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Mining Conditions in French Guiana

By Blanchard M. Snyder*

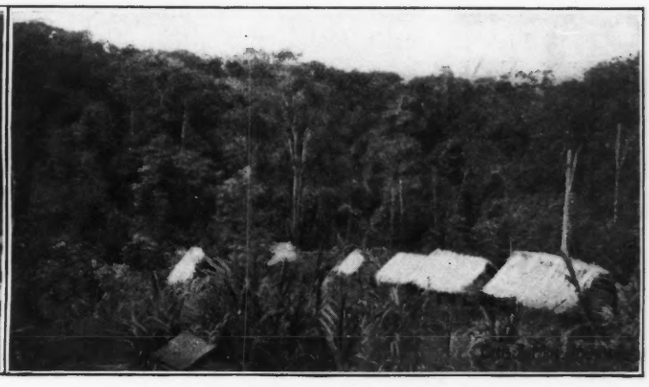
SYNOPSIS—Gold is the most valuable export of this French colony, but nearly all the production is made by native negro miners who work the placers, and where they fail, modern machinery operating under skillful technical control has not been able to make a profit. Dredging projects have not been successful as a rule, perhaps due to the abundance of clay associated with the gold. Fewer attempts have been made at quartz mining, and those few have failed.

French Guiana is the smallest South American country, having an area of a little over 30,000 square miles, about that of the state of South Carolina. It lies between 2° and 6° north latitude.

The Guianas were discovered by Columbus on his third voyage to the new world, in 1498. Early in the sixteenth century, stories of the riches of a mythical town in the center of Guiana, known as Manoa del Dorado, began to be circulated. This was the original *El Dorado,* and the stories circulated regarding it called attention to the country and its riches. In 1604, the first French colonists under La Ravardiere settled at Cayenne, and during the seventeenth and eighteenth centuries, numerous trading companies attempted colonization of French Guiana, the ventures usually ending disastrously.

In 1855, gold was discovered on the Approuague River, since which time mining has been the chief industry.

View on the Niana River



Mining Camp in the Bush

The Government Is Stable and Satisfactory

The capital is Cayenne, a city of 12,000 inhabitants, and here are the chief departments of the administration and the principal courts of law.

The red tape of officials is often annoying; a box of quartz samples sent to the United States required four hours and the signing of the sender's name 17 times in order to clear through the custom house. A copy of the certificate of assay of the samples, properly sworn to before a notary and viséd by the French consul, was also demanded by the officials.

The population comprises Europeans, negroes and mixed races, and is estimated at 49,000, of whom 12,000 are classified as "gold miners in the bush" and 6500 as convicts. In the Guianas, people of mixed European and negro blood predominate. Many of the officials of the government have negro blood in their veins. The gold miners in the bush are mainly negroes also, a few being former French convicts who are under parole. Many of the miners and prospectors are negroes from Barbados, Jamaica and other English-speaking islands.

With France there is a monthly service for mail and passengers on the steamships of the *Cie. Générale Transatlantique,* or the "French Mail," as it is called. The usual route from New York is via the boats of the Royal Dutch West India Mail, *Koninklijke West-Indische Maildienst,* which leave New York every two weeks for Paramaribo, Dutch Guiana, calling en route at Barbados and Trinidad Islands, and at Georgetown, British Guiana. The schedule is 11 days for this trip, which is generally

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pleasant and agreeable. At Paramaribo, there is a wait of a day to three weeks for the French Mail steamer to Cayenne, the capital and chief city of the colony. The first-cabin fare over this route is $90, New York to Cayenne.

Another way of reaching Cayenne is via Lamport & Holt or other steamship lines to Barbados, from which point an occasional sailing vessel leaves for Cayenne. There is also a steamer line to Cayenne from Trinidad, which point is reached by several lines from Europe and the United States.

The chief exportations, aside from gold, which forms over 95% of the value of the exports, are as follows: Rosewood, essence of rose, cabinet woods, coffee and balata rubber. In 1910, exports amounted to $2,241,700, while imports were valued at $2,370,800.

Mineral Resources

Gold is practically the only metal produced in the colony, but silver, copper, lead, iron and mercury ores are known to exist, though no attention has been given them as yet. Gold is found in the tributaries of all the river systems from the Oyapok to the Maroni. The chief production of gold has so far been from creek placers, most of it won by simple panning with the *batea* or by shoveling into sluice boxes. A few hydraulic and dredging installations have been made, not always attended with success. The placer deposits are largely in the creek beds or in bars alongside the streams, though a few buried channel deposits have been found. The overburden is from a few inches to several feet thick, overlying the pay which is usually found on a strata of clay or "glaze" on the bedrock. The pay gravel varies greatly in thickness, but in the creek deposits is usually not over a foot or two in thickness, but is often rich. In sluicing, the clay balls are broken up by native women working in the sluices.

Another type of placer deposit frequently found in the Guianas, though not as common as the stream placer, is the so called "alluvial" gold placer. These deposits are the result of long-continued, deep decay and erosion of gold-bearing rocks and veins, the final result being a residual concentration of the contained gold in a mantle of clayey earth or decomposed schist carrying limonite or other iron minerals. Such deposits are practically in place.

Much of the known placer ground within the explored area of the colony has been worked, and the opportunities for capital and improved methods are not so plentiful as might be supposed. Native mining methods have been criticized by some people, but as a rule they are well adapted to the peculiar conditions obtaining, and it is doubtful if American methods could be profitably substituted for them in many cases.

Foreigners seeking opportunities must usually undertake, with the aid of mechanical appliances, lower grade gravels than the negroes can handle, or open up deposits the latter have been unable to work, owing to excessive overburden, too much water to handle, etc. In the far interior, there is no doubt virgin country, but transportation is so slow and difficult that for the present, operations there cannot be considered by foreigners.

Up to date, little attention has been given to quartz mining, though there are numerous gold-bearing veins known to exist, many of them doubtless too low grade to work under present conditions. A few small quartz mills have, however, been erected and successfully operated for a time on high-grade ores.

Some precious stones, such as topaz, garnet and amethyst, are known; no diamonds have been found, though owing to their occurrence in British Guiana, their presence has been suspected.

The geology of the country has been little studied. Heavy alluvium and rank vegetation mask much of its area, leaving comparatively few rock exposures.

Granite, diorite and diabase are among the chief rocks, and there are large areas of metamorphic rocks, serpentine, gneiss, slates and schists (sericite, hornblende and amphibolite schists). In the latter series are found many of the gold veins and placers.

The production of gold during the following years has been:

	Kilograms gold	Estimated value
1905	3,130,295	$1,818,701
1906	3,583,354	2,081,928
1907	4,056,275	2,356,695
1908	4,470,675	2,597,462
1909	3,984,168	2,314,801

The total production of gold since its discovery in 1855 is estimated at over 120,000 kg., worth over $70,000,000.

Climate and Health

The climate is characterized by moderate temperatures and high humidity. The temperature is ordinarily between 78 to 86° F., with extremes of 68 and 95°. The humidity averages 90°. There are only two seasons, the wet and the dry. The dry season lasts from July to November or December, and during this period the recession of the waters of streams and swamp lands leaves much vegetable matter exposed to decay, which is largely the cause of the fevers prevalent in the interior. For this reason, the wet season is the more healthful and therefore a favorable time to enter the country.

The more prevalent diseases are malaria or intermittent fever and liver troubles resulting largely from the former malady. Even the negroes are subject to "chills and fever," and every foreigner will be attacked by malaria if he stays in the country any length of time.

Of 15 men whom I knew, who spent from two months to two years in the country, but two who were there only a few months escaped the fever, and one of these was operated upon for gall stones immediately upon his return to New York. Quinine is a specific for malaria, but as ordinarily taken it is not very effective. Administered hypodermically, a comparatively small amount suffices.

The methods used in Panama and other places for the prevention of malaria would no doubt be useful and enable foreigners to endure the climate, but the expense of cleaning up for a mile or more around a camp in the bush is excessive and not warranted until a mine is proved. Moreover, during the long and tedious passage up the streams to the gold fields, no such protection against inoculation is possible. Yellow fever has been rare in South America during recent years. Leprosy is occasionally found among the natives.

Sunstroke is a danger to be guarded against. The vertical rays of the tropical sun are dangerous to the unprotected head of a white man, and a few minutes' exposure has often resulted seriously. This trouble can

be easily avoided by invariably wearing a helmet when outdoors.

Food supplies of the kind used by Americans are not always easy to secure, especially when at a mine in the interior. Wine and rum or *taffia* are much used by the natives, but must be used in moderation by whites. A good man from the States, energetic and ambitious, usually works too hard at first and so reduces his vitality that he falls a prey to fevers, etc., while a man of lower ideals is likely to be affected by the low morals of the country and take to dissipation of various kinds, in which case he is of little use to an operating company.

Transportation within the Colony

Lack of suitable transportation facilities to the gold fields is to the miner a difficulty scarcely exceeded by that of the hostile climate. The only railroad in the colony is that between St. Laurent de Maroni and the penitentiary, eight miles distant. Several railroad lines have been proposed and reconnaisance surveys have been made, and the outlook is favorable for the early financing and construction of one of these lines.

There are only a few wagon roads in the province, and with one or two exceptions these are in such repair as to be well nigh impassable. Only two means of transportation to the mines are in use, namely, canoes on the rivers and creeks, and packing on the backs of negroes where the first method is impossible.

Natives Sluicing for Gold

Loading Canoes for Mines on the Maroni River

Supplies are loaded at the trading points near the mouths of the rivers, and the journey to the placers consumes from three days to upwards of three months, depending upon the distance, water conditions, etc.

The canoemen charge by the "barrel," provisions usually being sent in barrels or cases. A man is carried at the same rate as one barrel, and the charge, though varying greatly, averages five or six cents per mile per barrel.

Petrol launches and motor boats have been tried as a substitute for the native canoes, and where conditions were favorable, with success. Unfortunately, few mines are situated near the larger streams where their use is possible; numerous rapids in the rivers and low water in the creeks make the use of even a light-draft motor boat uncertain or impossible.

Many placers are situated some distance from navigable streams, in which event the last stage of transportation consists of packing supplies on the backs of negroes from the *degrad* or magazine at the water-side to the camp. A packer will carry a load of 60 to 90 lb. at an average cost per pound of 0.3c. per mile, which, though a reasonable charge, adds materially to the cost of supplies at many camps.

Native Labor Plentiful and Cheap, But Inefficient

Except for an occasional foreign miner or mechanic, the only labor available is the negro. On placers, negro miners are satisfactory, but they know little or nothing of underground mining or mechanical appliances. It is doubtful if there are 50 skilled underground miners among the native population of French Guiana. Under close supervision, the negroes make satisfactory muckers and laborers, but on work requiring skill or initiative it is the exceptional man who can be trained to fill the place.

Owing to sickness or other causes, from 20 to 30% of the natives are ordinarily off duty, so that a proportionate additional number of men must be carried on the payroll to insure a full working crew. Negroes receive rations and a daily wage of from 2½ to 8 francs, according to the work. The usual wage is 3½ to 5 francs, to which must be added the cost of rations, as prescribed by the government; an average figure for these would be approximately 1.8 francs (35c.) per man per day.

