were given in a valuable paper by F. T. Williams. Concentrating tables have of late years been the subject of much experiment, and S. A. Krom presented a description of a new diagonal-plane table which has many interesting features. The mining laws of the Dominion of Canada were the subject of a brief paper by J. M. Clark, to which the veteran Secretary added a discussion, together with a request for suggestions to Mr. Clark, who had been appointed by the Dominion Government to draft new mining laws. A detail of practical work was given by A. T. Schwennesen, who described the construction of a drafting table to be used in tracing through opaque paper. The meeting was greatly enjoyed by the members present, who highly commended the efforts made by the local committee for the entertainment of their guests.

A Radiator for Platinum Crucibles

By W. M. Thornton, Jr.

The accompanying drawing illustrates a very simple radiator for the evaporation of solutions to dryness in platinum crucibles. P is the platinum crucible, held in position by the Hoskins chemists' triangle M (a special nickel alloy). The ends of the Hoskins triangle are cut off at a point about midway their length and bent upward. The Hoskins triangle is supported by the walls of the nickel crucible N at a height that will hold the platinum crucible with its bottom and sides about equidistant from the bottom and sides of the nickel crucible. The outer crucible is supported by a triangle of nickel wire, R, which in turn rests upon a tripod, T, of iron (coated with aluminum paint). By placing a small flame under the outer crucible the inner crucible is uniformly heated by hot air, and its contents can be rapidly brought to dryness without danger of spattering. After the cessation of fumes the lid can be placed



RADIATOR FOR EVAPORATIONS.

on the nickel crucible and the platinum crucible baked at an even and moderately high temperature if desired. The apparatus in use by the author is constructed of a 'rein nickel' crucible of 100 c.c. capacity and a 1½-in. Hoskins triangle. These dimensions serve very well for platinum crucibles of 20 or 25 c.c. capacity. The following advantages are claimed for the apparatus:

1. It can be readily constructed of materials obtainable by any chemist at small cost.

2. Nickel serves as an excellent material for a radiator because of its high conducting and radiating power. It is also very resistant to burning and rusting; and, hence, is very durable. The Hoskins triangle is made of a very refractory alloy in which platinum vessels can be held and heated with impunity.

3. Since the shape of the 'rein nickel' crucible is approximately the same as that of the ordinary platinum crucible, all parts of the latter can be supported equidistant from the corresponding parts of the former, thus securing uniform heating.

The author has found the above form of radiator especially useful in the analysis of some highly titaniferous rocks from Nelson county, Virginia, in the laboratory of the Virginia Geological Survey. In separating the silica at 100° C. the titanium always hydrolyzes in large measure and precipitates on the separated silica. When the silica is subsequently determined by loss on evaporation with hydrofluoric and sulphuric acids, there is a considerable amount of solid titanium sulphate remaining. In conducting these evaporations on the hot plate, superheated steam and other vapors accumulated below a solid crust and much trouble was experienced on account of spattering. When the radiator was used, however, and with proper adjustment of the flame, spattering became a very rare occurrence.—*Journal of Industrial and Engineering Chemistry.*

Tin

Straits shipments for the first half of June were telegraphed on June 16 as 2300 tons, and for the whole month are estimated at 4700 tons. L. Vogelstein & Co. report that the tin available for June delivery—New York—promises to be about 3500 tons. As offerings of spot and June are limited, indicating small stocks, June deliveries will probably be in the neighborhood of 3000 tons—2000 tons less for the month and for the six months than last year. Assuming such to be the case, and allowing for the usual European deliveries and Straits shipments as above, the visible should about break even on June 30, that is, the same stocks will exist at the end of June as at the beginning, namely, 16,000 tons. This is the same quantity as was on hand June 30, 1910. In other words, it has come to this, that after a year of excited speculation based on predicted shortage, the market is exactly where it started, except in the matter of price.

An analysis of the situation shows small supplies in America as given, and probably also at other points, stocks having been attracted to London by the corner, and resting, presumably, in the hands of the syndicate. With the disappearance of the premium on spot, the market may be regarded as again in a normal condition except for this concentration of stocks, which, after all, is not an element of weakness in view of the good demand likely to follow. While prices are not low, tin is really in a stronger position than statistics indicate, owing to the exhaustion of invisible supplies. It is estimated that there are really 5000 tons less tin in the world now than a year ago. Buying to replenish stocks will doubtless exhibit itself with any further decline.

While the syndicate is generally supposed to have made money, its profits are as yet tied up in unsold stocks. How to harvest these profits is now the problem, a successful solution of which necessitates marketing holdings at a high price. Reference was previously made to the disastrous results following two preceding corners, but in regard to them it should be borne in mind that in one case the Secretan Syndicate failed, and in the other the panic in this country, the absolute suspension of business here, and our withdrawals of gold from all the world's markets, made a continuance of high prices impossible. Neither contingency threatens the present movement, and in view of the small supplies and good demand, much lower prices can hardly be looked for.

Concentrates

Most of these are in reply to questions received by mail. Our readers are invited to ask questions and give information dealing with the practice of mining, milling, and smelting.

IN coating steel or other furnaces, to render them fireproof, first brush over the brickwork to be covered with a solution made by boiling 1 pound each of silicate of soda and alum in 4 gallons of water, and follow immediately with this composition: Silica, 50 parts; plastic fire-clay, 10 parts; ball clay, 3 parts. Mix well.

ROPE may be rendered fire-proof by the following solution: Ammonium chloride (sal ammoniac), 15 parts, by weight; boracic acid, 6 parts; borax, 3; water, 100. The articles are to be left in the solution, heated to 212°F. for about three hours, then wrung out and dried. The mixture costs about 5 cents per quart.

VANADIUMISM is a disease which sometimes attacks workmen in plants where vanadium is used, especially in the trioxide form. The disease is marked by anemia, a dry irritating cough, and inflammation of the eyes and throat; it often results in tuberculosis. It is best prevented by protecting the workmen from dust by proper ventilation.

THE HOLDER of a bona fide mineral claim location within a forest reserve holds also the surface rights to his claim, and these are not subject to rental to others by the Forest Service. If he wishes to exclude stock from his claim he has the right to fence it in. Stockmen have no right to build fences across mineral claims, and the claim owner can not be excluded from access to his claim.

CORKS may be made impervious, and at the same time kept elastic, by saturating them with caoutchouc solution. Dissolve caoutchouc in benzine in the ratio of 1 part of the former to 19 parts of the latter. Into this liquid lay the corks to be impregnated and subject them to pressure of 150 to 180 pounds by means of a force pump, so that the liquid enters thoroughly. The corks thus treated must next be exposed to a strong draught of air until all trace of benzine has entirely evaporated and no more smell is noticeable.

ALUMINUM and other metals may be rendered unalterable and indestructible by water or atmospheric influences, by applying the following coating: Dissolve, preferably in an enameled vessel, 10 parts, by weight, of gum lac in 30 parts of liquid ammonia. Heat on the water bath for about one hour and cool. The metal to be covered with this varnish is carefully cleaned in potash, and, having applied the varnish, the article is placed in an oven, where it is heated, during a certain time, at a suitable temperature (about 1062°F.).

A VERY USEFUL and readily made support for doing hard soldering is composed of charcoal, asbestos, and plaster of paris. These are powdered in equal parts, made into a thick paste with water, and poured into a suitable mold. When this mass has dried it is removed from mold and a very thin cork plate is affixed on one surface by means of thin glue. The mission of this plate is to receive the points of the wire clamps with which the articles to be soldered are attached to the soldering block, the asbestos not affording sufficient hold for them.

A CEMENT which is effective for cementing rubber to iron and which is especially valuable for fastening rubber bands to band-saw wheels is made as follows: Powdered shellac, 1 part; strong ammonia, 10 parts. Put the shellac in the ammonia and set it away in a tightly closed jar for three or four weeks. By that time the mixture will become a perfectly liquid transparent mass, and is ready for use. When applied to rubber the ammonia softens it, but it quickly evaporates, leaving the rubber in the same condition as before. The shellac clings to the iron and thus forms a firm bond between the iron and the rubber.

IRON PIPES may be cheaply protected from rust by the use of enamel composed as follows: 130 parts powdered crystal glass, 20½ parts soda, 12 parts boracic acid. These substances, mixed in the most careful manner, are melted together in crucibles, the mass is chilled and transformed into a fine powder by crushing and grinding. The iron pipes are first cleaned in the usual manner by corroding, dried, and then coated with a very dilute gum arabic solution or any other gluing agent, and the powdered mass is spread over them by means of a sieve. The objects thus powdered are put in a room which is heated to 160°C. (to drive out all moisture) and are heated to dark redness, at which temperature the oxide coating melts.

GRINDSTONES are occasionally harder on one side than the other, causing the softer parts to wear away in hollows. This renders grinding difficult and soon makes the stone useless. The defect can be remedied completely by means of boiled linseed oil. When the stone is thoroughly dry, the soft side is turned uppermost, and brushed over with boiled oil, which sinks into the stone, until the latter is saturated. The operation takes about three to four hours in summer. As soon as the oil has dried, the stone may be damped, and used without any further delay. Unlike other similar remedies, this one does not prevent the stone from biting properly in the oiled parts, and the life of the stone is considerably lengthened, since it does not have to be dressed so often.

SULPHURIC ACID can be made from the SO_2 in the gases which escape from roasting and copper smelting plants, and this is now done in some cases. The two principal reasons that prevent its general adoption are, that, except in very large plants, the manufacture of a by-product, such as sulphuric acid, interferes with the regular work of the plant and is often a source of more annoyance than profit; and the escaping gases contain the SO_2 in too dilute a form to be readily utilized in the making of acid. If any considerable number of smelters engaged in the manufacture of acid the increase of the present production would be enormous, and it has been suggested to utilize it in the conversion of phosphates into fertilizers. By treating with the sulphuric acid the insoluble natural phosphate may be converted into a soluble or superphosphate which is a valuable source of phosphoric acid in agriculture.

ALUNITE is a hydrous sulphate of potash and aluminum. Attention of mining men was first attracted to it because of its accompanying the rich ore at Goldfield, Nevada. Taking this as a clue, R. T. Hill located claims near Las Vegas, and has carried on an active exploration for gold. It is understood that low-grade ore has been found, thus partly substantiating his theory, but as yet no rich ore has been uncovered. Lately the possible value of alunite as a source of potash has been discussed, and it has even been proposed to leach the Goldfield dumps. It is not impossible that this may prove to be important. Alunite contains 11.4% potash, and veins 6 to 10 ft. thick are reported from Sevier county, Utah. The mineral is hexagonal, occurring in rhombohedrons, and also massive with a fibrous to granular structure. It has a conchoidal to splintery fracture, vitreous lustre, and a hardness of 3.5 to 4, with a specific gravity of 2.58 to 2.72. It is white, grayish, or reddish, and has a white streak. It is infusible, but decrepitates before the blowpipe. Prospectors would do well to look out for the mineral. As the United States Geological Survey has a special appropriation for investigating potash minerals determinations can doubtless be obtained by sending specimens to the Director at Washington. Locate your claim first, however, so as to avoid conflict in case of withdrawal of the land. The material occurs in trachyte and allied rocks and is believed to represent alteration of rocks by sulphurous vapors. Make a lode location.

Discussion

Readers of the MINING AND SCIENTIFIC PRESS are invited to use this department for the discussion of technical and other matters pertaining to mining and metallurgy. The Editor welcomes the expression of views contrary to his own, believing that careful criticism is more valuable than casual compliment. Insertion of any contribution is determined by its probable interest to the readers of this journal.