It is usual to engage the men at outfitting points on the rivers, and, as they are usually without means, advances are made to them for the purchase of clothing, etc., and losses frequently occur through desertions of shiftless negroes on the way. This of course leaves the superintendent short of men when he arrives at his camp. The substitution of white miners from the United States for the unskilled natives would in most cases be of doubtful expediency, owing to the expense of importing them and the high wages demanded by competent men, added to the probability that they would give satisfactory service during a brief campaign only, before being attacked by fever or otherwise incapacitated.

Mining Laws Good, But Taxes High

The mining industry being the principal one at this time, it naturally bears a large proportion of the expense of maintaining the government. In addition to the taxes on supplies imported and the tax on mining concessions, which last is low, the miner must pay an export tax amounting to nearly 8% of the value of gold produced. This tax is placed at 226 francs per kg. of gold dust and 238 francs per kg. of gold in the form of bars. Taxes are thus seen to be a serious item in the

cost sheet of any producing mining company in the colony.

The mining laws provide for the acquisition of title to the minerals on an ytract of land in two ways, as provided by the *Décret* of Mar. 10, 1906. The prospector is expected to be provided with a permit or license to prospect, which gives him the right to prospect for minerals or placers on any public lands, such license being renewable annually by payment of a small fee (50 francs). Having found mineral of value, he can then protect his title to same in one of two ways:

(1) If surface placer, by the taking out of a "Permit for Exploitation of Placer" (*Permis D'Exploitation de Placer*). This must cover a rectangular area of not less than 10 nor more than 250 hectares. A hectare equals 2.47 acres. The rectangle must be marked by corner posts, upon which notices of location must be posted, and by cutting a line one meter wide through the bush around its perimeter. Application for such placer permit, accompanied by the annual tax of one franc per hectare, must be filed with the Mines Department.

(2) If for underground minerals or quartz veins, by taking out a mining permit (*Permis de Recherche*), to be followed later by a mining concession (*Concession de Mine*). The mining permit gives the holder the exclusive right to prospect and explore for certain minerals named in such permit, within a circle having a radius of 2 km. (1.24 miles). The actual location is made by driving a signal post at the center of the circle and posting a notice of location, etc., thereon. Upon payment of 40 centimes per hectare, and the proper recording of the application, a mining permit good for one year will be issued, and same may be renewed not more than twice, upon payment of an annual tax.

Before the expiration of such permit, a mining concession should be applied for, covering a rectangular area at least two-thirds of which must lie within the limits of the circle. Such concession is limited to a minimum of 200 hectares and a maximum of 1,000 hectares, and it must be surveyed and accurately described and monumented. Upon application and payment of the necessary fees, the chief of the department will verify the plans and will publish the application in the official journal of the colony, after which, if not contested, the governor, in privy council, grants the concession, which may, however, still be contested at any time within six months. Such a concession is renewable indefinitely upon payment of an annual tax of 60 centimes per hectare, but exploitation must be commenced within 10 years.

Foreign corporations cannot acquire mining property, hence must hold title through an agent or by acquiring title in the name of a holding company organized under the laws of France.

Vertical side and end lines are used, there being no extra-lateral rights in the case of quartz veins.

Mining Operations

The larger part of the gold produced has been won by native miners (working singly or in parties), using bateas, rockers or sluice-boxes. They outfit at some trading post near the coast, and in canoes work a tedious passage up the rivers and creeks, prospecting as they go, until gold-bearing gravel is found, which may be at some distance from any navigable stream. In many cases, months are required to reach the ground to be worked, and when supplies give out, or the dry season cuts off the water supply, operations cease and the party returns to the coast with the gold. Formerly, such operations were often exceedingly profitable and some negroes have taken out fortunes, but the easily accessible creeks have been so thoroughly worked over that the native miners now have difficulty in finding gravel that will pay for working by their methods.

These miners, or "marauders," as they are called, seldom own the placer ground they work, nor do they take out a license to prospect. If word of a strike of importance gets out, the miners flock in from all directions and all work feverishly until the pay is exhausted. Sometimes a merchant or other man of means will take a concession covering the ground, but this does not necessarily mean that the "marauders" are driven off. As a rule, they are allowed to continue, either by payment of a small royalty or on condition that they purchase all supplies from the merchant.

In the usual way of working, the miners shovel the gravel into sluice-boxes, native women being used to break up the clay, etc., in the sluices. By such means, the larger part of past and present production of gold has been won. During recent years, a number of foreign companies, mainly French corporations, have attempted to enter the field. Owing to the difficulties elsewhere enumerated, most of these ventures have been unprofitabl. One of the successful companies, however, and the only one using hydraulic mining, is the "Cie des Mines d'Or de la Guyane Hollandaise," operating on both sides of the Maroni River, in both Dutch and French Guiana. Owing the generally unfavorable topography of the placer districts, hydraulic mining as practiced by this company is seldom practicable.

Another successful company is the "Societé Anonyme des Gisements d'Or de Saint Elie," which owns the Saint Elie concession on Creek Tigre. The company formerly operated rich placers and a five-stamp mill on quartz, but the property is now closed down except for lessees on the creeks. This company is a large stockholder in a company known as the "Societé des Mines d'Or D'Adieu-Vat et de Bonne-Aventure." The latter owns and until recently has operated a quartz mine and 20-stamp mill at Adieu-Vat, near the Sinnamarie River and due east of the St. Elie.

The annual report for the year ended June 30, 1910, showed 3403.5 metric tons milled from one vein, producing 145.769 kg. of gold worth $83,337, or an average of 42.82 grams per metric ton ($24.44), the vein averaging 16 in. wide. From another vein, 4405 metric tons produced 43.007 kg. of gold, worth $24,587, or an average of 9.76 grams per ton ($5.58). The operations for the year resulted in a loss of 54,606 francs ($10,583). The average number of men employed was 202. Operating expenses and the cost of equipment at mine and mill, from the organization of the company to June 30, 1910, and the production of gold for the same period are given as follows:

Total expenses	4,039,640.74 francs
Total production gold	2,272,789.88 francs
Difference	1,766,850.86 francs

Or approximately $342,413.

It is evident that results at this, the largest quartz mine and mill in the colony, have not proved profitable, and the property is now idle, except for leasing operations on the creeks.

During 1911 and 1912, an American company undertook to reopen the Kokioko mine, near the St. Elie. This extremely rich placer was discovered by natives in 1907 and produced heavily for some time, but the pay dipped into the hill and the owners were unable to work it by open-cut methods. Owing to excess of water combined with the saprolitic character of the formation overlying the pay, creating a condition similar to that of quicksand, all efforts to reach the pay met with failure. During 1913, a French company undertook the same project, also without success, according to recent information.

A number of companies have attempted dredging, and some technical successes have been attained in recent years, although the difficulties encountered have not been slight. The first satisfactory installation was made by D. Levat, on the Courcibo River, but the dredge was sunk during a flood. The South American Goldfields, Ltd., built a 2-cu.ft. bucket dredge on the Elyseé Placer, on Lezard River, in 1905, and though defective in design, it operated profitably on 90c. gravel for some time. Later a dredge with 3-cu.ft. buckets was installed by the same company.

Dredging has also been tried on the upper Mana River by the "Syndicat Mana," with results said to be satisfactory. Also on the Maroni above the Inini River, there is said to be a successful dredging operation. On the Sinnamarie and Approuague Rivers, drilling has been done on possible dredging ground.

In the Guianas, dredging operations encounter many problems; transportation of heavy machinery in canoes or possibly overland to the dredging field is one; the removal of the heavy vegetation, tree trunks and roots is another. Insects attack wooden hulls, and hence steel hulls are necessary; skilled labor is difficult to secure and expensive, and the tropical climate and the hardships and diseases that go with it make such labor undependable.

Steel Production in Canada

Steel production in Canada for the year 1913 is reported as follows, the figures being collected and reported by the American Iron & Steel Association:

	1912		1913		Changes
	Tons	%	Tons	%	Tons
Bessemer	207,569	24.3	273,391	26.2	I. 65,822
Openhearth	645,062	75.6	768,663	73.7	I. 123,601
Electric and special	400	0.1	449	0.1	I. 49
Total	853,031	100.0	1,042,503	100.0	I. 188,472

Of the total in 1913, there were 1,006,149 tons ingots and 36,354 tons direct castings. Of the castings 32,101 tons were openhearth, 3809 tons bessemer and 444 tons other steel. There were 1582 tons of alloy steel. There were six works in 1913 making steel ingots and 13 works making castings. Seven plants make ingots or castings of bessemer steel, eight openhearth steel, two electric steel and one special steel. All the openhearth steel was made by the basic process.

The production of steel in Canada has increased rapidly, as is shown by the following table which gives the make for 10 years past in long tons:

1904	148,784	1909	678,751
1905	403,449	1910	741,924
1906	570,889	1911	790,871
1907	646,754	1912	853,031
1908	509,957	1913	1,042,503

Of the steel made last year, 424,121 tons were made in Nova Scotia, 596,555 tons in Ontario, 21,827 tons in Quebec and British Columbia.

Finished Iron and Steel

The production of finished iron and steel in Canada for two years past has been as follows, in long tons:

	Rolled		Forged	
	1912	1913	1912	1913
Steel	752,212	871,216	21,548	20,827
Iron	109,012	95,881	867	2,578
Totals	861,224	967,097	22,415	23,405

The total production of iron and steel cut and wire nails in 1913 was 1,520,000 kegs of 100 lb. each, an increase of 30,000 kegs over the preceding year.

In 1913 there were 33 works which made finished forms of iron and steel, of which 21 were rolling mills. Three new plants were built during the year, and three others were under construction at the close of the year.

The most important item of finished material in 1913 was rails, of which 506,709 tons were rolled, being 52.3% of the total. All these rails were of steel.

The Rand's Ore Reserves

By A. Cooper Key*

The Rand relies to a great extent for its stability of output and profits on the enormous advance development of its mines, some of which have millions of tons of ore opened up, i.e., exposed by driving or winzing on three sides of the blocks of ore. Pride of place is held by the Crown Mines consolidation, which can crush 200,000 tons per month. It has 10½ million tons available for attack, the value of which is not less than 15 millions sterling. The value of the whole is about 1s. per ton less than at this time last year. Of the two other big combines, the East Rand Proprietary has fallen off 410,000 tons, owing largely to the scarcity of labor in the second half of the year. On the other hand, the amalgamation of the West Rand, the Randfontein Central, has been able to increase its "stock in trade"—for so one can style the ore in sight—by 470,000 tons, although the grade is somewhat lower. The great coming mine of the Central district, the City Deep, whose output and profits will go toward balancing those of the Robinson, which will shortly decline owing to impending exhaustion, increased the unit value of its reserves by 1.3 dwt., the figure now being given at 10 dwt. It has gold to the value of 4½ million in sight, of which quite 2¼ million may be regarded as profit.