Direct Solar Observation

The Editor:

Sir—The article on surveying by E. R. Rice, in your issue of April 22, as well as some previous articles on the same subject, is of much interest. Mr. Rice's treatment of the three-point problem reminds me that the United States Geological Survey has a blank for working out the problem that makes it very simple and rapid. I have borrowed the idea from the Survey of the direct observation of the sun. The accompanying form is one that I have been using for the past few months. With it I can work out a sun course in about half the time formerly required. These blanks also greatly help those who are not familiar with the problem. Of course the values for latitude given are only useful in this district and each surveyor will have to make out a set for himself, or look them up.

JAMES UNDERHILL.

Idaho Springs, June 12.

Latitude 39°		
	Secant	Tangent
36	0.113220	9.917640
37	0.113324	9.917906
38	0.113429	9.918162
39	0.113534	9.918420
40	0.113638	9.918677
41	0.113743	9.918934
42	0.113848	9.919191
43	0.113953	9.919448
44	0.114058	9.919705
45	0.114163	9.919962
46	0.114268	9.920219
47	0.114373	9.920476
48	0.114478	9.920733
49	0.114584	9.920990
50	0.114689	9.921247
51	0.114795	9.921503
52	0.114900	9.921760
53	0.115006	9.922017
54	0.115111	9.922274
55	0.115217	9.922530

PLACE

DATE TIME

LATITUDE

$$\text{Cos. Z} = \frac{\pm \text{Sin. Dec.}}{\text{Cos. Lat. Cos. Alt.}} \mp \text{Tan. Lat. Tan. Alt.}$$

I = − No. Lats. II = + Mar.~Sep. − Sep.~Mar.

Dec. G. A. N. = ° ′ ″

Dif. hours = ° ′ ″

Dec. = ° ′ ″

Altitude	Refraction
10°	5′ 19″
11°	4′ 51″
12°	4′ 27″
13°	4′ 07″
14°	3′ 49″
15°	3′ 34″
16°	3′ 20″
17°	3′ 08″
18°	2′ 57″
19°	2′ 48″
20°	2′ 39″
25°	2′ 04″
30°	1′ 41″
35°	1′ 23″
40°	1′ 09″
45°	58″
50°	49″
60°	34″
70°	21″
80°	10″

Observed Altitude =

Refraction = sub = =

Altitude = =

Sin. Dec. = =

Sec. Lat. = add = =

Cos. Alt. = sub = =

Log. I = =

Tan. Lat. = =

Tan. Alt. = add = =

Log. II = =

I = −

II = add = −

Cos.

FORM FOR SOLAR OBSERVATIONS.

Unavoidable Errors in Sampling

The Editor:

Sir—Referring to a letter from J. D. Whitney, which appeared in the *Mining and Scientific Press* of April 29, I believe that my article of this issue may be of value to him. I have indirectly shown that no two mines are alike, the most that may be said is that they may be similar, and no valuating engineer, if he knows his business, should attempt to group all mines in a general rule-of-thumb method in an examination.

However, I am looking at Mr. Whitney's trouble from a different viewpoint than is suggested in a previous paper by C. S. Herzig. It was there stated that, in many cases, a valuation computed in an office from submitted assay maps will give accurate and reliable results. In this respect I disagree, personal investigation and a method of sampling, depending on each individual case, is, in my opinion the crux and asset of a mine report, and I would congratulate myself if in an office examination I came within 25%, either way, of the results obtained from personally conducted sampling based upon a carefully considered program arranged to meet the individual case.

Not knowing the conditions, it is difficult to say under what class in the discussion in my paper Mr. Whitney's property would fall, but I refer him to class five, which may meet the case.

MORTON WEBBER.

New York, May 23.

Investment in Prospects

The Editor:

Sir—Some friends have requested me to join with them in developing an orebody said to be 500 ft. wide, a mile long, and averaging $5.50 per ton in gold. Would it be wise to do this; and how should such a property be developed?

INVESTOR.

Chicago, June 14.

[Before expending funds for development our correspondent should take steps to ascertain what portion, if any, of his supposed orebody actually exists. When he has definite information as to the deposit any experienced engineer can advise him how to proceed. To save the cost of skilled advice is generally to be "penny wise and pound foolish."—EDITOR.]

Special Correspondence

BLACK HILLS, SOUTH DAKOTA

PROFITABLE YEAR FOR THE HOMESTAKE.—IMPERIAL AND TROJAN MILLS.—CASTLE CREEK DREDGE.—TEST ON ZINC ORE.—GOOD WORK AT WASP NO. 2.—FIRE PATROL CARS.—MICA PRODUCTION.

On June 1 the Homestake entered upon a new fiscal year, after closing one of the most productive years in its existence. During the past fiscal year the mine produced a little less than six million dollars in gold. Dividends to the amount of $1,330,400 were paid. The annual report of the company is distributed about the middle of August, and at that time all details will be available. The company suffered twice from fire within the past few days, the first outbreak destroying nearly $50,000 worth of hewed timbers near Rochford. This was nearly all 11-in. flat timber, ready for shipment to the mine. Indications are that the fire was of incendiary origin. Fire threatened to destroy the Old Abe hoist, but the Lead fire department saved the plant from what seemed sure destruction. A complete equipment for wireless telegraphy is being installed for the purpose of affording an independent line of communication between the main office at Lead and the hydro-electric power plant on the Spearfish, fifteen miles distant. This is the first installation of its kind made in the Black Hills.

The Imperial company is planning to start its wet-crushing cyanide plant in the First ward of Deadwood. The company's ore is now being shipped to the Lundberg, Dorr & Wilson cyanide plant at Terry. The work of driving from the bottom of the deep exploration shaft near the west side of the Imperial ground is about to be resumed. Operations were suspended a short time ago, following a fire which damaged station timbering and put the electric motor for the ventilating service out of commission. The fire was started by the motor burning out. The Trojan Mining Co. mill is about ready to start the first section of 150 tons daily capacity, and every effort is being made to have it in operation early in July. Drifts are being run to connect the mill with the mine workings, and gasoline locomotives will be used for hauling. All ore will be transported under cover—either underground or under snow-sheds. Among other improvements being made to the mill, Dorr classifiers and pulp thickeners are being installed.

The dredge of the Castle Creek Hydraulic Gold Mining Co. at Mystic, on Castle creek, was started in June. It is being operated by the Stearns-Roger Mfg. Co., of Denver, the builders, who contracted to erect and successfully operate the boat for thirty days. The hull is 102 ft. long and 30 ft. wide. The housing gives an additional width of 4 ft. The dredge will dig 35 ft. below water-line, the average extreme depth to bedrock being 34.6 ft. The bucket-line consists of 78 manganese steel-lipped buckets, each with a capacity of 5 cu. ft. As the bucket-line is geared to make a complete circuit in three minutes, 26 buckets will be discharged per minute. At a point convenient to the C. B. & Q. railway tracks, less than 200 yd. from the present location of the dredge, is the power-house, enclosing four 100-hp. boilers. Three of these will furnish ample steam to generate 250 kw. required for the operation of the boat, and the fourth will be held in reserve. A 300-hp. 28 by 48 Corliss engine drives the generator.

The Deadwood Lead & Zinc Co. has just completed the concentration of 15 tons of ore from the Dunn property, on Spruce gulch. The ore was taken to the Safe Investment mill, near Nemo. The product shows a good separation of the lead-iron middling from the galena, and the problem now is to secure a good separation of the zinc from the iron. Samples of the middling will be sent to plants equipped with Huff electrostatic machines, where a thorough test will be made. O. N. Brown, manager of the Deadwood company, is confident that a good separation of the zinc and iron can be made in the Huff machines, and, if so, Spruce gulch will be one of the biggest zinc mining camps in the United States, as the orebody is of enormous proportions, and hundreds of samples show it contains a fair percentage of zinc and lead, with a little gold and silver. The company has been financed by local capital entirely, and some of the shrewdest mining men in the Black Hills are heavily interested.

The Wasp No. 2 is again paying dividends. The new mill was started the first of last December, the former plant having been destroyed by fire several months previously. Since starting, the capacity of the plant has been gradually worked up to 490 tons per day, and will probably remain close to that figure. The production for May was $30,000, one-half of which was profit; mining, milling, and general expenses amounting to $1 per ton. The ore is mined in an open-cut, where it is shoveled into 4-ton skips that dump into bins at the top of the mill. The mill consists of a No. 5 Gates crusher, followed by two No. 1 crushers of similar pattern, and four 14 by 36 rolls. The ore is dry-crushed to 6 mesh, and given four to five days leaching in cyanide solution. The tailing is shoveled out through the bottom of the tanks and trammed to the dump. The low operating cost at this mine is record-breaking. The average bullion recovery lately has been around $2 per ton, this showing a saving of 75% of the assay value of the mill feed.

The district below Galena, and immediately adjacent to it, is a busy one, with building operations in progress in connection with the erection of plants and dwelling houses to be used in the working of the Osterman-Danckwardt smelter. All of the concrete retaining and foundation walls for both the smelter plant and the Gilt Edge-Maid concentration mill have been completed, and a large force of carpenters is now engaged in framing the timbers for the superstructure of these plants. In all there are about 60 men employed. The five dwelling houses being erected for H. C. Osterman, Paul Danckwardt, and employees of the company at a point a short distance up the creek from the smelter site are well along. There has been some delay in the work, owing to difficulty in getting prompt delivery of material, but on the whole the work is progressing satisfactorily and apparently there will be no trouble in getting the smelter going by the end of July. The work at the Gilt Edge mine, where N. Treweek, the superintendent, is opening a 96-ft. vertical vein of pyritic ore in the old King adit, is moving along smoothly, and undoubtedly the stopes will be opened and the mine in shape to produce a large tonnage by the time the smelter and concentrator are completed.

Lawrence county is doing commendable work in road building this year, the expenditure of the road fund at the present time being arranged to make more permanent roads and lessening grades. One of the most important pieces of work is the constructing of a new road up Dead Dog hill, between Deadwood and Portland. This will have a maximum grade of 8% when completed, thus cutting out one of the worst and most frequently used hills in the county.

The Black Hills section has been exceptionally dry this spring, the precipitation in June up to the 15th being 0.82 in. May was also unusually dry, and the result has been a number of forest fires. The C. B. & Q. railway runs for a hundred miles through the Hills, and its engines have started a large number of fires. This railway has now put on a number of fire patrol cars; a small car with gasoline motive power, which follows a short distance behind each train, and prevents many disastrous fires. The distance from a good oilfield, is, it is stated, all that deters the railroad from immediately equipping all its engines for using oil for fuel.

Mine No. 1, of the Westinghouse company, at Custer, is now being operated to full capacity, producing 4000 lb. of mica per week. The Westinghouse company is now securing practically all of its mica from its properties in the neighborhood of Custer, as this mica has been found to be of an excellent grade for electrical work. The Cuyahoga company is erecting a shaft-house and will sink

a shaft 100 ft. this summer. Lumber is being manufactured at the company's mill, on the property. F. A. Gira, of Custer, is superintendent.

TORONTO, CANADA

Diamonds in British Columbia.—Geological Investigations.—Closing of Iron Mines.—Railroad at Porcupine.—New York Attitude on Porcupine.—New Handbook.

The recent discovery of diamonds in British Columbia has been followed by another find of similar character in a locality distant about forty miles from Sherbrooke, Quebec. As in the former case the diamonds were found to occur with chromite, and to make the discovery commercially valuable some economical process for their extraction must be discovered. The Canadian Geological Survey has been for some time experimenting with this object in view. The perfecting of such a process would not only result in the establishment of a Canadian industry, but would give encouragement to chromite mining. R. A. A. Johnston, mineralogist of the Survey, will shortly leave for Germany to make further researches, taking with him a number of samples of the Canadian diamonds. The most important feature of the season's work of the Survey will be the commencement of the geological mapping of a second cross-section of the Rocky Mountains, following the route of the Canadian Pacific railway, which will be entrusted to a party of eight geologists in charge of R. A. Daly. It will probably require ten years to complete the undertaking. The services of another prominent American geologist, A. C. Lawson, have also been secured for the season for investigations in the Lake Superior region.