Most of the companies now declare their reserves on the mining-tons basis, instead of on milling tons as formerly; this tends to increase the aggregate, but to lower the value. The change was decided upon owing to the fact that variations in labor supply have a bearing on the percentage of rock it is feasible to discard. Hand stoping by the Kafir laborers permits of narrower widths; machine work involves the breaking of more waste; this would admit of greater sorting percentage, but not in proportion, as more unsortable fines are produced under machine conditions owing to the greater shattering of the rock. There are about 9450 drills in commission on the Rand, as compared with 5900 at work, a large proportion being under repair at any given time. In mines with comparatively flat orebodies and reasonable widths of reef, machine drills do well, but where the inclination is a steep one, as for example, at Randfontein and the East Rand Proprietary, the reports of their work are not so favorable.

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In the far East Rand district, the showings of the four "Modder" companies—they all have that curious Dutch word somewhere in their title—reflect great activity; the senior company, the New Modderfontein, had added 650,000 tons to reserves up to the end of its fiscal year, since materially increased; the younger Modder B is 200,000 tons to the good, the value of the entire reserve having increased by over 1 dwt. In these mines, the policy of opening out in big blocks has been adopted with great success. Exclusive of the charge of 1s. 6d. per ton for development redemption, these mines are being worked at the low figure of 14s., say $3.35 per ton. In this area there are three mines in the development category. The Modder Deep has opened out a million tons of 7-dwt. rock; the Modder State, the first and so far the only mine worked under the Government-lease scheme, 560,000 tons of 6½-dwt. ore, but this is likely to improve so soon as the better ore of the southern section enters with the average. Springs Mines is not sufficiently developed to permit of estimating its payable ore reserve. The Van Ryn Deep, another mine in this vicinity, started crushing in July and paid its initial dividend in December; it has nearly 700,000 tons additional to the credit of its ore reserves, but, more striking and important still, the value of the entire tonnage is 1½ dwt. higher. The recovery is estimated at 35s. per ton, say $8.30, about half of which may be reckoned as profit.

From the tables attached, it will be seen that no less than 30 of the Rand producing companies have each over a million tons of ore in sight, some considerably more. A general survey of the position shows that in spite of the industrial disturbances of July, followed by a shortage of the "essential Kafir" labor, the ore reserves have been well maintained. The extractable value of the aggregate may be estimated at £150,000,000. The tonnage of 115,000,000 represents about one-fifth of the entire quantity of payable rock in the producing mines, and about five years' consumption for the mills at existing rates.

TONNAGES, VALUES AND STOPING WIDTHS OF THE RAND MINE RESERVES

Producing Companies	As at December, 1912			As at December, 1913, or Latest Date		
	Tons	Dwt.	In.	Tons	Dwt.	In.
Aurora West	556,163	5.1	43	554,909	5.7	..
Bantjes Con.	840,800	7.0	41	974,700	6.3	42
Brakpan	2,457,000	6.74	61	2,224,000	6.7	61
City Deep	2,123,650	8.7	..	2,167,650	10	42
Cinderella Con. *e*	573,000	6.7	..	613,000	6.35	..
partial	304,000	...	..	partial 231,000	....	..
City & Suburban	773,300	8.4	55	786,500	8.3	..
Con. Langlaagte	2,069,630	*a*6.4	..	2,194,400	*a*6.4	..
Cons. Main Reef	610,680	7.2	..	614,470	7.32	48
Crown Mines	10,607,670	7.1	62	10,449,000	6.82	63
Durban Rood. Deep	1,306,100	6.9	..	1,312,700	6.7	47
East Rand Prop.	6,013,000	6.8	54	5,600,000	6.7	54
Ferreira Deep	2,070,900	9.4	61	1,974,400	8.7	68
Geduld Proprietary	*c* 1,475,000	6.98	53	1,757,000	6.9	58
	116,000	5.79	53	106,000	6.3	59
Geldenhuis Deep	1,904,700	6.3	49	1,669,500	6.4	49
Ginsberg	346,681	*a*6.9	..	312,540	*a*6.0	..
Glencairn	761,000	*a*3.5	..	587,920	*a*3.6	..
Jupiter *e*	1,270,000	*b*4.4	..	1,273,000	4.5	..
partial	101,000	4.0	..	161,000	4.1	..
Knights Central	647,000	6.1	62.5	539,100	6.0	60
Knights Deep	1,477,400	4.47	..	2,777,000	4.3	..
				partial 259,000	3.7	..
Langlaagte Estate	1,370,639	....	..	1,512,360	....	..
Luipaardsvlei Estate	500,471	5.7	..	581,800	5.5	..
Main Reef West.	685,720	6.3	..	591,830	6.02	55
May Consolidated	133,000	6.64	52	61,350	6.33	..
(pillars)	25,000	8.49	53	20,700	9.9	..
Meyer & Charlton	341,745	12	..	471,844	11.7	..
Modder B	2,594,000	7.2	54	2,800,400	8.3	55
New Goch	957,600	5.1	89	917,088	5.16	..
New Heriot	590,742	8.1	46	581,124	8.1	46
New Kleinfontein	1,190,663	7.59	46	*c* 1,658,481	6.3	59
New Modderfontein	3,900,000	8.1	..	4,547,000	8.1	..
New Primrose	413,033	*a*6.5	..	401,045	*a*6.2	..
New Rietfontein	135,887	*a*6.5	..	51,737	7.55	..
	130,107					
New Unified	275,028	*a*6.4	..	387,500	*a*5.9	..
Nourse Mines	1,969,000	6.6	..	1,795,600	6.6	..
Princess Estate	637,000	7.24	27.7	614,000	7.2	28.6
Randfontein Central	6,350,781	6.8	..	*f*6,818,929	6.5	..
Robinson	1,130,600	11	75	.....	....	..
Robinson *d*	242,500	....	..	.....	..	..
Robinson Main R.	1,160,800	4.3	..	.....	..	..
Rose Deep	3,695,100	6.1	56	3,828,400	5.8	56
Robinson Deep	1,114,000	6.7	..	*c* 1,538,000	6.0	..
				partial 346,000	5.88	..
Roodepoort United	379,283	5.08	41	370,732	5.3	45
partial	100,000	6.34	38	189,000	5.4	45
Simmer & Jack	2,680,000	6.2	..	*c* 2,524,000	5.4	..
partial	438,000	5.3	..	partial 406,000	4.7	..
Simmer Deep	1,575,000	4.2	..	1,670,000	4.3	..
Van Ryn	2,154,000	6.4	..	2,064,500	6.5	..
Van Ryn Deep	1,278,003	7.1	51	1,953,845	8.6	55
Village Deep	2,235,300	6.9	52	*f* 2,662,600	6.6	60
Village Main Reef	1,418,750	8.8	..	.....	..	..
West Rand Cons	1,116,733	6.02	49	1,364,956	6.16	..
partial	326,500	....	..	partial 213,360	....	..
Witwatersrand	1,331,540	*a*6.1	..	1,225,688	*a*6.4	..
Witwatersrand Deep	1,492,257	6.83	50	1,666,000	6.8	50
Wolhuter	832,977	6.48	50	784,100	6.1	51
Developing Cos.						
Apex	496,438	6.18	59	496,438	6.18	59
Govt. G. M. Areas (M)	.....	....	..	559,500	6.6	50
Modder Deep	.....	....	..	982,000	7.0	75
				partial 191,000	10.5	62

a Estimated recovery value. *b* Mine grade. *c* Mining tons instead of milling tons as previously. *d* Old workings, stopes and shaft pillars. *e* Crushing suspended. *f* Figures not available.

Ontario's Mineral Production for Half Year

The statistics of Ontario's metal production for the half year ended June 30, have been compiled by the Bureau of Mines. As in most other industries, the production as a whole for the half year shows a decrease. However, there is likelihood of the gold output being increased in the near future, as trade depression does not affect the "market" for this metal.

ONTARIO METAL PRODUCTION FOR HALF YEAR ENDED JUNE 30

Product	1914 output	1913 output
Gold, oz.	99,269	2,171,147
Silver, oz.	13,379,044	7,693,713
Copper, tons	8,357	832,645
Nickel, tons	13,105	2,514,414
Iron ore, tons	47,160	141,324
Pig iron, tons	343,408	5,051,840
Cobalt, tons	129	7,374
Cobalt and nickel oxides, lb.	757,268	186,347

Charges for Wasting Slag

Railway carriers serving the Pittsburgh, Wheeling, Youngstown and Cleveland districts on Aug. 15 filed tariffs proposing a charge of 20c. per net ton for wasting or disposing of furnace slag, flue dust, refuse, etc., and 35c. a net ton for ashes mixed with refuse, brickbrats, dirt, etc. Unless overruled, tariffs will become effective Sept. 15.

Tariffs state that the minimum weight per car will be 80% of the marked capacity, actual weight to be charged for in excess of the minimum; that $25 per car will be charged shippers if material cannot be unloaded by hand, and that no allowances will be made for spotting or switching cars.

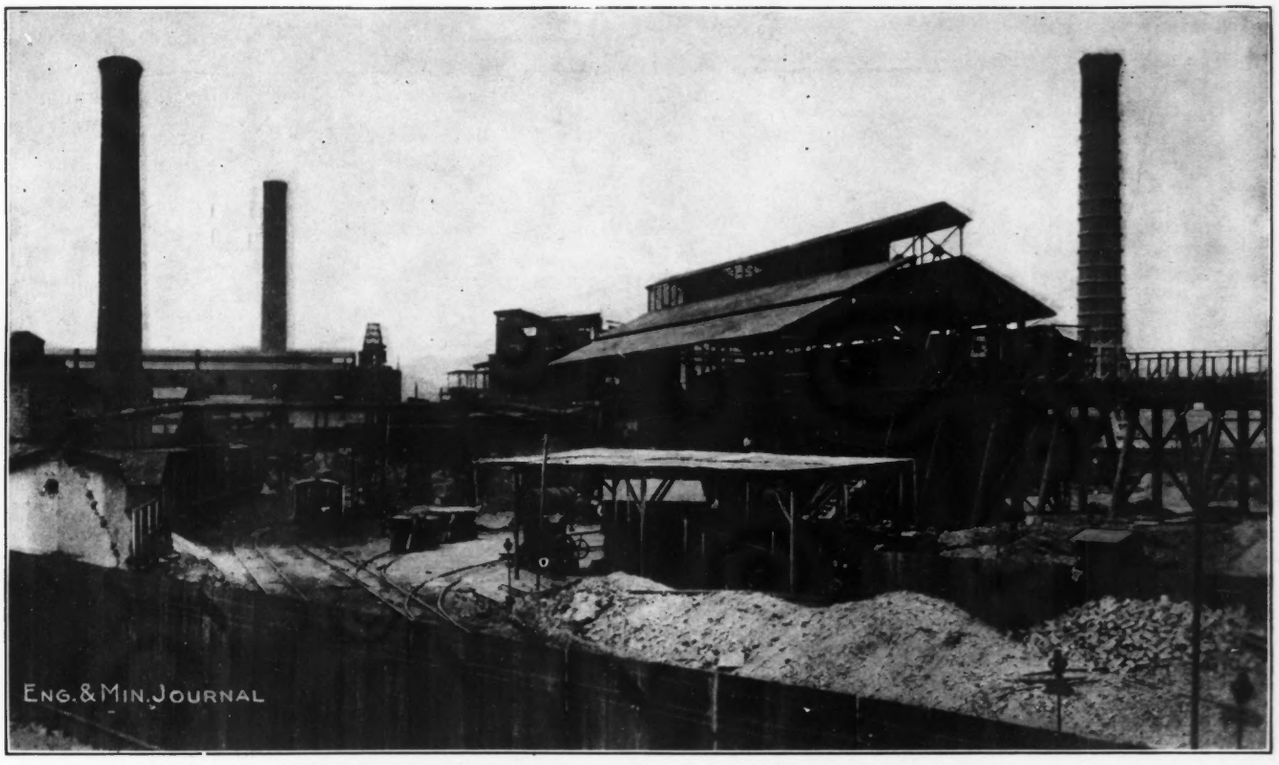
Furnace slag has been hauled gratis. It is used largely for filling purposes, and has been used to a great extent for filling railroad yards, extending switches and filling track beds. Furnace owners will oppose the effort to establish these charges. They will also, it is said, make a charge to the railroads for any slag or ashes used by them for their own work.