The Moose Mountain iron mines at Sellwood, 25 miles north of Sudbury, have been closed down for an indefinite period on account of the over-production of iron ore, throwing 250 men out of work. The company will proceed immediately with the erection of its new concentrating plant, to cost $300,000. The Canadian Government has issued an order in council abolishing the royalty on gold extracted from quartz in the Yukon Territory. This step was taken in order to encourage an industry, which so far has made such little progress that no royalty has yet been collected.

The laying of steel on the Porcupine branch of the Temiskaming & Northern Ontario railway has been completed, and the road will be in running order by July 1 as promised. It will be extended beyond Porcupine to the Pearl Lake district to serve the Hollinger and other mines, the Timmins-McMartin syndicate having agreed to finance the undertaking by loaning the railway commission about $150,000. Hydro-electric power from the Porcupine Power Co.'s plant on the Mattagami has reached the Hollinger, and the company will shortly be in a position to supply other mines. At the Hollinger over 200 ft. of driving has been done on the 200-ft. level; the vein is from 4 to 20 ft. in width. The assays are reported as being variable, but showing in some places high-grade ore of equal richness to that found on the upper level. The Rea is working on the 200-ft. level and the vein has been encountered in a cross-cut 14 ft. from the shaft, where it is considerably richer than on the surface. The main shaft of the Dome Extension is down to 75 ft. When the 100-ft. level is reached, a cross-cut will be run to intersect the vein 30 ft. distant. This is 36 ft. wide on the surface, with four lateral veins from one to three feet wide, running parallel, and all carrying good milling ore. At the Tisdale a new 9-ft. vein with good gold content has been found. The Vipond has cut, on the 1000-ft. level, the long high-grade ore-shoot that has been stripped for several hundred feet on the surface. It is claimed that it carries $40 per ton for a width of 3 ft. and $12 per ton for two feet on each side of the quartz. The shareholders of the Swastika have ratified a by-law increasing the capital from $1,000,000 to $2,000,000. M. W. Summerhayes has been appointed manager. C. W. Geddes succeeds Mowry Bates as manager of the Foley-O'Brien. W. L. Malcolmson, of London, recently visited the Porcupine camp in the interest of British investors. He was accompanied by H. B. Pearson.

Porcupine is carrying a good deal of dead weight in the New York mining share markets. Hostility to any market developments is plainly apparent. The press and the Stock Exchange maintain a distinctly antagonistic attitude. Nevertheless, most of the market activity is in the various Porcupine issues. The camp is evidently winning the endorsement of the best engineers who visit it, and enthusiastic friends of the new goldfield claim that all attempts to smother it will in the end make so many more friends for Porcupine. While several properties now stand as proved mines of size and merit, it is plain to see that owners are, for the most part, endeavoring to discount and capitalize the future and sell on that basis. There is a well conducted press agent's campaign in full swing on the Hollinger, evidently for market purposes. The Rea has been attracting much attention and is now looked upon as ranking with the Dome and the Hollinger. It has been stated that recently the Consolidated Gold Fields of South Africa saw fit to relinquish its holdings in this company. It develops that such is not the fact, and while the Consolidated Gold Fields holdings in the company are not held directly, it may be stated as a fact, that the Consolidated Gold Fields has never sold any of its stock.

Porcupine promoters and prospectors are waiting now for two things: the completion of the railroad, which is now into Golden City with construction trains, and the cessation of the black fly, which for the next three or four weeks makes life a burden for even the seasoned traveler through the bush and the muskeg. H. P. Davis has compiled a handbook of Porcupine, containing statistics and information, an accurate map, an outline of the geology, and a description of the important properties developed up to date.

JOHANNESBURG, TRANSVAAL

Tentative Geology on the Rand.—Unwise Exploration.—Details of March Production.—Decrease in Recovery and Increase in Working Cost.—Power Production by Mines.—Details of Cost.

For some time past the opinion has been expressed here that something should be done to obtain some reliable records of the training and fitness of engineers to report upon mines and properties, either by Government licence or otherwise. Here, as in other parts of the world, a far too liberal use of the letters M.E. and C.E., as mentioned in *The Mining Magazine*, is being made, and probably leads to misunderstandings; as it is not generally known that they only signify 'mining engineer' or 'civil engineer' as the case may be, and do not carry with them any certificate of training or ability to give competent advice in either branch of engineering. Even the local technical paper does not seem to use much discrimination in the selection of its sources of information, for in commenting upon some remarks sent previously, the local mining paper represents a map recently published in that journal with accompanying sections showing reefs in an impossible position, as a 'tentative geological map.' When a map shows the Government Reef overlying the generally accepted equivalent of the Main Reef Series, instead of underlying, as accepted by the Government Geological Survey, the word 'tentative' scarcely seems fit; especially as the author of the map also puts forward the heterodox view that the banket reefs of the Rand are of igneous origin. There has been a good deal of 'tentative geology' on the Rand of late; more especially during the last twelve months, and, strange as it may seem, nearly all the leading mining houses have been victimized by these tentative geological ideas into the spending of various sums in boring, and other exploration. These attempts to discover New Rands, and duplicates of the Main Reef Series, by the aid of local capital having resulted in complete failure, recourse is being had to London, and elsewhere, to obtain more capital for the purpose of continuing the search, and though the local attempts have failed, there seems every prospect of this additional outside capital

being obtained. One perhaps cannot blame the leading mining houses for spending money in prospecting where the stakes are so high, even though only 'tentative' geological views are advanced to support the theory. But when the views are proved by actual work to be wrong, it seems scarcely fair to ask people thousands of miles away to find further capital to expend on what is generally regarded here as a lost cause.

The Reef has not by any means obtained its highest output of gold, however heavy, and in some respects unwieldy, the large output has become. In April the average daily production was valued at £90,395, as compared with £88,962 in March, when the highest output of any previous month was obtained, so that it seems clear that only the shortness of the month prevented April showing another record output. There never was a time, perhaps, when the Rand had as much 'up its sleeve' in reserve as at present, both in developed ore and milling and reduction plants, awaiting labor and power to add their quota to the Rand gold output. Of the four hundred idle stamps at the Randfontein another hundred are soon to be dropped; and the City Deep is threatening to at least treble its output as soon as the necessary power can be obtained from the Victoria Falls Power Co. The Brakpan company, too, is on the point of entering the list of producers, while the Roodepoort United and the Bantjes can easily add to their output; not to mention the Meyer & Charleton mine, which will soon re-enter the list of producing mines with an enlarged shaft and rejuvenated reduction plant. The total gold output of the Transvaal for the month of April, as declared by the Chamber of Mines, was 667,714 oz. of fine gold, valued at £2,836,267; the total decrease as compared with March being 8351 oz., of a value of £35,473. The outside districts, it should be noticed, actually showed an increase over March of 2475 oz., valued at £10,511, so that the actual decrease on the Rand was 10,826 oz. The most noticeable features were the return of the East Rand Proprietary Mines to the top of the list; the falling of the Crown Mines from first to third position; and the improvement shown by the Nigel mine in the Heidelburg district. It has already been stated that an additional hundred stamps will soon be dropped at Randfontein, an event which, when they get into full swing, ought to place the Randfontein mine in the position of premier gold producer of the world, with two hundred stamps still in reserve. The April output was derived from these sources: Mills, £1,750,044; lands, £1,033,949; and miscellaneous sources, £52,274; total, £2,836,267. In April 1909, the total value of the output was £2,496,078, so that the increase cannot be said to have been at all startling or in keeping with the rapid and continued increases earlier made in these fields. But when we come to compare the profits made some time ago, we find the least encouragement; for in April 1909, with the output mentioned above, there was a daily average gold production of £83,200, and a daily average profit of £30,200; while two years later the average gold production has increased to £89,000, but the daily average profit has only increased to £30,600. The explanation for this will be found in the fact that two years ago the average yield per ton of ore crushed in the Rand was 29s. per ton, and the average working cost was 17s. 2d. per ton; but for March, the last month for which the figures are available, the total recovery per ton of rock milled was 27s. 7d., and the working costs 17s. 11d., so that the recovery per ton was 1s. 5d. less, while the cost of working was 9d. per ton more; a total difference of 2s. 2d. per ton, or half a pennyweight on the wrong side.

Notwithstanding the fact that the Rand goldfield is preeminently well placed, the mines being supplied by electric power from the Victoria Falls Power Co., several of the largest amalgamations, such as the East Rand Proprietary Mines and the Randfontein, have decided to generate their own power, and, where put into effect, the results have proved satisfactory. Take, for instance, the experience of the Randfontein Central property, consisting of five mines, over a length of four miles. These five mines produce about 184,000 tons per month, the maximum load expected for all purposes is estimated at 14,000 hp., while 19,000 hp. has been provided. The steam-plant consists of 24 Babcock & Wilcox land type of boiler, with a working pressure of 160 lb., fitted with mechanical stokers using dust coal, giving 11,500 B. t. u., costing 10s. 6d. per ton delivered into bunkers. The generating plant consists of two 1000-kw. sets, three 2000-kw. sets, and two 6000-kw. sets, all of them Parsons multiple reaction type. The capital cost of the whole installation was £312,000, or at the rate of £16 per kilowatt of plant installed. In March, 5,085,420 units were generated at a cost of 0.247d. per unit, the details of cost being as follows: Coal, 0.153d. per unit; repairs and maintenance, 0.046; salaries and wages, 0.038; oil, waste, and stores, 0.003; and office and general, 10,007; total cost of production being thus 0.247d. per unit.

LONDON

COAL MINES IN KENT.—NUMEROUS SEAMS DISCOVERED.—EFFECTS ON RAILWAYS.—HULTON EXPLOSION.—AN OVER-WORKED MANAGER.—SELLING CORNISH TIN BY METALLIC CONTENT.

Development of the coal deposits in Kent continues to be slow and, with the exception of that at Shakespeare Cliff, the pits have not yet reached the seams. The great hindrance to operations has been the large amount of water in the overlying chalk and greensand, and it has been necessary to provide an effective pumping plant to cope with it. The history of the exploitation of these deposits forms a chapter of romance in connection with English

CROWN MINES. SOUTH RAND SHAFT.

mining. It is seventy years since coal was found across the Channel, in France, and in 1852 the now celebrated collieries at Courrieres, and Lens started operations. Shortly afterward Godwin Austen, a land-owner in Sussex, undertook exploratory work in southeastern England to prove his theory that the same geological formation as in France would be found there. Murchison opposed the theory, but Prestwich was converted to it. Unfortunately none of the borings made by Godwin Austen or by Henry Willett ever struck any coal. The theory was revived in 1886 by Boyd Dawkins, of Manchester, who persuaded Sir Edward Watkin, then chairman of the South Eastern Railway, to continue sinking the shaft of the abandoned Channel Tunnel works at Shakespeare Cliff, Dover. In 1890 the boring cut the first coal seam at 1125 ft. Then followed a long period of financial and managerial entanglement. A split took place in the control, and Arthur Burr left, to conduct exploration work on his own account farther inland. He has since carried things forward by the sheer force of his own enthusiasm. Many bore-holes have been put down between Dover, Canterbury, and Sandwich, and many seams have been cut at depths of from 1400 to 2500 ft. The latest discovery is a seam 13 ft. thick. The borings have proved the existence of coal-land measuring 20 miles long by 10 miles wide. Colliery shafts have been sunk at Snowdown and Tilmanstone, but at neither place has the coal been reached so far, on account of delays due to scarcity

of capital and the necessity of providing pumping plant. The collieries are being well equipped. So far as can be ascertained the coal seams promise to be not more difficult to work than those in Scotland, but the problem of making a profit under the conditions ruling in Kent cannot be solved in advance. At present coal is expensive in Kent, as it has to be brought from South Wales or the North of England. The Kent railways have to pay high prices for their coal, and they are notorious for their inability to earn decent dividends or to improve their roads and rolling stock. With a cheap local supply of fuel operating costs would go down. However, it is only to be expected that when the Kent collieries start production, the coal producers that have hitherto controlled the market will cut rates, a policy which will be good for the community but not for the local collieries. The energy of Mr. Burr is extraordinary, and though a confirmed invalid, his enthusiasm is as great as ever.