The El Paso Smelting Works--II

By Richard H. Vail

SYNOPSIS—Copper smelting has come into the ascendant at El Paso since the development of copper properties in that region, particularly the Chino operation. The new copper department at El Paso comprises eight Wedge roasters, three 19x100-ft. reverberatories and three basic-lined converters, two of which are Peirce-Smith and one the Great Falls type. Besides this equipment, there are two old 40x144-in. blast furnaces. The most interesting feature of the copper plant is the craneless converter department.

The present copper-smelting department of the El Paso Smelting Works owes its existence to the taking of the contract to smelt the Chino concentrates. Originally copper ores were smelted at the El Paso works with the lead-matte concentration runs, but as the supply of copper ores grew, furnaces were especially allotted for this purpose. The two 40x144-in. copper blast furnaces that have been in commission for about 10 years, are in the same building with the lead blast furnaces, but new buildings have been provided for the Wedge roasters, reverberatory furnaces and converters added since the smelting of Chino concentrates was undertaken. The new copper department is noteworthy in that it is the only works of importance in the United States that operates a converting department without an overhead traveling crane.



The Copper Department of the El Paso Smelting Works

Copper Blast Furnaces

The blast furnaces have double-tier jackets and eight 3½-in. tuyeres on a side. A cast-iron breast jacket is used, and a water-jacketed copper spout with cast copper nose, trapping the blast 8½ in. The settlers are 14 ft. in diameter and a cast-iron tapping block is used. About 30-oz. blast pressure is carried, and a charge column of 10 ft. Normally about 4½% of flue dust is made About 11% of coke is used and an average tonnage of 278 tons, or nearly seven tons per square foot of hearth area, was maintained during a recent month with the following slag: SiO_2, 38.2; FeO, 26.6; MnO, 0.8; CaO, 24.2; ZnO, trace; Al_2O_3, 8.4; Cu, 0.39%; Ag, 0.1 oz. The copper on charge amounted to 7.7%, and the sulphur on charge was 9.8%. The matte fall averages about 15% and the grade of the matte for the above month was 47.4%.

The matte is tapped into pot cars brought in on a depressed track by the dinkey locomotive that serves the converters. Recently an auxiliary settler, 12 ft. in diameter and covered with a domed roof of silica brick, has been tried as an experiment in slag disposal for both the copper and lead furnaces. This settler is oil-fired and consumes about four barrels of oil per day. Little matte has been caught in the second settler, its chief value at the copper furnace being in reducing the expense of slag disposal. The auxiliary settler is tapped for slag at intervals when convenient for the slag-hauling locomotive and in this respect involves no extra expense over slag-hauling from the Rhodes separator furnace to which the lead slag is regularly taken. This auxiliary-settler system may be extended after further trial, instead of adopting the more usual plan of spur tracks, which would involve tunneling and tracks of short radii.

Large Tonnage in the Wedge Roasters

In the copper-roasting department there are eight 22-ft. Wedge water-cooled roasters, which have three roasting hearths and a drying hearth on top. These are oil-fired on account of the low sulphur contents of the concentrates; about 0.2 bbl. of oil are used per ton roasted. With the low desulphurization a large tonnage is obtained from the Wedge furnaces which averaged 140 tons per day during a recent month; as much as 180 tons have been put through in a single day. The sulphur in the concentrates averages from 13 to 16%, and in the calcines, from 9 to 11%. The concentrates are brought to the roaster department in small tram cars which dump into a bucket-elevator delivering on a 20-in. conveyor belt and tripper feeding the roaster hoppers. The calcine hoppers are comparatively small and provide little storage; some inconvenience is felt thereby, owing to the long interval between reverberatory charges.

The gases from the Wedge roasters and the copper blast furnaces pass into a brick flue having a cross-section, 10x15 ft., which later enlarges to 16x20 ft., with hopper bottom; one wall of the copper flue for about 600 ft. forms a common wall with a flue 10x17½ ft. for the lead-furnace gases. These flues unite about 100 ft. from the main stack, which is 225 ft. high and octagonal in cross-section, the least diameter being 14 ft. 8 in. There are discharged from the stack about 300,000 cu.ft. of gases per minute, at a temperature of about 270° F.; the gases consequently have a high velocity.

Reverberatory Furnaces

There are three reverberatory furnaces, 19x100 ft., the waste gases from which are utilized by seven 400-hp. Erie vertical water-tube boilers. The reverberatories are oil-fired and smelt an average of 300 tons per day. The tonnage has been as high as 398 tons of solid charge for a period of 10 days. Oil burners are used and air is supplied to the burners at 15-lb. pressure. One of the furnaces has openings above the burners to admit excess air. The oil consumption is about one barrel per ton of charge smelted. The matte usually contains from 42 to 45% copper, but at periods has been as high as 55%. The reverberatory slag is removed in 50-cu.ft. pots, hauled by a 20-ton coal-fired locomotive. The flues over the skimming doors leading to the boilers are sheathed with sheet asbestos to keep the heat off the men while skimming.

Fettling of the reverberatories is done with high-silica, copper-sulphide ores, averaging SiO_2, 70%, Fe, 2; S, 3; Cu, 7%. The fettling is thrown in from the side doors except at the bridge, where there are fettling hoppers that permit the material to be dropped through the roof. While the fettling material has a tendency to slough off into the furnace, no great difficulty is experienced with the fluxing of the side walls. The No. 2 furnace, with some small repairs, ran for 14 months before the side walls required renewal.

A Craneless Converter Department

The converting department is unique among large smelting works in that it was built to operate without an overhead traveling crane. All matte and other material fed to the converters is brought to the feed floor by 20-ton coal-burning locomotives on an elevated track that serves both the converter and the reverberatory feed floor; the converter slag and copper are likewise transferred by dinkey locomotives on a track below the converter operating floor.

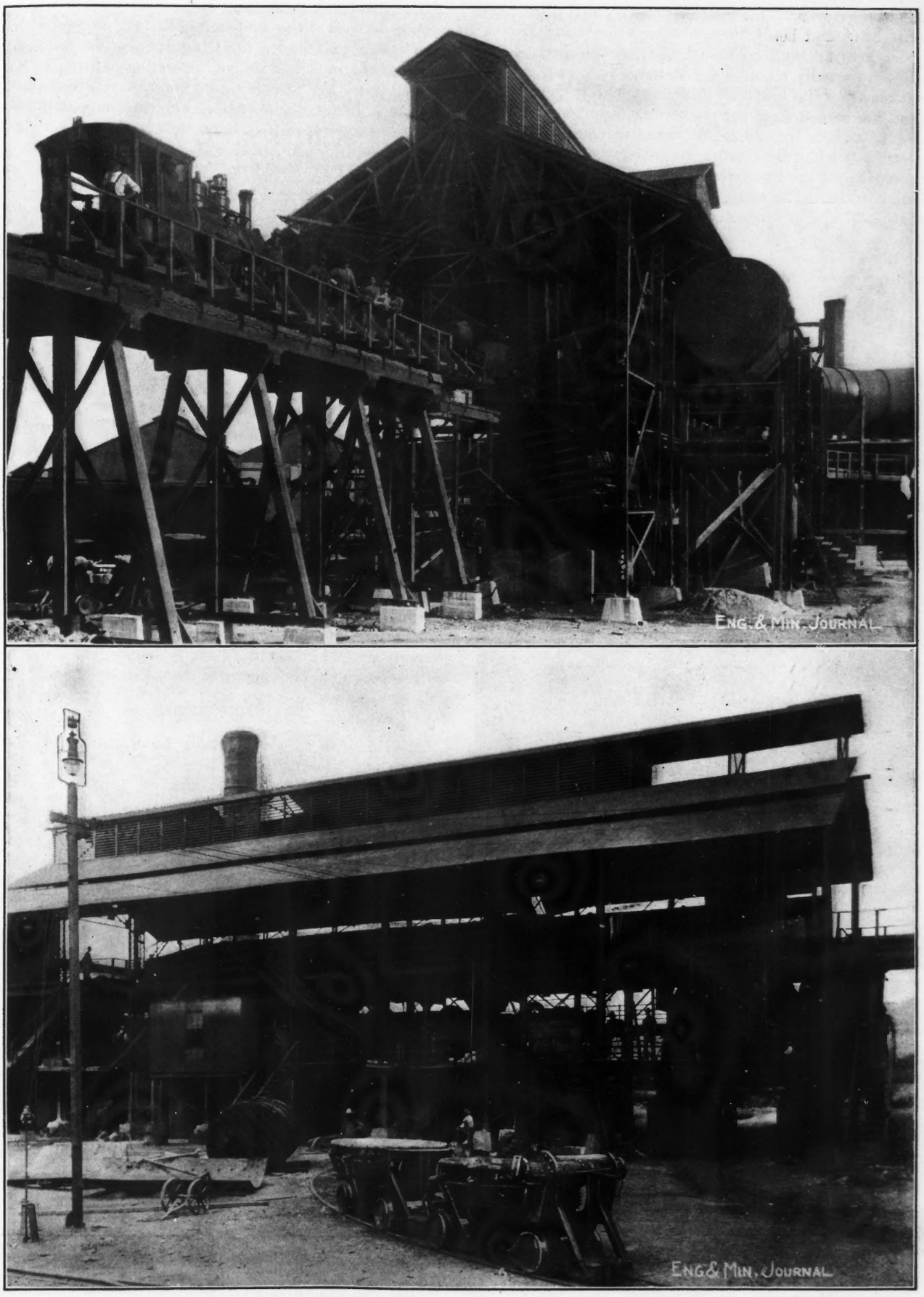
The operation of a converter department without an overhead crane is a novelty that on short observation does not commend itself greatly to one accustomed to a crane-served plant. The converter department here when in full operation employs a locomotive and crew for the slag haulage, and another for matte and bullion. The locomotives operate on a switchback having a length of 850 ft. and a grade of 2%. In transferring slag to the reverberatory feed floor, it is necessary to disturb the flux cars over the converters; before leaving the building, these must be replaced. Also, it may easily be surmised that at night it is difficult to secure prompt service from locomotive crews that are outside of the building, and possibly one-sixth of a mile away. In the craneless plant, however, there is a great saving in first cost, and where there is ample converter capacity and cheap labor, it might be accepted as a substitute for the usual equipment.

The converter department originally comprised two 10x26-ft. Peirce-Smith converters, but these were supplemented last year by the addition of a 12-ft. upright converter, made by the Power & Mining Machinery Co. The converter department, when in full operation, produces about 8,000,000 lb. of copper per month. About 7000 tons have been obtained per lining from the Peirce-Smith converters; the upright converter at the time these notes were taken had not been in use long enough to have had representative runs. The upright converter gave more trouble from slopping, probably on account of the comparatively shallow distance, 10 in., from tuyere line to the bottom of the "saucer;" this distance has since been extended to 13 in. and better results have been obtained. The No. 2 Peirce-Smith converter was last year completely relined and 1½-in. tuyere pipes were used in place of 1¼-in. pipes formerly employed.

Air is supplied to the converters at from 10 to 15 lb. pressure and about 160,000 cu.ft. of air are used per ton of copper. Matte in 6- to 10-ton hand-tilted ladle cars is hauled by a dinkey locomotive to the upper floor of the building and tilted into the converters. The silica flux for the converters is brought to the upper floor in larry cars, which, when in position, feed directly into the converter. However, when silica is desired, it is necessary to send a man to the upper floor to open the car gate. The slag from the converters averages SiO_2, 23.5%; Fe, 50.8; Cu, 1.7; Ag, 0.25 oz. The Peirce-Smith converters are equipped with oil burners to keep the charges hot in case of delay. Little difficulty is experienced here with converter collars, owing to the fact that the converter mouths are built up with clay, and that there is little slopping. Since the converter department has no crane, the avoidance of bad converter collars is a necessity at this works. This may not permit of running the converters at so high a capacity as at some plants, but it may be questioned whether more time is required for "mudding" the converter mouth than for pulling a bad collar.

Copper-Casting Department

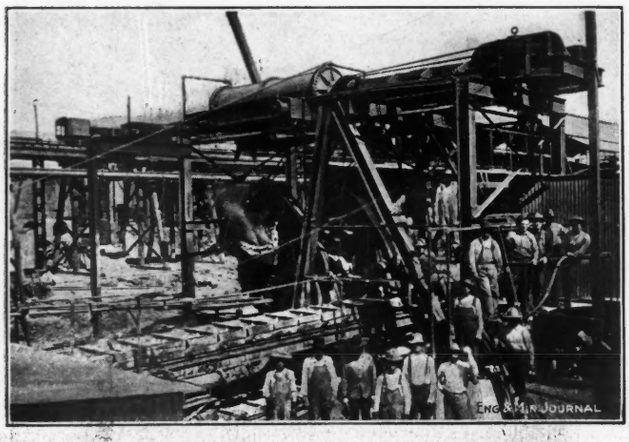
The copper from the converters is poured into a cylinder 6 ft. in diameter by 9 ft. long, mounted on two



TWO VIEWS OF THE CRANELESS CONVERTER PLANT AT EL PASO

The converter feed floor is served by coal-burning locomotives operating on a trestle and switchback 850 ft. long.

four-wheel trucks. This pouring ladle is lined with magnesite brick and holds 20 tons when clean; they have a tendency to fill up even though they are oil-fired. Two ladles are usually required for a charge of copper, which is taken from the converter in from 20 to 30 min. The ladles are hauled from the converting department to the casting machine by locomotive; when in place, the pouring ladle is lifted by a hydraulic tilting device so that it revolves about the tip of the spout, which remains in the same position. The hydraulic cylinder for operating the ladle is 36 in. in diameter by 11 ft. long and receives water at 190- to 200-lb. pressure. From the ladle spout the copper stream is received in a hydraulically operated pouring spoon from which it is delivered into cast-iron molds on a straight-line casting machine. This is hydraulically operated, and the average pouring speed is about 2½ bars per min. The cast-iron molds are reinforced on the back with a steel plate. An overlapping lip on the molds prevents the spilling of copper and the formation of fins; little trimming of the bars is necessary. The collection and pouring of the copper do not appear to be so expeditiously done as in a crane-served plant; for example, as at Hayden, where a larger



COPPER-POURING CYLINDER AND CASTING MACHINE

pouring cylinder capable of receiving several converter charges is used; the larger pouring cylinder also gives less trouble from incrustations.

POWER-HOUSE EQUIPMENT

The equipment at the power house includes two Erie City 400-hp. horizontal water-tube boilers and three Cahall 300-hp. boilers of similar type. These boilers are used when the five reverberatory waste-heat boilers are out of service for any reason. The oil consumption in the power-house boilers during a typical month was only 1188 bbl. Figuring a 30% utilization of the oil burned in the reverberatories, the water evaporated by all boilers for the above month was 7.83 lb. per pound of coal (oil equivalent) and the water evaporated per horsepower-hour was 28.4 lb. The temperature of the feed water was 160° F. and the steam pressure 135 lb. The indicated horsepower required for the works, on full-time basis for all equipment, is about 1200 hp. All steam engines in the power house are run condensing, two Wheeler condensers being used and a vacuum of about 19 in. maintained. In a typical month, 13,100,000 lb. of exhaust steam at 192° F. were condesed, 780,760,000 lb. of circulating water at 74° F. being required.

Air is furnished to the lead and copper blast furnaces by rotary blowers: One 300-cu.ft. (No. 10) Connersville blower is direct connected to a Hamilton corliss, tandem-compound engine, 16x32x36 in., operating at from 70 to 105 r.p.m.; two No. 9 Connersville blowers are direct connected to a Pennsylvania corliss, tandem-compound, 20-36x42-in. engine operating at 60 to 100 r.p.m.; one No. 7 Roots blower is driven at each end by General Electric motors. Two Nordberg, cross-compound, converter blowing engines are used. One has steam cylinders 22 and 48 in. in diameter, 48-in. air cylinders and 48-in. stroke; its capacity is 12,000 cu.ft. of air at 16-lb. pressure. No. 2 engine has 26- and 56-in. steam cylinders, 54 in. air cylinders, and 48-in. stroke; its capacity is 15,000 cu.ft. at 16-lb. pressure. These engines supply air to the converters and to the reverberatory oil burners. A small Ingersoll-Rand compressor supplies air at 100-lb. pressure for mechanical tools in the company's shops; this is shortly to be supplanted by a compressor of larger capacity, a 500-cu.ft. Ingersoll-Rand double-stage compressor having been ordered.

Electric power is supplied by two 250-kw., 250-volt General Electric direct-current generators; these are direct connected to two Nordberg cross-compound, 15x30x36-in. engines operating at 120 r.p.m. Hydraulic power for operating lifts, converter-hood dampers and the copper-casting machine is obtained from two 12x18x18-in. Buffalo outside-packed, plunger-type duplex steam pumps These are equipped with automatic pressure governors set to maintain a pressure of 195 lb. in the hydraulic system. There are two 7x12x10-in. Deane duplex fire pumps, and three Worthington outside-packed plunger-type pumps, 7x12x12 in., to supply feed water to the reverberatory and power-house boilers.

OIL CONSUMPTION

Oil is used as fuel throughout the works, except for the five coal-burning locomotives in industrial service, one coal-fired Godfrey roaster and, of course, the coke for the blast-furnace charge. The oil consumption for a typical month was as follows: Reverberatories, 15,021 bbl.; power-house boilers, 1188; separator furnace, 750; Godfrey roasters, 393; Wedge roasters, 2382; converters, 264; copper-casting ladle, 250; assay office, 150; total for month, 20,398 bbl.

About 1000 men are employed at the El Paso plant. Most of the work in the metallurgical departments is done by Mexicans and the common labor is exclusively of this nationality; eight-hour shifts are worked for all continuous operations, the prevailing rate of wages being $1.50 for unskilled labor. The mechanical shops work nine hours and there is a daylight roustabout gang working 10 hours.

The El Paso Smelting Works are under the general management of Kuno Doerr, and under the immediate direction of J. J. Ormsbee, superintendent; H. F. Easter, first assistant superintendent; Alan F. McCormick, second assistant; W. J. Eustace, chief clerk.

Texas Mineral Production in 1913 showed an increase in value of nearly 40%, according to the U. S. Geological Survey. Principal items were: Petroleum, 15,099,478 bbl.; coal, including lignite, 2,429,144 tons; asphalt, principally residue from heavy asphaltic oils, 122,026; gypsum, 161,090 tons; salt, 355,529 bbl. Other mineral products, copper, quicksilver, sulphur, etc., were produced, but the quantities are not stated.

The Men and Machinery of the Comstock--The Sutro Tunnel

By G. W. Dickie

SYNOPSIS—An exceedingly interesting character in connection with the early days of the Comstock lode was Adolph Sutro, who was responsible for the famous Sutro tunnel, originally built to handle the ore from the lode to the refining works on the Carson River, but used only for draining purposes. This tunnel made possible the handling of water from the extreme depths which became necessary. The pumping engines of various types which were built on this account are described and illustrated. They provided problems which, up to that time, had never been considered.

Before the demand for big machinery on the Comstock became an accomplished fact in the history of that wonderful mining camp, an interesting character and strong personality connected with a great project that requires consideration in this narrative came into notice in Comstock affairs. Adolph Sutro, a German Jew, doing business in San Francisco as a stock and bond broker, became, through his business dealings, connected with and much interested in the Comstock mines. Previous to this time the celebrated William Sharon and his financial friends had projected and built the Virginia and Truckee R.R., to handle the rapidly increasing freight and passenger traffic which the development of the mines had created. This was before the construction of the Virginia and Gold Hill Water-Works. The scarcity of water at Virginia City in these earlier days had compelled the mining companies to locate their mills for extracting the precious metals, gold and silver from the ores, on the Carson River, and Sharon's railroad was built to transport these ores from the mines to the mills, which were some 1700 ft. below them and about 10 to 12 miles distant. The relative positions of the mines and mill vertically set Mr. Sutro thinking, for he had been educated as an engineer and out of his thinking came the idea of driving a tunnel from the Carson River at the mills to the Comstock lode, which is a direct horizontal line to the nearest point of contact would be four miles.

The Sutro Tunnel

The project was a big one, but although the financiers in San Francisco were not afraid of big things, Sutro's dream did not captivate them. The Bank of California crowd was in the height of its power then and the Bonanza crowd had not yet become a power. The Virginia and Truckee R.R. was making money even if the mines were not and to carry out Sutro's scheme would hurt the railroad. Sutro then tried to interest the general public in his scheme and endeavored to get them to invest in the shares of the Sutro Tunnel Co.; some of the methods he adopted to win their attention certainly amused them if they did not get their money; in fact, they did both. He got a stereopticon, hired Platt's Hall, a famous central meeting place on Montgomery St., and began by a series of illustrated lectures to interest the good citizens of San Francisco in the proposed tunnel and those who opposed it.