Just before Christmas last a disastrous explosion occurred at one of the Hulton collieries in Lancashire. The Chief Inspector of Mines, R. A. S. Redmayne, has just issued a lengthy report on his investigations into the cause. The 'Yard' seam, in which the explosion took place, is notoriously gassy, and it has also the evil reputation of having an unsafe roof. Mr. Redmayne is of opinion that the explosion originated in a place where a gang of men were clearing a fall of roof, and he considers it probable that while they were doing so, there was another fall which liberated much gas. Then, either the sudden increase in gas overheated a lamp, or some of the falling material broke a lamp. It will thus be seen that carelessness took no part in the disaster, and that the stock story about a miner opening a lamp to light his pipe is found, as usual, to be unsubstantiated. But Mr. Redmayne animadverts on the want of skilled supervision, and considers that the owners are to blame for not giving Mr. Tonge, their manager, more assistance. Mr. Tonge is not only managing director of a company owning several collieries, but he is mining engineer to the company as well, and also manager of each individual colliery. This is too much work and responsibility for one man. Probably the company will take the hint and provide Mr. Tonge with the necessary skilled assistance. An interesting description by W. A. Halton, surgeon of the colliery, of the effects of the disaster, and the rescue work done there, appeared in *The British Medical Journal* for May 20.

The tin industry of Cornwall is being threatened with another set-back, owing to the metal merchants wanting to sell metallic tin by analysis. Unfortunately for Cornwall, the controllers of the metal market are more interested in the purer concentrate and metal produced from Malay and Australian gravels. The 'black tin' sold fortnightly at Redruth is by no means pure tin oxide, and the smelters pay poor prices accordingly. The metal people want to penalize metallic tin produced in Cornwall by £10 per ton for every ½% impurity. It is perfectly well known that Cornish metal is not quite so pure as that which comes from the Eastern gravels, and tin-plate makers would prefer not to buy it at the same price as Eastern tin. The Cornish smelters are up in arms and threaten to pay less to the mines, the eventual sufferers, unless the latter can pluck up courage and sell the concentrate in Germany, where much better prices can be obtained.

KETCHIKAN, ALASKA

Development Delayed for Want of Capital.—Too Optimistic Promoters.—Waste of Capital.—Some Promising Localities.

Very little prospecting has been carried on in this district during the last few years, principally owing to want of capital to develop the orebodies after having been discovered. It is to be regretted that in many cases the prospector has been holding his property at too high a figure, and asking a large sum for the initial payment, when the work done and the results hardly justify such a stiff price. Still there are a number of prospects of merit that can be had at reasonable figures. The favorable transportation facilities, numerous water-powers, mild seasons, and unlimited amount of timber everywhere should all tend to attract mining investors to this district. It is admitted by all who have examined this district that its greatest drawback has been the grass-root promoters, persons who have misrepresented facts to investors of limited means, claiming to have enough ore in sight to warrant the construction of tramways, bunkers, and other equipment necessary for shipping or treating the ore. The outcome has in nearly every instance been the same, when these improvements have been made, the funds are gone and the stockholder is still looking for returns; while if the same money had been spent in developing the orebodies, a number of mines could undoubtedly have been developed and funds could then be easily raised to furnish the mines with proper equipment for handling the ore.

At present two companies at least are doing first-class development work, and it has already been proved that the ore continues in depth and in some cases its value has increased slightly. The prospector in the near future will probably spend most of his time and energy prospecting for gold. The most promising localities in this district, so far as known, are in the vicinity of Dolomi, Hollis, Sea Level, Helm Bay, and a strip bordering on Tongas Narrows. A number of gold prospects at the places mentioned have more or less development work already done and are worthy of further investigation.

NEW YORK

Unwarranted Quotations.—Relative Earning Power of Shares.—Ohio Copper and Other Companies.—Lead Smelting Contracts.—Appraisal of Copper Properties.—Testing Permanence at Cobalt.—Progress at Porcupine.

Mining men, from prospectors to magnates, are perhaps more governed by sentiment than men in other walks of life, but that the power of such sentiment should prevail when mining securities reach the share market and should warp the attitude of the general public, seems improbable. Yet there are some market anomalies wholly inexplicable on any other hypothesis save that of sentiment. The copper metal market and the factors important therein have been analyzed and reanalyzed daily and weekly for months. During the month of May, domestic deliveries made a sharp increase. Stock piles have been low for months, and some consumers have replenished. The quotations on copper have advanced from 12 to 12⅝c., and there is much talk of further advance and improved prospects for the next quarter. While the bettered position of the metal is wholly legitimate, some of the alleged consequences can hardly be considered so. Amalgamated Copper has been moved from 61 to 70, a tremendous advance that cannot seriously be based upon the fractional advance in metal prices. Amalgamated pays $2 per year with no prospects of immediate increase, and sells at $70. Utah Copper pays $3 per year, with every probability of a largely increased output in the near future, yet it sells for $52. Nevada Consolidated pays $1.50 per annum and sells for $21.50. The Amalgamated could double its dividend rate, and still the present price would be too high. Nor is there anything in accumulated earnings or future prospects to justify the present market. Therefore, it must be sentiment. Issues such as Kerr Lake and Goldfield Consolidated are held down to less than 10% of the current price of Amalgamated, though disbursing the same amount in dividends. The man who sells Amalgamated and buys either of the two issues named, would multiply his present income by more than eleven times; as against the $2 he would receive something more than $22. The slight and recent improvement in copper is pointed to, but no account is taken of the new production to come from the investment of millions in the new low-grade milling properties: Ray Consolidated, 100,000,000 lb.; Inspiration, 50,000,000 lb.; Braden Copper, 37,000,000 lb.; Cerro de Pasco, 37,000,000 lb.; Miami, 28,000,000 lb.; an increase from Utah Copper of 65,000,000 lb.; with Chino, Mason Valley, and others not estimated. It is true that

the connection between Amalgamated and the International Smelting & Refining Co. has been strengthened by the purchase of the United Metals Selling Co., but the liabilities for the purchase of the latter, as well as for the purchase of the Butte copper properties of W. A. Clark, are still outstanding. Amalgamated has a surplus of $18,452,392, but this item alone cannot support the present price of the stock.

Chino is arranging its final financing by a bond issue of $2,500,000 of 6% ten-year gold bonds carrying the privilege of conversion into stock at $25 per share during any time within five years after twelve months from the date of issue.

The Calumet & Arizona has apparently benefited by the absorption of the Superior & Pittsburg. The shares have moved up some ten points, and it is taken as assured that the company can continue its present rate of $1 quarterly for some years to come. The Calumet & Arizona has paid to its shareholders just 100% on its present market price of $60.50.

At the recent meeting of the Ohio Copper Co. all the places on the board were filled by adherents of F. A. Heinze. It is now said that there will be a change of control, and that, as a matter of fact, all of the directors have signed resignations and that a new board can be placed in charge at any time. The Arizona Commercial and the Superior & Boston are to erect a smelter for the joint use of the two companies. A bond issue of $500,000 is said to have been underwritten for the Superior & Boston, and nearly all other preliminary negotiations have been completed. Ely Central is to be sold by the receiver to pay accumulated debts; the shareholders who bought shares at from $4 down will in all probability receive absolutely nothing.

The Hecla, of the Coeur d'Alene, and the Daly Judge of Park City, Utah, have each made a contract with the International Smelting & Refining Co. for the handling of their lead ores. The International management first planned a lead furnace to handle 250 tons per day. Now two furnaces are being constructed with a total capacity of 500 tons daily. The contract with the two companies named, the lead ores from the Utah Consolidated, and smaller lots of custom ores will provide enough ore to operate this part of the smelter at full capacity. The lead furnaces will be blown-in some time in October.

J. R. Finlay, formerly general manager of the Goldfield Consolidated, has been chosen by the Board of Assessors of the State of Michigan to examine 160 copper properties in the Lake country. Mr. Finlay in doing this work will, in a way, check over the results obtained by J. Parke Channing, who made the appraisals for the Calumet & Hecla merger. However, as Mr. Finlay is only allowed sixty days to make his returns to the State board, it follows that he can make little or no original and independent examination, but will be forced to simply compile the data gathered by his assistants. The work is in reality much too important to be handled in so short a time in a manner that is just either to the properties or to the examiners, who must be responsible for the reports made. Mr. Finlay has established headquarters in Houghton, and has a large corps of men already at work underground.

Fred Hellman, of Leggett & Hellman, has taken direct charge of the Wettlaufer property, South Lorrain, near Cobalt, Ontario. The Wettlaufer is a Lewisohn property, a subsidiary of the Silver Mines Exploration Co., and has recently been placed on a dividend basis of 5% quarterly. One of the very important undertakings in the mining world is that of the Nipissing Mines Co., which has just announced its intention to attempt to settle the much-mooted question of Cobalt ores at depth. On vein No. 64, which has already proved profitable to a depth of 245 ft., the company is to sink to 1000 ft. with cross-cuts at each 100-ft. level. Do the orebodies go down, has always been the query in Cobalt. The uncertainty has made Cobalt stocks the cheapest in the world in proportion to the dividends returned. Notwithstanding the fact that Cobalt was and is a poor man's camp, and has made such immense profits in proportion to the sums invested in equipment, the lack of proof of permanence has held back the share market.

The railroad from Kelso into Porcupine is so far completed that a regular passenger schedule is now being maintained. A large number of prospectors, investors, promoters, and brokers in New York are ready to go into the new camp, and a revival of local interest is expected. For the past six weeks the incipient Porcupine boom has been losing ground rather than otherwise in New York. There is no change of attitude on the part of the metropolitan press, and so far as the great dailies are concerned, the new mining camp is not on the map, but is obviously and studiously ignored.

BLUEFIELDS, NICARAGUA

CANCELLATION OF CONCESSIONS. — DEITRICK CONCESSION ABROGATED.—EFFECT ON DISTRICT.—SALE OF INTERESTS.

About the end of last March a government decree ordered that certain foreign concessions in Nicaragua should be considered by a mixed court, with a view to their abrogation. Now the president of the Republic has issued a decree declaring that the concession granted to James Deitrick, December 18, 1902, covering mines and mineral deposits in New Segovia and Jinotega, and that of December 6, 1907, to R. J. La Villebeuve, covering the mineral zones and abandoned mines of Bluefields and Prinzapulca, are abrogated. Three other concessions, covering steamship lines, the rubber industry, and harbor work were abrogated at the same time.

The concession granted to James Deitrick was subsequently acquired by the United States & Nicaragua Co. This company built a hotel and purchased steamers and barges, but did practically nothing toward developing the mineral resources of the concession, beyond taking in some

MAP OF NICARAGUA.

Hendy 3-stamp batteries, which were never erected. The company claimed that the mines in the Piz-Piz district were included within its concession, and as the Government refused to accept denouncements in the disputed area, development has been greatly hindered. Not long ago the mine-owners combined and, securing the services of a surveyor, made exact determinations of the latitude of the mines, with the result that none of them were found to be within the territory of the United States & Nicaragua Co. The abrogation of the concession will clear away any further chance for dispute. It is probable that this company will file a heavy claim for damages.

The 3700 shares of La Luz & Los Angeles M. Co., owned by A. Adler & Co. of New Orleans, have been sold to J. W. Fletcher of Pittsburg for $185,000. A. Adler & Co. still own 1100 of the 2000 shares in the Siempre Viva M. Co. and 301 of the 500 shares in the Topaz Mining Co. A description of the Piz-Piz district appeared in the *Mining and Scientific Press* for March 5, 1910.