Mr. Ralston, who was at that time at the head of the Bank of California, which was opposed to the tunnel, had a beautiful country home at Belmont, a little village 28 miles south of San Francisco; he was fond of driving fine horses and used to drive in to his office from Belmont in the morning in a resplendent coach, drawn by six fast thoroughbreds, changing horses at Uncle Tom's Cabin, a

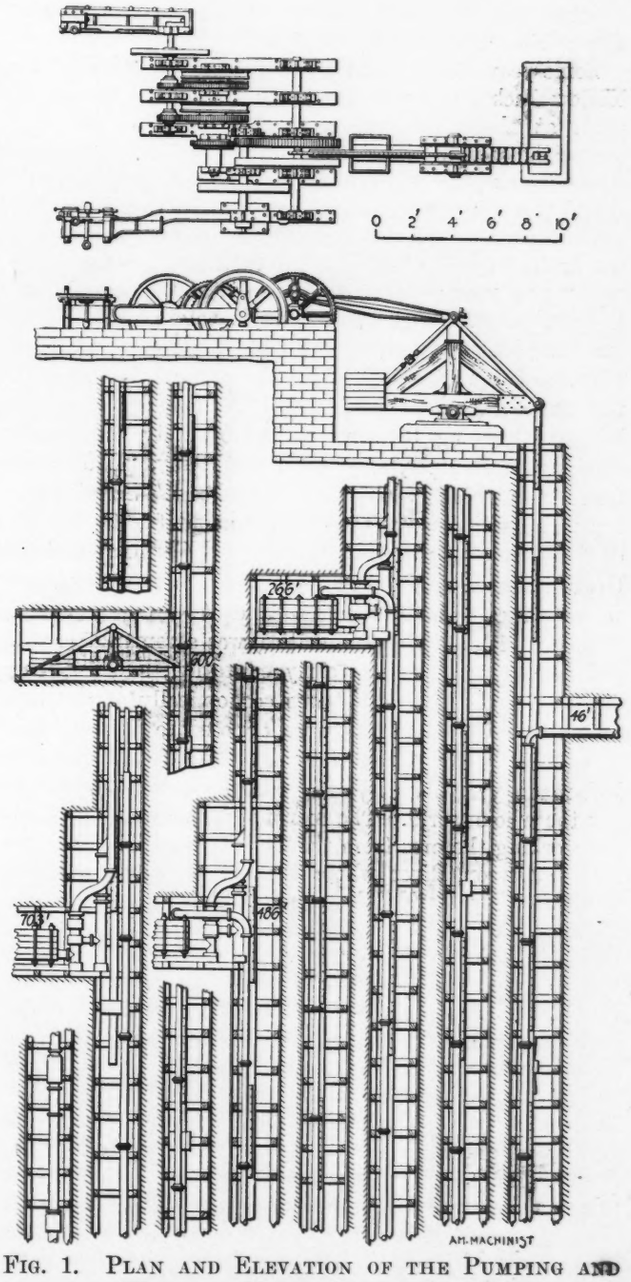


Fig. 1. Plan and Elevation of the Pumping and Hoisting Works Built in 1874

resort about half-way to town; in the afternoon he would drive back in the same way. This was a fine ride, as I can testify, having made the trip with Mr. Ralston on two or more occasions, and he made good time.

Usually the first picture shown by Sutro was that of Ralston's grand turnout with Ralston on the box and Sharon beside him. "These," Sutro would say with his quaint German accent, "These are the men who don't want my tunnel built." Then he would go on to tell his audience of the foolishness of the railroad's method of transporting ore by hoisting it up 1700 ft. above the mills, loading it on cars, and then lowering it down 1700 ft. on the cars to be milled. Having worked up the crowd to this point, he would throw a picture on the screen, showing a train of empty ore cars doubled back on itself on one of the many sharp turns of the road, the engine just passing the caboose, the engineer leaning out of his cab and talking to the brakeman in the caboose, and he would remark, "Ladies and gentlemen, this is Sharon's crooked railroad."

Some years before this, a sad accident happened. The Yellow Jacket mine on the north end had a fire in the shaft at about the 800-ft. level, which cut off from escape the miners below and a number of lives were lost. The horror of this was still in the minds of people. Sutro would throw a picture of the burning shaft on the screen with the terror-stricken and helpless miners huddled in the drifts below. "Ladies and Gentlemen," Sutro would say, " you know what this picture is and I do not want to hurt your feelings by keeping it before you." Then another picture was shown with the Yellow Jacket Shaft afire from the 800-ft. level to the surface, but showing the Sutro tunnel at the 1700-ft. level and the miners leisurely walking the four miles to safety contentedly smoking their pipes, and Sutro would say, "Ladies and Gentlemen, this is what might have been." So with pictures and talk he managed to get about $1,000,000 out of San Francisco; the rest he raised in Germany and the Great Sutro Tunnel was driven through the mountains to the mines between the 1600- and 1700-ft. levels.

Sutro, with all his peculiarities, was a remarkable man and both by nature and early education, a constructor and engineer. His tunnel was economically correct, but certain moneyed interests were opposed to it even after it was an accomplished fact and the Great Bonanza had made Virginia City known and celebrated throughout the whole world. The men in control built the mills for working the ores from the Consolidated Virginia, not on the Carson River where the old mills were, but at Virginia City, beside the mines. This was made possible by the building of the Gold Hill Water-Works, which brought to Virginia City an abundant supply of water, so no ore trains ever went through the Sutro tunnel. It came, however, to be a great water drain, making pumping possible from depths that could not have been reached without it. It struck into a lateral gallery connecting the shafts of all the mines and Sutro had contracts covering the use of the tunnel for the conveyance of ores and the drainage of water; unfortunately for the Tunnel company, the contracts for drainage were not remunerative and the tunnel was not a profitable venture; nevertheless fortunes were made and lost in the fluctuations of its stocks. It was its function as a water drain that has made it necessary to introduce the famous four-mile tunnel and the man who made it into our narrative at this point.

Early Methods of Handling Water

In the earlier days of gold and silver mining on the Pacific Coast states, neither great depths nor large quantities of water had to be dealt with and the machine shops around the Bay of San Francisco furnished such simple devices as were then found to be sufficient. A water wheel, generally a hurdy-gurdy, driven by a small jet from some high head, was the usual prime mover. A pump-bob of the simplest construction and all of wood and a bucket lift were all the pit work necessary. Some rigs like this may be seen working to this day in placer diggings. In quartz mines water was not often available for power and steam had to be applied to this purpose.

Some of the first pumps used on the Comstock were of considerable power. The best of the older pumping engines that I recollect was that at the Savage mine, a fine beam engine of about 200 hp., geared 5 to 1, driving a line of 12-in. plunger pumps, and a bucket-lift sinking pump at a depth of 1800 ft. This engine was removed in 1875 and replaced by a compound direct-acting differential engine. The old engine which was a fine specimen of its type was used for years after to drive the machinery of a quartz mill.

As the mines increased in depth and larger quantities of water had to be raised to greater heights, powerful engines and heavy gears had to be built to do the work. Some time about the middle of 1874, I. F. Thompson, engineer for a number of the mining companies, came to the Risdon Iron Works with a proposal for new pumping and hoisting works for several of the mines. This involved us in something bigger than we had as yet undertaken and we had no data concerning previous construction of similar installations even approaching this magnitude; in fact, these were greater pumps of their kind than had been built anywhere. We had to go very carefully into our calculations. It was settled that 14-in. pumps should be used and that the depth that would be reached ultimately would be 2000 ft. I made the plans for these great works which included both pumping and hoisting, and fortunately I have found a lithograph of the original drawing. The illustration, Fig. 1, is from a photograph of the lithograph. I may state that I myself redrew the plans used to illustrate these articles and many others also on the lithographic stones in such spare time as I had in those old strenuous days. To realize the amount of labor this involved you must think of drawing a plan of a complicated mechanism upside down backwards by gas light with a greased pen after a hard day's work. The arrangement as shown may be taken as representing the best we had done previous to 1875 with high-pressure expansive non-condensing engines. It turned out that identical sets of this machinery would be required for the Silver Hill, Dayton, Caledonia, New York and Ophir Mines, and we undertook to have all five sets in operation in 12 months.

The five sets were all built from the same design and were of the following dimensions (see Fig. 2): Engine for pumping gear, 24 in. diameter of cylinder, 60-in. stroke, fitted with double beat valves and variable cut-off. The illustration, Fig. 1, shows the arrangement of gearing: this consisted of two pinions 24 in. diameter

and 14-in. face, gearing into two spur wheels 168 in. diameter and 14-in. face. The pitch of the gears was 4 in. The wristpin for the connecting-rod or pitman was secured in hubs on the arms of the spur wheels; there were two sets of hubs, one giving a stroke of 8 ft. to the pumps and the other a stroke of 6 ft. The flywheel, which was 14 ft. diameter, weighed 20 tons. Behind the pumping gear a winch barrel was arranged for handling pumps and pit work in the shaft.

The hoisting gear consisted of a horizontal slide-valve engine with 20 in. diameter of cylinder and 30-in. stroke. Two pinions on the engine shaft geared into spur wheels, the spur wheels being on separate shafts, each shaft having a brake wheel. Flat ropes were used 6x½ in., which wound on a spool between the gears and the brake wheels. These were balanced hoists, one cage coming up while the other was going down. Every care was taken to make these works of a most enduring character. The foundations and the bedplates were of a most massive design. The weight of the machinery in each surface set was 325,000 lb. and the pit work weighed 400,000 lb., exclusive of all wooden parts, which latter were supplied by the mines.