General Mining News

ALASKA

The Innoko

Reports from Iditarod are to the effect that rich placer ground has been discovered in an old creek channel near Otter creek, by Charles Peterson and Elof Nelson.

Prince William Sound

A. K. Beatson developed the Bonanza mine, situated on Latouche island, at a cost of $105,000. He began operations in 1897, and later incorporated the Beatson Copper Co. to take over the property. In the course of development there was opened a big tonnage of ore that sampled 10% copper, and it was demonstrated that a profit of 4½ cents could be made on 9-cent copper at New York. The mine was sold two years ago to the Guggenheims, by whom it is being operated, with W. H. Seagrave as superintendent.

The Commonwealth Mining & Development Co. has been organized to take over and develop the lode claims located on Mineral creek, near Valdez, by H. Coggeshall, Robert Kernan, and Mrs. George Landon, who become stockholders in the company. The claims are close to the Williams-Gentzler group and are said to contain three veins in which fair-grade ore is found. The Ellis Imperial property has been equipped with an air-compressor, which is the first in use in Valdez district. William Thompson, Bert Ford, William Wilson, and Sam Blum, in developing their lode claims near Shoup bay, recently discovered ore, high-grade specimens of which assayed nearly $500 per ton. The ore occurs in a 3-ft. vein. The claims are in the vicinity of the claims of the Shoup-Glacier M. Co., on which ore has been found.

The Tanana

Rhoads & Hall, who have developed a quartz property on Bedrock creek, a tributary of Cleary, have purchased in San Francisco a Hendy 5-stamp mill, steam boiler, engine, and other equipment, all of which have been shipped to Fairbanks. Golden & Sherrard, mining near the head of Cleary creek, sent about 60 tons of ore to the Chena mill, the clean-up from which was gold bullion worth $5000. Much of the development of lode claims is in the vicinities of Cleary and Fairbanks creeks, which are from 18 to 20 miles out from the town of Fairbanks. The Tanana Valley railroad, which extends from Fairbanks to Goldstream and Cleary creek, was operated with difficulty during March on account of the heavy fall of snow, drifted by high winds.

ARIZONA

Cochise County

The production of blister copper at the Calumet & Arizona smelter, at Douglas, during the first five months of the year, was 9916 tons, which is 1163 tons less than for the corresponding period of 1910. The Shattuck mines of Bisbee have ceased operating, except with a small force on development work. The larger force of 125 miners was laid off.

The May output of copper at the Copper Queen smelter, Douglas, amounted to 9,543,779 lb. The ore from the Copper Queen mines, at Bisbee, yielded 5,719,187 lb.; ore and concentrate from Moctezuma mine and mill, at Nacozari, yielded 2,403,583 lb., while 1,421,009 lb. was produced from custom ore. The Detroit Copper Co., operating its mine and smelter at Morenci, produced for May 1,709,530 lb. copper. The Copper Queen mine and smelter, the Moctezuma mines, and the Detroit mines and smelter are all controlled by Phelps, Dodge & Co. of New York. It will be seen, then, that the total production of copper during May by these allied properties aggregating 11,253,309 pounds.

The Great Western Copper Co. expects to ship 1500 tons of ore from the dump at the Mame shaft in the Courtland district, to the El Paso smelter.

Gila County (Globe District)

The body of ore in the Inspiration group, near Miami, as demonstrated by development work and churn-drill exploration, is estimated at 24,000,000 tons. This deposit has a width of 1400 ft. in the widest place, and a length of 3500 ft. It is announced that the Inspiration Copper Co., which owns the property, is to proceed now with the designing and construction of a concentrating mill. The work is in charge of Henry Krumb, consulting engineer, and T. R. Drummond, the general superintendent.

Greenlee County

The production of copper by the Shannon Copper Co., Clifton, amounted to 1,220,000 lb. for May, and was 6,216,000 lb. for the first five months of 1911. It is claimed the Shannon is producing copper at a cost of 11¼c. per pound.

Some of the directors of the Arizona Copper Co. have been looking over the property of the company at Clifton, Metcalf, and Morenci, and the proposal to erect a new smelting plant probably will be decided at meetings soon to be held at Edinburgh, Scotland. It is reported that the company has acquired a site for the proposed smelter on the west side of San Francisco river, three miles downstream from the old plant.

Mohave County

The Cyclopic mines, in Union Basin district, which have been in charge of S. C. Bagg for two years, are reported sold to a company of Eastern people. The Union Basin M. Co., owner of the Golconda mine, is mining zinc sulphide ore, running 64% zinc, on the 400-ft. level. The company, according to the Kingman *Miner*, may be reorganized for the purpose of acquiring other properties in the vicinity of the original mine. The properties are in the Cerbat range, out 20 miles from Kingman, and are managed by John Boyle, Jr.

Yavapai County

The Climax M. Co. is developing its property, in the Bradshaw mountains, 18 miles from Prescott, and operating a small mill. A recent clean-up, made after a 5-days run, consisted of gold bullion worth $3500. There is said to be plenty of ore exposed in drifts and stopes, and it is probable that the mine will be worked on a larger scale.

The Cleopatra Copper Co., operating at Jerome, is shipping 500 tons of copper sulphide ore to the smelter of the Clara Consolidated company, at Swansea, in Yuma county. G. W. Hull and associates control the Cleopatra, and it is said they have 2000 tons more ready to ship.

Edward Block, of Prescott, has sold a group of claims in Copper Basin, on which there is a deposit of kaolin, 3 to 10 ft. wide, containing gold in profitable quantities. It is announced that the purchaser is to erect a milling plant.

CALIFORNIA

Oil Output for May

The gross production of oil for May of all the districts of the State was 7,099,449 bbl.; field consumption during the month, 394,190 bbl.; leaving a net production of 6,705,259 bbl., a daily net average of 216,300 bbl. The following table shows the net output in barrels by districts:

Districts.	May.	April.
Coalinga	1,542,292	1,382,770
Kern River	1,093,710	1,076,000
McKittrick	399,242	419,300
Midway	1,667,631	1,677,700
Maricopa	380,141	389,380
Whittier-Coyotes	94,151	93,941
Salt Lake	230,000	237,325
Fullerton	561,105	476,045
Ventura	32,553	37,601
Los Angeles City	36,800	36,500
Newhall	12,109	11,240
Santa Maria, Lompoc	650,000	699,916
Summerland	5,525	5,410
Total net production	6,705,259	6,544,128

Amador County

(Special Correspondence.)—The Alpine M. Co., operating at Plymouth, has cleaned out and partly retimbered the 600-ft. shaft, which is now in good condition from the collar to the lowest station. The company has leased for two months the Levaggi mill, which is to be operated for the purpose of making a number of tests on ore from the lowest workings. If the results of such tests warrant doing so, a 20-stamp mill will be built. F. Henry, the superintendent, is away for two months, and John L. Henry, the general manager, is in direct charge.

Plymouth, June 15.

The report of the Lincoln Con. M. Co., from March 15 to June 15, 1911, shows that the work on the 500-ft. level comprised the extension of the west cross-cut 442 ft. and the driving of the north drift 209 ft.; work on the 800-ft. level consisted in re-opening the old south drift and extending it 60 ft. in ore assaying $6.40 to $22.40 per ton. It is also noted that on the 1200-ft. level a west cross-cut is being driven in greenstone for the purpose of opening the vein that was reached on the 500-ft. level; this cross-cutting has been advanced 500 ft., and the vein is estimated to be 250 ft. ahead. During the quarter the company has expended $13,928 for labor, supplies, office expenses, fuel, freight, and power. The property is at Sutter Creek.

Kern County

The Butte mine, at Randsburg, is producing regularly under direction of Edward Shipsey, who is taking ore from the 50, 109, and 165-ft. levels. A 95-ft. raise has been driven from the 150-ft. drift on the 165-ft. level.

Mariposa County

The Oro Rico Mines Co., controlled by J. C. Wilson of San Francisco, and his associates, has had the Oro Rico mine under development during the last two years, and it is estimated that there is now 125,000 tons of ore blocked out, of an average value of $8 per ton. The ore consists principally of quartz, containing free gold, and sulphide material carrying silver, gold, and copper. The gold content represents about one-half of the value of the ore, the silver and copper the other half. The development comprises a 600-ft. cross-cut by which the vein is tapped at a depth of 320 ft., about 1000 ft. of drifts, and a 360-ft. winze, the latter having been sunk in ore on the main west drift. Stations No. 1, 2, 3, and 4 are established in the winze, and a level has been driven on the vein from each station; and in the stopes of this part of the mine is where the principal ore reserves are developed. The ore is raised to the main level by an electric hoist, set at the collar of the winze. The vein has a width of about 7 ft. The mine is situated in the vicinity of Coulterville, and is about 20 miles from the Yosemite Valley railroad. The 20-stamp mill, being built at the mine, is to be completed and ready to operate by August 25. It is being built by the Joshua Hendy Iron Works, and will have amalgamating plates and Deister tables. Electric power is supplied by the Pacific Gas & Electric Co. The Oro Rico was worked to some extent before this company acquired it. The holdings extend about two miles on the strike of the mineral zone, which is a part of the Mother Lode. The work is under the direction of Fred McMillan, consulting engineer.

The Original M. & M. Co., the stockholders in which are Merced people, recently shipped 23 tons of ore to the Selby smelter that sampled $62.60 gold and 53c. silver per ton, the gross proceeds being $1232; the net returns to the company amounted to $1091. The ore shipped was mined in the course of development, and was sent as a test. There is estimated to be 250 tons on the dump that will assay $40 to $50 per ton, and other shipments are to be made. This mine, known as the Original, is situated on the Merced river, close to El Portal, and is on the same lode as is the Hite Cove mine, which is on the line between Merced and Mariposa counties. G. W. Englehoff is in charge of the property.

Nevada County

The Gold Cañon mine and 5-stamp mill are now being operated by persons who have it under a bond. Development has been in progress since last fall. The water is being pumped out of the shaft to permit miners to work below the adit-level.

Plumas County

The Mother Lode Mining & Reduction Co. has built a crushing mill and cyanide plant of 150 tons capacity which is to be operated on tailing from the Crescent and Green Mountain mines, in Indian valley. The Dixie Queen mine, situated on Round lake, out from Johnsville, is now in operation, with W. T. Young in charge. G. McGee has commenced work for the season on the Salmon Lake mine.

Shasta County

The case of the Shasta county farmers against the Balaklala Con. Copper Co., relative to alleged injury to vegetation by smelter fume, came up June 20 in the United States Circuit Court, at San Francisco, and in accordance with a stipulation agreed to by attorneys for the litigants, an order was made by Judge Morrow to the effect that the defendant's smelter at Coram shall be closed down indefinitely before July 25, 1911, and that the company shall pay $4000 to plaintiffs to reimburse them for money spent in having analyses and investigations made. Between now and July 25 the company can smelt the 10,000 tons of ore stored at its plant. The stipulation also provides that the contempt cases pending against the company shall be dismissed.

The Big Seven Con. Gold M. Co., controlled by H. D. Staley and associates, is operating the Uncle Sam mine, on Squaw creek, 8 miles from Redding, with a force of 25 men. Three air-drills are in use in the mine. The 10-stamp mill has been in operation since February, crushing 20 tons of ore per day, the gold and silver being recovered on amalgamating plates and in the concentrate saved on the tables. It is claimed 90% of the assay value of the ore is extracted. This company does not own the Uncle Sam, but is working it under lease.

Sierra County

The Tightner mine, at Alleghany, owned by H. L. Johnson, by whom it has been worked during the last ten years, is under option to J. M. O'Brien of San Francisco, who has placed C. C. Derby and L. N. Wagner of the latter place in charge of the property. They are to explore, prospect, and sample the mine thoroughly during the term of the option. In order to facilitate such work Mr. O'Brien has purchased an air-compressor, power drills, electric motors, and other equipment, which were hauled from Nevada City to the mine last week and are being put in position for work. The air-compressor is to be driven by power transmitted to the mine from the plant of the Middle Yuba Hydro-Electric Power Co. The ore-shoot of the Tightner has been productive to a depth of 125 ft., and a long adit is being driven to tap this shoot at a depth of 600 feet.

The Monte Cristo gravel mines, near Downieville, are yielding gold at the rate of nearly $1000 per day. The channel is being worked to a width of 45 ft., and has been prospected and proved to a width of 60 ft. without reaching either rim. The Electric Separating Co., having a working bond on the Omega gravel mine, between Mountain House and Forest, has 28 men at work, mining gold-bearing gravel from the channel and running it through the mill. The coarse gold is saved by amalgamation and sluicing, the fine gold being recovered by electric separators. The gravel is cemented and requires crushing.

Tuolumne County

(Special Correspondence.)—Litigation over the Iron Spring mine has ended and the development of the property, which is owned by Ben Darmert and D. J. Sutton, will be resumed. About 25 men are employed in development work at the Tarantula mine, operated by the United Gold Mining & Milling Co. New hoisting equipment and self-dumping skip have been provided. The Wickham mine, near the Rawhide, owned by W. P. Houston and G. V. Snow, has been bonded to Bruce and Nelson, who will retimber the shaft and resume development. The crushing

plant at the Maddox mine, consisting of 5 stamps and a Huntington mill, was destroyed by fire. A new mill will be erected. The fire did not stop, however, the underground work, in which 12 men are engaged. The mine is owned and operated by the Phoenix Lake Mining Co. It is announced that the Santa Ysabel mine will be further developed. Six bars of gold, worth $16,000, the result of a clean-up at the New Albany mine, after a 20-day run, were sent to the mint this week. The property is owned by the United Mines Corporation, but for the last few weeks has been worked under direction of J. L. Gibbs, representing creditors to whom the mining company was indebted. It is understood that the gold taken out is sufficient to pay these claims.

Tuolumne, June 15.

COLORADO

Boulder County

The Colorado-Arizona Mines Co., owner of the Cash-Rebecca mine at Magnolia, has had a force of 12 to 15 men at work for 18 months, and during that time has built an electric-power plant, laid 4000 ft. of pipe for a water system, retimbered the mine shaft, and partly remodeled the mill and cyanide plant. Frank Leonard is in charge of the property.

Clear Creek County

(Special Correspondence.)—It is reported that the Centennial mine, on Leavenworth mountain, has been sold to New York investors for $125,000, by David Kennedy, the owner, who is in the East to close the deal. The Wide West mine, an old-time producer, has been taken under long-time lease by J. A. Noone. Operations were started last week and driving is in progress on a streak of carbonate ore assaying 475 oz. silver per ton.

Georgetown, June 17.

Lake County (Leadville)

The Yak tunnel, which cuts through the district from California gulch to the head of Big Evans gulch, is becoming a great factor in the development and extraction of ore. The Yak company is mining in Dollie B., Resurrection, Silver Cord, and White Cap ground, all tributary to this tunnel, and about 25 sets of lessees are working in properties along its course, many of them on mines in the vicinity of Big Evans. The ore sent out through this tunnel in the month of May amounted to 10,000 tons, which includes that shipped by lessees. It is claimed that $100,000 has been spent by lessees in developing ground tributary to this great haulage-way since the beginning of this year. Important work is being done on leased ground at the Resurrection and Sedalia mines. Included in this is the driving in progress from the Resurrection shaft No. 2, which is below the Yak level and is intended to tap the orebodies in the Diamond mine, supposed to contain sulphide ore of good grade. C. A. Edwards and associates, lessees on ground of the Seneca M. Co., using the Anderson shaft, have found a body of carbonate of zinc in a winze on the lowest level.

The Luema Mining Co. has sunk its Valley shaft to a depth of 600 ft. and has cut out stations at 500 and 600 ft., from which cross-cuts have been driven to the vein. It has been demonstrated by this work that the vein and ore are practically the same at 500 and 600-ft. depths as exists on the higher levels. The property is on South Evans gulch, and the Valley vein consists of a fissure in granite. This fissure has been opened for a length of 1800 ft. on the Cleveland group, lying to the south, and development in progress on the Silver Spoon group, to the north, is for the purpose of mining on the same fissure. The ore developed on the Cleveland runs high in gold, and is accompanied by some silver and copper of value.

The zinc ore being shipped from Leadville to Eastern smelters amounts to 500 tons per day. The number of zinc-producing mines is increasing in the district, and S. D. Nicholson, who has charge of the Wolftone, Henrietta, and Maid of Erin mines, is quoted as predicting a further increase in the production of zinc ores. The Little Pittsburg mine, being operated by H. M. Hoffer and associates, is again a producer of zinc carbonate ore.

Ouray County

The Grizzly Bear mining claims have been sold to the Gold Trio Mines Co., by which further development work is to be done. The Humboldt group of 16 patented claims, near Sneffels, belongs to John B. Farish and associates. The claims were located in 1879, and later were developed and made productive. Since 1893 the property has been idle. There is said to be ore on the dumps that could be handled now at a profit, and in the stopes and levels it is claimed there are 50,000 tons of ore that will sample $20 per ton. The mine is being examined and sampled by Fred G. Farish. It is on the trail which leads from Sneffels to Savage basin.

Summit County

The company which has driven the King Solomon cross-cut a distance of nearly 5000 ft., at Frisco, has shipped a carload of ore taken from No. 11 vein, intersected by the cross-cut, the smelter returns for which showed an average value of $36 per ton. This vein contains 2 ft. of ore, the principal metals in it being silver, lead, and copper. A narrow vein, close to No. 11, and parallel to it, has been opened, which is said to contain a streak of ore assaying about 18 oz. gold per ton.

The Wilson mine and mill, at Kokomo, are in operation under direction of H. M. Shepherd. The product of the mill is a concentrate. The Kokomo Metals Co. has built a mill which is ready to be operated. This company has developed in its mine a sufficient tonnage of lead-zinc ore to keep the mill supplied for some time. The property is on Elk mountain.

Teller County (Cripple Creek)

The 16 sets of lessees at work on the Isabella mines, Bull hill, are mining and shipping 10 to 12 cars of ore per week. The greater part of this is hoisted from the Lee shaft. A rich shoot of ore on the Buena Vista vein, at the 600-ft. level, is said to be 12 to 14 ft. wide, the ore being high grade. A carload of ore per day is being shipped from the Frank Caley lease on the Jerry Johnson group, Ironclad hill. Jack Gaffney and partners, sublessees on the same property, are now able to ship an occasional car of ore that runs $30 to $40 per ton. The Index Development & Leasing Co. is mining ore at the 500-ft. level of the Index mine, Gold hill, that samples about $35 per ton. Two carloads of ore were shipped recently.

IDAHO

Lemhi County

The Pittsburg-Idaho company, operator of the lead-silver mine at Gilmore, is shipping to Salt Lake City smelters 120 tons of ore daily. New steam boilers were recently put in place, and the company now has sufficient power to enable it to increase its force in development and production. The 400-ft. shaft, sunk from an adit, is being made deeper, and an inclined winze is being driven from the 400-ft. level to facilitate development work. Good ore has also been found in driving the Silver Dollar adit to the same vein 2000 ft. from the main workings. The ore in this mine occurs in short, thick shoots. Two parallel shoots, found on the 300-ft. level, were 200 ft. in length and 3 to 25 ft. in width, the ore sampling about 35% lead and 15 oz. silver per ton. These orebodies occur in a fissure in blue limestone. Gilmore is now reached by the Pittsburg & Gilmore railroad.

Shoshone County

The Coeur d'Alene North Fork M. & S. Co., which is operating in the Murray district, is mining ore regularly from stopes on the 800 and 1400-ft. levels, and concentrating about 200 tons of ore per day. The 1400-ft. level is that connected with the No. 3 cross-cut, driven 2300 ft. from Pritchard creek to the Monarch vein, cutting the latter at a depth of 1400 ft. These workings are connected with those above by an 800-ft. raise. The ores consist of sulphide of iron, containing lead and silver, with some zinc.

ILLINOIS

(Special Correspondence.)—The legislature, which has just adjourned, made the following annual appropriation for support of the State Geological Survey: Regular support, $25,000; survey and study of overflowed lands, $7500; preparing and engraving illustrations and maps, $2500; investigations of the coal mining industry and of coal waste with the Department of Mining at the University and the U. S. Bureau of Mines, $4500.

Springfield, June 12.

MICHIGAN

Houghton County

The May operations of the Wolverine Mining Co. may be summarized as follows: Ore hoisted, 36,168 tons; ore crushed, 34,944 tons; mineral recovered, 513 tons; yield of copper per ton of ore, 29.36 lb., which is an increase of about 2 lb. over the extraction made in April.

MONTANA

Lincoln County

(Special Correspondence.)—The churn-drill to be used in prospecting 400 acres of Libby creek placer ground, before deciding to build a dredge, has arrived, and the work is to be undertaken by T. Y. Ownby and G. F. Hinton, who represent Colorado and Eastern people. Tests will be made in order to estimate the value of the ground and determine its depth. The Silver Cable mine, owned by James T. Hartt, has been examined in the interest of persons who are figuring on acquiring the property. It is situated 23 miles south of Libby, and was considerably developed and equipped with a small mill a few years ago. It is said to have a 4-ft. vein of silver-lead ore.

Libby, June 15.

Silverbow County

The Original mine, one of the former Clark properties, is being developed by the Anaconda company. The 2400-ft. shaft is to be sunk to a depth of 2800 ft. The Tuolumne company has opened a body of good ore on the 1400-ft. level. When the south vein on the 1600-ft. level was reached, there was found a body of ore running from 5 to 12% copper. But it was discovered that the miners were in the High Ore mine, and in order to prove the ground, the Tuolumne people started to raise to the 1400-ft. level and cut the south vein. Where it was opened was 170 ft. nearer the shaft than on the 1600-ft. level, proving that they were in their own ground. Now, in order to further explore the ground, the company is raising to the 1200-ft. level.

NEVADA

Esmeralda County

The explosion of a charge of powder in a missed hole while miners were drilling in the Valcalde tunnel of the Pittsburg-Silver Peak mines, near Blair, on June 15, resulted in the instant death of Joe Busto, and the serious injury of C. Gasparovich, Walter Ward, and Robert Peterson.

Eureka County

The Eureka & Palisade railroad, sold last winter at foreclosure sale to Geo. W. Heintz of the United States S. R. & M. Co., has been redeemed by George Whittell, of San Francisco, one of the stockholders, who is reported to have stated that the washed-out sections of the road would be rebuilt. This work will require the grading and building of about 10 miles of road.

Lincoln County

The Mendha-Nevada M. Co., having a developed mine at Pioche, has shipped about 6000 tons of ore to the Salt Lake valley smelters, that sampled $30 per ton, and is now making plans for a mill to be built this summer. A lot of 11 tons of Mendha ore was concentrated at the ratio of a little over 3 tons to 1 by the General Engineering Co., Salt Lake City, the resulting concentrate assaying 0.59 oz. gold and 25.8 oz. silver per ton, and 34% lead, 12% iron, and 23% silica. The result of cyanide tests made on the vanner tailing showed that this material was amenable to cyanidation, that the consumption of cyanide was 1.8 lb. per ton of pulp, and that 18 hours agitation was sufficient in practice. The cyanide test showed the extraction of gold was 41.8%, and that of silver 14.8% of the content of the head sample. The concentration test showed a recovery of $10.35 per ton of crude ore, and the saving of $14.58 per ton by concentration and cyanidation.