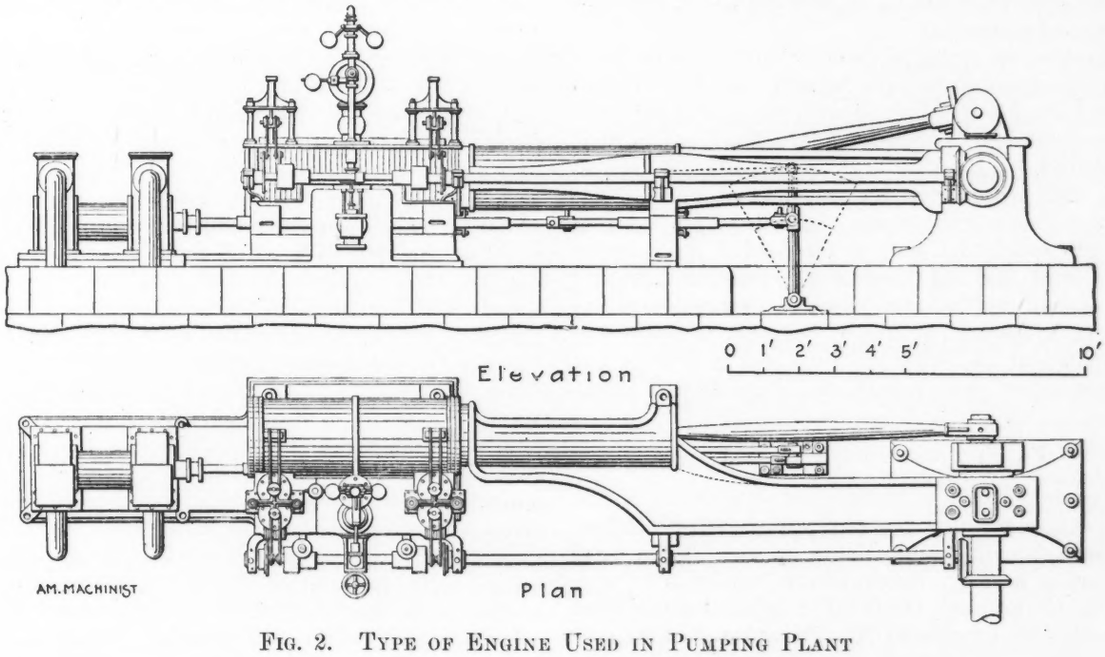


FIG. 2. TYPE OF ENGINE USED IN PUMPING PLANT

If these engines had all been fitted with condensers and the number of strokes made by the pumps kept within the limits of safe working, it would have been a hard matter to have beaten them in their economy of fuel. In pumping from deep mines, the great weight of the pit work, which is of so much importance in any direct-acting system, soon proves the destruction of the geared system. In driving from wristpins fitted in the arms of two large spur wheels, as in the example I have just given, the accelerating and retarding of the motion imparted to the great mass of pit work must follow that of the wristpin, which it will do only up to a certain rate of speed. This rate of speed is determined by the weight of the structure set in motion, the speed at which it is moved, that is the number of revolutions, and the strength of the parts. Consequently with geared pumping engines working at great depths with a heavy mass of pit work to keep in motion, the speed must be kept very slow indeed. Geared engines for pumping from great depths should, therefore, have their pumps made very large and run very slow or the frequent breakdowns and consequent delays would soon condemn the whole system, as was soon discovered on the Comstock. Fortunately I have an indicator card, showing seven consecutive revolutions of the engine of one of the five pumping sets that I referred to above; this card covers one complete double stroke of the pump, as the pump made six double strokes per minute and the engine 42 revolutions per minute. On the card four of the revolutions are on one end of the cylinder and three are on the other. A careful study of this card shows the effects of the weight of the pitmans, and pit work, on the power developed in the cylinder in spite of the 20-ton flywheel. The speed of the engine was maintained nearly constant by an ordinary centrifugal governor. In this particular case there was 1400 ft. of pit work in motion and an attempt to increase the pump speed from six double strokes per minute to eight resulted in a severe breakdown and hastened the introduction of another type of pumping engine on the Comstock.

THE DIFFERENTIAL PUMPING ENGINE

The pumping engine that began to claim attention when several of the mines had reached a depth where the geared type was no longer reliable and which began to take its place at the head of some of the deepest mines on the Comstock was that known as Davey's Patent Differential Pumping Engine. In England this engine was known in two distinct types, the single-cylinder and the compound engine. When it came to designing this type of engine for the Comstock mines, three types had to be provided to meet all the conditions. Of the single-cylinder type only two were built that I remember; both of these were built by the Union Iron Works. One was at the Consolidated Virginia and California Combination shaft and the other at the Lady Washington shaft. The cylinders were 56 in. diameter and 8-ft. stroke, using

120 lb. steam pressure. The steam was expanded as far as the weight of the pit work and the piston speed would admit, which, in these cases, was not much; after making the stroke the steam was exhausted into the atmosphere as in an ordinary steam pump. They were horizontal and double-acting, operating the pit work through a right-angle bob working a single line of 14-in. pumps. The engine on the Consolidated and California shaft did not work long before it was compounded.

Of the compound condensing type several examples, both beam and horizontal, were built. In this type the steam was expanded to a much greater extent than in the single-cylinder type, the use of two cylinders making this possible even when the load was light and the velocity small. They admitted of the use of comparatively high steam pressures, which, in conjunction with the high degree of expansion, gave them what was considered at that time a great economy of fuel.

The third type was the compound noncondensing, two or three of which were built. These were the same as the second type, but without the condenser; where there was a possibility of obtaining condensing water, this type was never recommended.

In regard to the design of pumping plants there was a standing question of dispute between the Union Iron Works and the Risdon Iron Works which enabled mine superintendents to determine whether a plan sent to them eminated from the brain of I. M. Scott or G. W. Dickie; that was the presence or absence of a flywheel. Mr. Scott always wanted the stroke controlled by a rotating shaft and flywheel. Mr. Fair, at the head of the Bonanza crowd, always had his inspirations from Mr. Scott; this led sometimes to rather strange arrangements for working in a flywheel of which the great pumping engine installed at the Virginia mine was a striking example; the history of this demands a place in this narrative.

The Virginia Mine Engine

Mr. Thompson went to Europe and particularly to the British Isles to examine pumping and hoisting machinery on deep mines. Joseph Moore, of the Risdon Iron Works, had a brother, Ralph Moore, who was at this time, 1874, Government Inspector of Mines for the West of Scotland. He introduced Mr. Thompson to a style of pumping engine which had then obtained considerable popularity among the mine owners of Lanarkshire. This engine was patented and manufactured by Mr. Barclay, of Kilmarnock, Scotland. Mr. Thompson was so impressed that he ordered from Mr. Barclay a very large engine that would work a line of 15-in. pumps to 2800 ft. It was a compound engine and its distinctive feature was the method of attaching the engine to the pumps. This was accomplished by means of a long beam or girder which extended over the shaft far enough to receive the upper end of the spear rod and from that point extended back into the pump house a distance of about 60 ft., where the journal pins on the inner end rested in pillow blocks supported on a pedestal of masonry. The high-pressure cylinder was 42 in. diameter and 7-ft. stroke, while the low-pressure cylinder was 78 in. diameter and 8-ft. stroke; the pumps were to have a stroke of 9 ft.

As the engine was double-acting, the pit work, including the operating girder, had to be balanced sufficiently to make the up-and-down strokes equal for power. The low-pressure cylinder was placed as close to the neck of the shaft as the security of foundations would permit and the high-pressure cylinder was placed close behind it, the piston-rods of both cylinders being guided by a parallel motion of the well known James Watt type. Such was the engine ordered by Mr. Thompson, but he had still to find a place for it and that was not so easy. Neither the Union Iron Works nor the Risdon Iron Works would approve of an engine built abroad and the directors of the mining companies at both ends of the Comstock did not care to take any risks where the engineers, whose opinions they had always been guided by, would not recommend Thompson's foreign engine. The points of superiority claimed by the Barclay engine were that the maximum stresses were greatly reduced by expansion in a second cylinder, that the foundations were not so expensive and that the engine itself, by dispensing with the beam and substituting an overhanging lifting girder, was less costly. I have a letter written by myself at the time to one of the best known superintendents on the Comstock, from which I quote the following: "As this engine (the Barclay) may be introduced to the attention of mining companies in this country, and as there are no Cornish pumping engines at work on our mines with which to compare it, we will have to compare it with the horizontal differential pumping engine built by us for the Alta mine, or with the beam differential pumping engine built by us for the Lady Bryan, and for engines of moderate dimensions such as I have mentioned, the horizontal compound can be built just as cheap as the Barclay and will work as well, with the advantage of being able to work double spear rods balanced, which I think is an advantage of some importance. For larger engines the upright cylinders become a necessity, and we must compare the Barclay with such beam engines as we have already in operation. Here in the matter of the foundations (unless the nature of the ground favors the underground beam), the Barclay engine has the advantage. The lifting girder of the Barclay engine will also be cheaper built than the regular beam of our beam-engine arrangements; otherwise the cost of either engine will be the same, the finish being equal. As to the relative economy of either engine, there is nothing in the design of the one any more than in the other that can affect this question. Well loaded and properly worked, either the Barclay or the beam compound will give good results. It is saying a great deal for the Barclay engine when I state that it has become a formidable rival to the Cornish engine in situations where the latter has been in undisturbed possession for three quarters of a century. Let it come amongst us and we will either beat it or admit its superiority."

The above shows the spirit in which we discussed the engine problems of the deep mines of the Comstock

Murcia Copper & Iron, Ltd

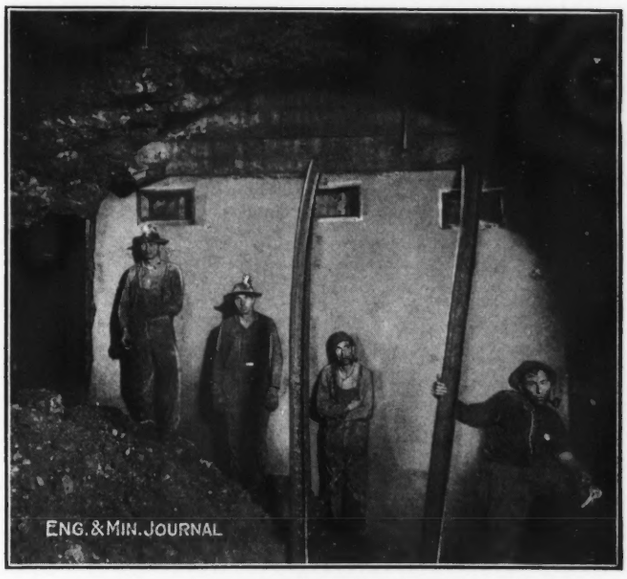
According to *Madrid Cientifico,* Aug. 5, 1914, a corporation with the above mentioned title has been formed recently to acquire and exploit a field containing deposits of copper and iron at Blanca, province of Murcia, Spain. Company has capital of £60,000, divided into shares of £1 each. There are 4000 bonds of £20 each, bearing 5½% interest and retiring in 30 years.

Details of Practical Mining

Pouring Concrete Stope Pillars from Surface

By Temple Chapman*

The accompanying photograph shows the upper part of one of the concrete pillars in the Longacre & Chapman mine at Neck City, Mo. There have been built six of these pillars of reinforced concrete, a preliminary description of which appeared in the Journal, June 6, 1914. They average 40 ft. in height and 16 ft. square. Sixty-pound T-rails set in the cement were carried from the top of one pillar to the top of the next pillar, about 25 ft. away. Hitches were also left by setting empty dynamite boxes in the cement to carry the ends of timbers. Cordwood was filled in above the timbers and the T-rails, the latter being braced, thus making a wide support, both the roof over the pillars and the roof between them being held.



One of the Completed Pillars with Rails Bent by Cave over Uncompleted Pillar

The concrete was mixed on the surface and poured down holes, drilled for the purpose, directly into the forms built in the mine. Old screen jackets were cut into slices 10 ft. long by 6 in. wide, and used for reinforcement. These strips were laid in the cement east and west, about 6 in. apart. Then a foot higher up they would be laid north and south. The forms were built of 1-in. boards, held in by heavy wire. The piers increased about 6 ft. in height each day, the previous day's mixture being pretty well set by the next morning. The boards for forms were all recovered after each pillar was completed.