Lyon County

The Nevada Douglas Copper Co., for which Duncan MacVichie is consulting engineer, is having its mines in Yerington district put in such condition as will make it practicable to mine a large tonnage of ore in an economical manner. The mine work is in direct charge of A. A. Arentz, whose development in the southern part of the Ludwig group has resulted in exposing bodies of ore of smelting grade not hitherto included in the ore reserves. This ore runs 6 to 9% copper. The second, third, fourth, fifth, and sixth stations of the Ludwig shaft are in good order and ready for active mining.

Nye County

The Tonopah Extension M. Co. mined and treated 4100 tons of ore during May, extracted 93% of its gold and silver content, the output for the month being 3835½ lb. of bullion, valued at $42,000. The mill work at this property was well described by John G. Kirchen in an article published in the *Mining and Scientific Press* of April 9, 1910.

The Round Mountain M. Co. is building a new mill which is expected to be finished in July. Meanwhile, the old mill is operating and turning out $30,000 to $40,000 per month in bullion.

Storey County (Virginia City)

The north drift No. 3, on the 2400-ft. level of the Mexican mine has been driven to the south line of the Union Con. mine, the face of the drift being in ore that assays $11.35 per ton. It is stated that the north drift on the 2500-ft. level is being advanced in ore toward the Union Con. ground, which is to be developed through those two levels on the Mexican. Ore hoisted from the Mexican for the week ended June 17 amounted to 375 mine-cars, of the value of $21,194. Of this, 63 cars, averaging $66.62 per ton, were taken from the 2300-ft. level; 78 cars running $5, and 74 cars at $27.08 per ton came from the 2400-ft. level; 39 cars, assaying $107.61, 106 cars running $92.60, 15 cars at $39.40 were taken from the 2500-ft. level.

The week's output at the Ophir was 275 mine-cars of ore, estimated at 248 tons, of an average value of $45.74; this was taken from the Hardy vein, on the 2100-ft. level. The work at the Con. Virginia consisted in driving on the 2550-ft. level, timbering on the 2450, and repairing on the 1750. No stoping was done.

Ward shaft work consisted in building the concrete bulkhead in the Gold hill drainage-level at 2000 ft., not yet completed; doing diamond-drill prospecting on the 2450-ft. level, and driving at the 2000-ft. level toward Julia ground. The Yellow Jacket mill was operated on dump ore. During the week ended June 17 the Mexican shipped 4 cars of first-grade ore to the smelter; the Ophir shipped one car of concentrate to the smelter, and 340 tons of ore to the Kinkead mill.

NEW MEXICO

Grant County

The stockholders of the Chino Copper Co. are to meet June 30 to act upon the proposal of the directors to issue bonds in the amount of $2,500,000. If this bond issue shall be authorized, all stockholders of record June 20 are to be entitled to subscribe *pro rata* on the basis of one bond of $500 for each 140 shares held. It is announced by Charles M. MacNeill, president of the company, that development work at the mines has resulted in such an increase of available ore as to warrant the increase in the capacity of the concentrator, now under construction, from 3000 to 5000 tons per day.

Socorro County

(Special Correspondence.)—The ore mined and milled at

the Socorro during May was 5000 tons. The output for the first 10 days of June averaged 155 tons per day, 93% of the gold and silver therein being extracted at the mill. The Ernestine M. Co. treated 3300 tons in May, from which was extracted 24,785 oz. of silver and gold, and 20 tons of concentrate. The property is now producing about 700 tons of ore per week, which is milled. The plant at the Deadwood mines is being increased. At present 250 tons of ore per week is being treated.

Alma, June 15.

OREGON

Baker County

The Underwood placer mine, situated on Boulder creek, two miles from Cornucopia, is being worked this season by J. H. Underwood and C. H. Rhodes, a clean-up made recently having amounted to $8000.

Jackson County

The Homestake mine, near Woodville, is to be operated by Captain Clark and associates, who have a lease and bond on it. They are overhauling the mill and putting the mine in condition for work.

Josephine County

The Michigan mine, situated on Applegate river, near Murphy, and 8 miles south of Grants Pass, is controlled by people resident of Charlotte, Michigan. It is in charge of Adolph Maier, who is erecting a mill of 25 tons daily capacity. The ore, according to sampling and assaying, runs $11 to $22 per ton. The vein is said to be in granodiorite, strikes southeast, dips 15° northwest, and has a width of 6 ft., the pay-streak being 2 to 4 ft. wide. There is one 2-compartment shaft, 135 ft. deep, with two crosscuts driven to the vein. Other development is near the surface.

UTAH

Beaver County

(Special Correspondence.)—The management of South Utah claims that the mine is producing 500,000 to 600,000 lb. of copper per month at a cost of 9 cents per pound, now that improvements have been made at the concentrator and the grade of ore has improved. The property is at Newhouse.

Milford, June 17.

Grand County

(Special Correspondence.)—C. D. Inman, of Goldfield, Nev., Frank M. Meyers of Seattle, and W. G. Page of Los Angeles have closed a deal for the purchase of 500 acres of placer ground which they say contains 12,000,000 to 15,000,000 yards of gold sands, estimated to run about 20 cents. The property lies in the La Sal mountains. Operations will begin at once.

Moab, June 1.

Juab County

(Special Correspondence.)—The Uncle Sam M. Co. has declared a dividend of $25,000, making a total of $445,000 paid since organization. The annual report for the year ended June 1, 1911, showed net profits for that year of $120,515, and cash on hand amounting to $62,751. The directors and officers were re-elected at the annual meeting. The Centennial-Eureka company has paid its first dividend this year, amounting to $3 per share, or $300,000. This makes a total of $30 per share, or $3,000,000 in five years. The United States Smelting, Refining & Mining Co. owns 98,864 shares out of the 100,000 shares of the stock. Iron Blossom, for the week ended June 10, shipped 38 cars of ore; the Centennial-Eureka shipped 36 cars. The Opohongo is sinking its shaft in copper-gold-silver ore, assaying close to $50 per ton. William Hatfield thinks he has the extension of the Mammoth vein.

Eureka, June 17.

Salt Lake County

(Special Correspondence.)—After a stockholders' struggle, lasting several years, control of the Columbus Consolidated at Alta has passed from the faction headed by Tony Jacobson, to A. H. Cowie, W. O. Williams, and C. H. Gibbs, directors, who will continue work of unwatering the lower levels.

Alta, June 17.

Summit County

(Special Correspondence.)—A raise of 1100 ft., from the Alliance adit, the 1500-ft. level of the Silver King Coalition mine, to the workings of the Keith-Kearns mine, has been completed after a year's work. The work was difficult on account of bad ground, and predictions had been made that it could not be accomplished. The Snake Creek adit was in 3472 ft. June 2.

Park City, June 17.

WASHINGTON

Stevens County

The Pacific Copper M. & M. Co., controlled by M. E. and M. S. Hosea, of Spokane, is reported having interseeted a 40-ft. lode of copper, gold, and silver ore, assaying over $30 per ton. Considerable amount of development has been done, a carload of sorted ore is to be shipped, a shaft is being sunk on the orebody, and a mill may be built later.

CANADA

British Columbia

It is stated that Frank C. Armstrong, of New York, and D. L. McGibbon, of Montreal, have acquired a controlling interest in the Sheep Creek Summit Gold Mines, Ltd., owner of the Summit mine, in Sheep Creek district, situated near Ymir. George E. Farish is to take charge of the work. Ore has been shipped during the last two seasons.

Ontario

P. Kirkegaard, consulting engineer for the North Dome Mining Co., at Porcupine, reports as follows under date of June 15: North Dome shaft down 34 ft.; sample taken at 32 ft., vein 7 ft. wide, ore assayed $84 per ton. Drill-hole 120 ft. deep. Expect to reach orebody at about 175 ft. Drilling is at the rate of 20 ft. per 24 hours.

MEXICO

Sonora

(Special Correspondence.)—The Barranca mine is closed down and has been left in charge of a watchman. The ore treated at the mill, built last year, proved disappointing, both as to the value and the extraction obtained. It is reported that checks given by the management on the Bank of Sonora for labor were returned marked 'no funds.' The Barranca, which has had a varied career, was partly developed by San Francisco capitalists, who sold it under a working bond to Stephen W. Dorsey, of Los Angeles, and he disposed of it in 1906 to the Hudsons Consolidated, an English company, which placed the property on the London market with a capitalization of £160,000, the latest quotation being 7 shillings 16 pence.

At the Berlin mine a hoisting plant is being provided and the workings are being unwatered, under direction of B. F. Ogden, acting for S. W. Dorsey, of Los Angeles. The Las Cruzas mine, situated near Snaqui Grande, and belonging to the Flores family, has been bonded to Mr. Fletcher, of Los Angeles, who is having the old workings unwatered. The property is one of the *antiguas* of the district, on which further exploration and development are to be carried on. Las Animas mine, at San Javier, has been bonded to Mr. Laughlin, who is overhauling the mill, with the intention of concentrating the ore and shipping the product to the El Paso smelter. The ore is low grade, carrying lead and zinc, and is considered difficult to treat. Those formerly in charge were unable to make a satisfactory product, much of the valuable metal being carried away in the slime.

Barranca, June 12.

Two smelters will soon be blown-in which are situated in the northern portion of Sonora, those of the Cobriza Mining Co. at Noria, and that of the Sonora Copper Smelting Co. in the same neighborhood. The two plants were completed some time ago, but on account of unsettled conditions the blowing-in was postponed.

Recent Publications

U. S. Bureau of Mines, Bull. 5, 'Washing and Coking Tests of Coal at Fuel-Testing Plant, Denver, Colorado, July 1, 1908, to June 30, 1909.' By A. W. Belden, G. R. Delamater, J. W. Groves, and K. M. Way; 1910; 62 pages.

The following publications have been recently issued by the U. S. Geological Survey:

Mineral Resources, 1909: 'The Production of Gold and Silver in 1909,' by H. D. McCaskey; 1911, 33 pp. 'The Production of Natural Gas in 1909,' by B. Hill; 1911; 136 pp. 'The Production of Asbestos in 1910,' by J. S. Diller; 1911; 13 pp. 'The Production of Asphalt, Related Bitumens, and Bituminous Rock in 1909,' by David T. Day; 1911; 5 pp. 'The Stone Industry and the Manufacture of Lime in 1909,' by Ernest F. Burchard; 1911; 51 pp. 'Statistics of the Clay-Working Industries in the United States in 1909,' by Jefferson Middleton; 1911; 67 pp. 'Lead in 1909,' by C. E. Siebenthal; 1911; 25 pp. 'The Production of Mineral Waters in 1909,' by Samuel Sanford; 1911; 41 pages.

Bulletins: No. 438, 'Geology and Mineral Resources of the St. Louis Quadrangle,' by N. M. Fenneman; 1911; 73 pp.; map, index. No. 443, 'Reconnaissance of Geology and Mineral Reconrces of Prince William Sound, Alaska,' by U. S. Grant and D. F. Higgins; 1911; 89 pp.; map, index. No. 447, 'Mineral Resonrces of Johnstown, Pennsylvania, and Vicinity,' by W. C. Phalen and Lawrence Martin; 1911; 143 pp.; map, index. No. 453, 'Results of Spirit Leveling in Minnesota, 1897 to 1910, Inclusive,' by R. B. Marshall; 1911; 39 pp.; index. No. 442-A, 'Mining Industry in 1909 and Alaska Coal and Its Utilization,' by Alfred H. Brooks; 1911; map. No. 465, 'State Geological Surveys of the United States,' by C. W. Hayes; 1911; 177 pp. No. 470-E, 'Rare Metals,' by F. L. Hess; 1911; 12 pp. No. 470-I, 'Mineral Paints,' by B. L. Miller; 1911; 15 pp. No. 470-J, 'Sulphur and Pyrite,' by R. W. Richards and J. H. Bridges; 1911; 8 pages.

Catalogues Received

Thos. H. Dallett Co., Philadelphia, Pa. Bulletins No. 203 and 204. 'Air Compressors.' 6 by 9 inches.

Robert W. Hunt & Co., New York. Outlining the field of operation of this engineering firm. 32 pages. 3½ by 6¼ inches.

The Bristol Co., Waterbury, Conn. Bulletin No. 131. 'Bristol's Recording Voltmeters.' 44 pages. Illustrated. 8 by 10½ inches.

Sullivan Machinery Co., Chicago. Bulletin 58-J. 'Sullivan Straight-Line Air Compressors.' 20 pages. Illustrated. 6 by 9 inches.

The Westinghouse Machine Co., East Pittsburg, Pa. Circular W. M. 503. 'Westinghouse Gas Producers.' 32 pages. Illustrated. 7 by 10 inches.

Edgar Allen American Manganese Steel Co., Chicago. 'Manganese Steel Castings.' Enumerating list of castings manufactured by them from manganese steel. 16 pages. 4 by 6½ inches.

Wm. Powell Co., Cincinnati, Ohio. Catalogue No. 10. 'Dependable Engineering Specialties.' Describing the 'Star' steam specialties. Useful tables, etc. 300 pages. Illustrated. 5½ by 8 inches.

Oliver Continuous Filter Co., San Francisco. Describing the Oliver Continuous Filter, with filter costs and metallurgical data of filter operations; also, list of installations. 16 pages. Illustrated. 6 by 9½ inches.

Thew Automatic Shovel Co., Lorain, Ohio. Catalogue No. 8. 'Thew Steam and Electric Shovels.' Describing their Full Circle Swing Shovel, mounted on traction wheels or car wheels; also for underground mining, ditch construction, and quarry service. 32 pages. Illustrated. 9 by 6¼ inches.

Decisions Relating to Mining

Specially reported for the Mining and Scientific Press.

Injury to Miner—Recovery

Three thousand two hundred dollars recovered for an injury to a miner whose hand was broken and who was permanently crippled by the falling of a lump of coal is not so excessive as to indicate either passion or prejudice on the part of the jury in assessing the damages.

Poli *v.* Numa Block Coal Co., (Iowa) 127 Northwestern, 1105. Oct. 1910.

Liability of Mine Operator for Negligence of Engineer

The fact that the operator of a mine is required by statute to employ only licensed engineers and pit bosses, does not make such engineers and bosses quasi-officers of the State to relieve the owner or operator from liability for negligence.

Poli *v.* Numa Block Coal Co., (Iowa) 127 Northwestern, 1105. Oct. 1910.

Bona Fide Purchaser of Mining Stock

A wife who receives mining stock from her husband in payment of or as security for a preëxisting debt, is not an innocent purchaser, and takes such stock subject to the lien of the corporation for the indebtedness of the husband to the corporation.

Eureka Mining, Smelting & Power Co. *v.* Lively, (Wash.) 110 Pac., 425. Aug., 1910.

Assumption of Risk and Contributory Negligence

An employee in a mine does not assume the risk of injury arising from the employer's violation of the statutory duty, and a miner has the right to wait a reasonable time for the owner or operator of the mine to repair an insufficient covering on the cage before being chargeable with contributory negligence where he is injured by an object falling down the shaft, unless the hazard was so great that a reasonably prudent person would not expose himself to the danger; and whether the miner was guilty of contributory negligence in such a case is a question for the jury on all the evidence.

Poli *v.* Numa Block Coal Co., (Iowa) 127 Northwestern, 1105. Oct. 1910.

Duty of Mining Company to Provide Safe Place—Covering over Cage

It is the duty of a mining company to provide a safe place of work for its miners, and this duty cannot be delegated or left to the discretion of the servants. The statute of Iowa provides that proper covers be provided overhead on mine cages to protect the employees and others who may be on the cage or in the shaft from injury from the falling of objects from above. A mining company or an operator of a mine cannot escape liability for its failure to provide such a safe place by leaving the operation of the mine without responsible care and oversight.

Poli *v.* Numa Block Coal Co., (Iowa) 127 Northwestern, 1105. Oct. 1910.

Construction of Gas and Oil Lease

A gas and oil lease provided for the payment of $100 yearly for each and every well drilled and from which gas was transported or used off the land and that the lessee should deliver to the lessor one-sixth of all the oil produced and saved from the premises. The lessee entered upon the premises and drilled six wells which produced both gas and oil. In an action on the lease and contract to recover the rentals it was held that the lessee could not fraudulently refuse to transport the gas from the premises for the sole purpose of defrauding the lessor out of the rentals, and that the payment of the royalty for the oil did not prevent a recovery of the royalty for the gas.

Pittsburg-Columbia Oil & Gas Co. *v.* Broyles, (Ind.) 91 Northeastern, 574. May 1910.

Personal

Professional men are invited to send news of their engagements and travels. Such news is interesting to friends.

S. F. SHAW is at Porcupine.

H. F. BAIN has gone to Juneau.

C. J. LONDON is in San Francisco.

KARL HOFMANN is in San Francisco.

E. B. KIRBY has been in San Francisco.

CHARLES JANIN has returned from Colorado.

GEORGE E. FARISH is in British Columbia.

E. A. HAGGOTT, of Los Angeles, is in Mohave county, Arizona.

NED J. CHURCHILL is superintendent of the Tennessee mine, at Chloride, Arizona.

R. D. GEORGE is recovering rapidly and will go East to recuperate, when able to travel.

JOHN DERN, president of the American Mining Congress, was in Washington June 15.

W. C. HALL, of Fairbanks, Alaska, is in San Francisco, and will go north again this month.

H. M. WILSON, chief engineer of the Bureau of Mines, visited Birmingham, Alabama, recently.

FREDERICK G. CLAPP has returned to Pittsburg, after a trip of six weeks in the Mexican oilfields.

MARION S. MACCARTHY, of Alamos, Mexico, was in San Francisco and has gone to Victoria, B. C.

WILL C. RUSSELL has returned from New York to Colorado, for the Rawley Mining Co., at Bonanza.

E. H. Messiter is now vice-president of the Electric Weighing Co. at 180 13th avenue, New York.

ROBERT E. CRANSTON has gone to Grangeville, Idaho, to examine the placers at Big Bend on the Salmon river.

JOSEPH A. HOLMES attended the annual meeting of the American Society of Mechanical Engineers, Pittsburg, June 2 and 3.

HOWARD POILLON has been appointed manager of the mines and oxide plant at Cutter, New Mexico, for the Vanadium Mines Company.

W. H. STORMS has returned to Berkeley from Tuolumne county, California, where he has been engaged in geological work on the Jumper and Golden Rule mines.

Obituary

NATHANIEL W. LORD, head of the Department of Mining and Metallurgy at Ohio State University, and former consulting chemist of the Technologic branch of the United States Geological Survey, died of heart failure on May 23. He was for years identified not only with the work in mining at Ohio University, but also with the fuel-testing work there, in which he set new standards for such work. A brilliant man of science, a powerful teacher, and a good citizen, he leaves many to mourn his going on before.

THE death of Dr. ROBERT W. ELLS, geologist of the Canadian Geological Survey, occurred at Ottawa on May 23, as the result of a paralytic stroke. He was born at Cornwallis, N. S., in 1845, and graduated from McGill University in 1872 with first-class honors. He joined the staff of the Survey in that year and spent the rest of his life in its service. Dr. Ells was a Fellow of the Royal Society of Canada, and of the American Geological Society, and represented the province of Ontario on the Corporation of Mc Gill University. He published numerous reports on the geology and mineral resources of the provinces, as well as many papers for scientific societies. He was best known in recent years for his work in connection with the problem of utilizing the oil shales of eastern Canada, his memoir published in 1910 being the standard authority on that subject.

Market Reports

LOCAL METAL PRICES.

San Francisco, June 22.

Antimony	12—12¾c	Quicksilver (flask)	46.50
Electrolytic Copper	14—15¼c	Tin	47—48¾c
Pig Lead	4.75—5.70c	Spelter	7—7¾c

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

METAL PRICES.

By wire from New York.

Average daily prices in cents per pound.

Date.	Electrolytic Copper.	Lead.	Spelter.	Silver, per oz.
June 15	12.45	4.45	5.48	53⅛
" 16	12.45	4.48	5.53	53⅛
" 17	12.45	4.48	5.53	53¼
" 18	Sunday.	No market.		
" 19	12.48	4.48	5.58	53
" 20	12.55	4.48	5.63	53
" 21	12.55	4.48	5.63	52⅞

ANGLO-AMERICAN SHARES.

Cabled from London.

	June 15. £ s. d.	June 22. £ s. d.
Camp Bird	1 10 6	1 11 6
El Oro	1 4 6	1 5 3
Esperanza	1 10 6	1 10 7½
Dolores	1 5 0	1 5 0
Oroville Dredging	0 6 9	0 6 9
Mexico Mines	8 10 0	8 5 0
Tomboy	0 15 6	0 18 9

(By courtesy of W. P. Bonbright & Co., 24 Broad St., N. Y.)

MINING STOCK QUOTATIONS—NEW YORK.

(By wire from C. S. Burton & Co., New York.)

	Closing prices, June 22.		Closing prices, June 22.
Amalgamated Copper	$ 69⅞	La Rose	$ 4¼
A. S. & R. Co.	81⅝	Mason Valley	9⅜
Braden Copper	4⅞	Miami Copper	22⅝
B. C. Copper Co.	5⅛	Mines Co. of America	5⅛
Butte Coalition	19½	Nevada Con	20
Chino	23⅞	Nevada Utah	¾
Davis Daly	1	Nipissing	10⅜
Dobie	2⅞	Ohio Copper	1½
Dolores	5⅛	Ray Central	1⅝
First National	1⅜	Ray Con	18
Foley O'Brien	1⅜	South Utah	⅞
Giroux	6⅞	Superior & Pittsburg	17⅜
Goldfield Con	6 1/16	Tenn. Copper	40⅞
Greene-Cananea	7⅜	Trinity	4⅛
Guanajuato Con	⅜	Tuolumne Copper	4⅜
Hollinger	15⅝	United Copper	2⅝
Inspiration	9	Utah Copper	50
Kerr Lake	5⅜	Yukon Gold	4

COPPER SHARES—BOSTON.

	Closing prices, June 22.		Closing prices, June 22.
Adventure	$ 6¼	Mohawk	$ 50
Allouez	30	North Butte	33¾
Atlantic	6⅛	Old Dominion	47⅜
Calumet & Arizona	59½	Osceola	105
Calumet & Hecla	475	Parrot	12
Centennial	12	Santa Fe	1¼
Copper Range	61¼	Shannon	11⅜
Daly West	5¾	Superior & Pittsburg	17
Franklin	12⅝	Tamarack	35
Granby	42¾	Trinity	4⅛
Greene Cananea, ctf.	7⅛	Utah Con.	18¾
Isle-Royale	17¾	Victoria	1¾
La Salle	3⅛	Winona	8¼
Mass Copper	9⅛	Wolverine	113

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

NEVADA STOCKS.

San Francisco, June 22.

Atlanta	$ .12	Mayflower	$ .04
Belcher	.60	Mexican	4.05
Belmont	6.07	Midway	.17
B. & B.	.38	Montana Tonopah	.77
Booth	.09	Nevada Hills	3.10
Chollar	.11	Ophir	1.92
Combination Fraction	.10	Pittsburg Silver Peak	.68
Con. Virginia	1.20	Round Mountain	.57
Florence	1.35	Sandstorm Kendall	.06
Goldfield Con	6.02	Savage	.21
Gould & Curry	.20	Tonopah Extension	.97
Jim Butler	.75	Tonopah of Nevada	6.02
Jumbo Extension	.23	Union	1.52
MacNamara	.20	West End	.49

(By courtesy of San Francisco Stock Exchange.)