When the pillar got up to 35 ft., or within 5 ft. of the roof, the roof was carefully trimmed and left a little high where the drill hole came through. The last cement would then be mixed a little richer and wetter and would fill every space up tight to the top.

One pillar had just been started when the roof immediately over it, which the pillar was intended to support, caved in. The rails had been left sticking 30 ft. out from the adjoining pillar over to the site of the pillar under the cave. These rails, shown in the picture, were bent down and broken off by the caving roof. The caved dirt has filled the drift up nearly to the top of the nearest concrete pier. However, this pier held up its share of the roof and prevented the cave from spreading and becoming general. Could the pillar that was started have been completed, no cave would have occurred. The concrete piers and log pens now in place are enough to permit taking out all the remaining ore in the mine. War prices have made this ore extremely valuable. The timber work in the mine has had to be reinforced with more timbers so much that it is found that the concrete is not only stronger, but also no more expensive.

*Stockbridge, Mass.

Systematic Control of Injury Cases*

Along with several other mining companies in the Iron River district of Michigan, the Munro Iron Mining Co. is using a system of following up the cases of personal injuries received in its mines, which has proved thoroughly effective.

When a man is hired, an identification card is made out giving a description of his person, the places where he has worked recently and his cause for leaving, his family connections, nationality, education in English, etc. Furthermore, after they are ascertained, his drink habits are included.

The timekeepers, dry-men, captains, skip tenders, foremen, etc., are warned to be on a constant lookout for injuries, no matter how slight. When one is discovered, the man is sent to the doctor for attention and the injury is reported to the timekeeper. The timekeeper in turn reports by telephone to the general office and makes out a card showing the date, name and nature of the injury. This card is hung on a registry board, which is kept where the captain and foremen can easily refer to it when taking on their shifts. No man with his name on the board is allowed to go underground.

The timekeeper also makes out a report giving a history of the accident and statements of witnesses, and forwards this to the general office. The general office upon receipt of the telephone notification from the timekeeper, passes on the notice by telephone to the hospital, and also posts on a registry board in the registry office a card similar to that posted by the timekeeper.

*An abstract of an article by Herbert J. Fisher, presented before the Ishpeming meeting of the Lake Superior Mining Institute, Aug. 31, 1913.

Finally the hospital posts a similar card on its registry board, opposite the date and day of the week on which the man was injured. If he does not appear for treatment, the hospital communicates with the general office and the compensation clerk takes steps to locate the workman. When he does come to the hospital and receives his dressing, a hospital card is filled in and the physician's report is made. The physician's report gives all the necessary data, describing the man, the nature of the injury, the treatment received, the statement of the injured man, the names of witnesses, and also on a anatomical chart locates the injury. A large part of this information also appears on a hospital card, which is kept on file in the hospital, the physician's card having been forwarded to the general office. The injured man is given what is called a dressing card and envelope, which he carries with him, and he is advised when to report for another dressing.

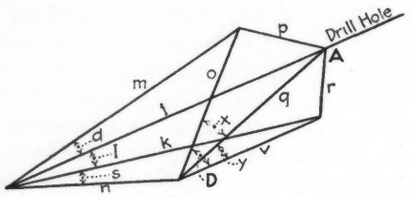


FIG. 1.
Down Hole

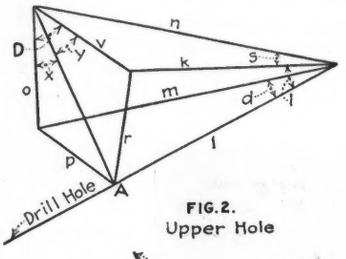


FIG. 2.
Upper Hole

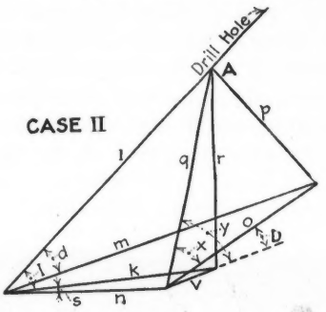


FIG. 3.
Down Hole

CASE I

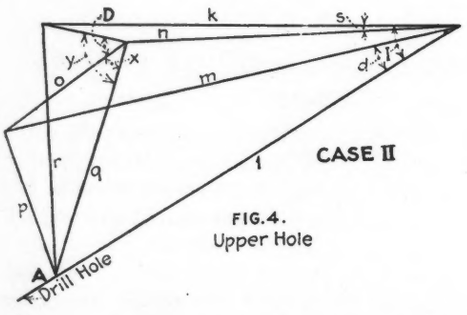


FIG. 4.
Upper Hole

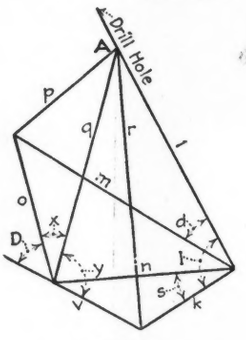


FIG. 5.
Down Hole

CASE III

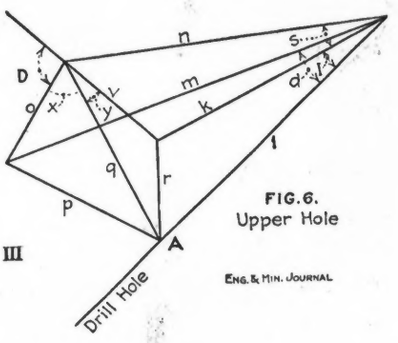


FIG. 6.
Upper Hole

Then on the registry board is inserted a small card in a column under the day of the week in which he must report for this next dressing. Thus the physician's registry board shows just what men are to be expected on each day. If a man fails to appear he is looked up as described.

When the injured man can resume work, the physician indicates this on his dressing card, the workman then presents this to his foreman and is allowed to work if things are satisfactory. This card the foreman checks with the mine registry board to be sure there is no error. Meanwhile, the physician has filled in a postal card and forwarded it to the general office, which communicates with the timekeeper, who takes the man's card off his mine registry board.

The physician is required to report to the general office when any man comes to him for treatment of an injury, unless the general office has already reported to him. In this way it is insured that an injury card is posted on the various registry boards, and that these correspond. No man is allowed to go to work again until his dressing card shows that the physician has given his permission.

By means of this checking system, it is quite unusual for a man having even a little injury to be able to leave the mine without the existence of the hurt being known. It is found furthermore that the system is not difficult in operation and has been found satisfactory by the various officers of the company concerned.

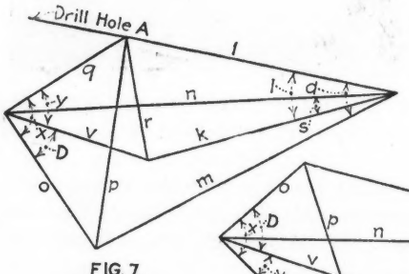


FIG. 7.
Down Hole

CASE IV

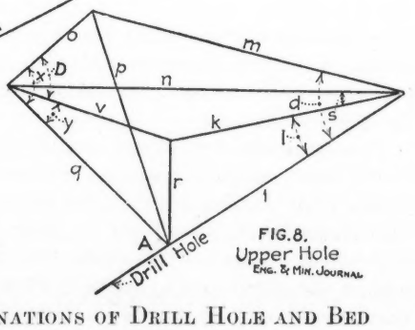


FIG. 8.
Upper Hole

VARIOUS COMBINATIONS OF DRILL HOLE AND BED

Determination of Dip of Beds from Drill Cores

BY E. E. WHITE*

Having occasion some time ago to determine the true dip of beds penetrated by a drill hole not inclined at right angles to the strike of the bedding, and not being able to find a published method, I worked out the following formulas. They are applicable where the strike of the bedding and the direction and inclination of the drill hole are known.

The general formula is most easily derived for the case of a hole dipping downward in the same direction as the beds, as in Fig. 1.

*Ishpeming, Mich.

Let

I = Inclination of drill hole from horizontal.

d = Angle between bedding and axis of the drill hole as obtained from the drill cores.

S = Difference in strike between the bedding and the drill hole.

D = Trne dip of strata.

Then in Fig. 1:

Let

p = Length of perpendicular dropped from any point A on the drill hole to the plane of the bedding.

r = Length of perpendicular dropped from A to the horizontal plane through the intersection of the drill hole with the plane of the bedding.

Let

$m\ o\ n$ represent a bedding plane.

$k\ v\ n$ represent a horizontal plane through intersection of drill hole and bedding plane.

$q\ v\ r$ and $q\ o\ p$ represent vertical planes at right angles to n, through A.

n = Strike line of bedding

Consider r as equal to unity.

Then

$$cos\ \ I = k.\quad cos\ d = m.\quad cos\ S = \frac{n}{k}$$

$$sin\ I = r.\quad sin\ d = p.$$

Hence

$$n = k\ cos\ S = cos\ I\ cos\ S$$

$$o = \sqrt{m^2 - n^2} = \sqrt{cos^2\ d - cos^2\ I\ cos^2\ S}$$

$$q = \sqrt{o^2 + p^2} = \sqrt{cos^2\ d - cos^2\ I\ cos^2\ S + sin^2\ d} = \sqrt{1 - cos^2\ I\ cos^2\ S}$$

$$angle\ x = sin^{-1}\frac{p}{q} = sin^{-1}\frac{sin\ d}{\sqrt{1 - cos^2\ I\ cos^2\ S}}$$

$$angle\ y = sin^{-1}\frac{r}{q} = sin^{-1}\frac{sin\ I}{\sqrt{1 - cos^2\ I\ cos^2\ S}}$$

$$Angle\ D = angle\ y + angle\ x.$$

From these formulas for x and y, the value of D may easily be worked out with a table of squares or square roots and a table of natural trigonometric functions. A table of the squares of the cosines of angles 0° to 90° is convenient.

There are three other possible cases for a hole dipping downward and also four possible cases for a hole dipping upward. The formula for each of the four cases is different but is the same for up and down holes in each case; it may be derived from the proper figure for each case.

In case 1, $D = y + x$. The beds dip in the same direction as the drill hole from their intersection more steeply than the plane through the drill hole and the strike line of the beds, Figs. 1 and 2.

In case 2, $D = y - x$. The beds dip in the same direction as the drill hole from their intersection, but less steeply than the plane through the drill hole and the strike line of the beds, Figs. 3 and 4.

In case 3, $D = (90° - y) + (90° - x) = 180° - y - x$. The beds dip in the opposite direction to the drill hole from their intersection, and more steeply than a plane perpendicular to the plane through the drill hole and the strike line of the beds, Figs. 5 and 6.

In case 4, $D = (90° - y) - (90° - x) = x - y$. The beds dip in the opposite direction to the drill hole from their intersection, and less steeply than a plane perpendicular to the plane through the drill hole and the strike line of the beds. Figs. 7 and 8.

It will be noted that if the hole is at right angles to the strike of the bedding, these formulas become:

Case 1, $D = I + d$.

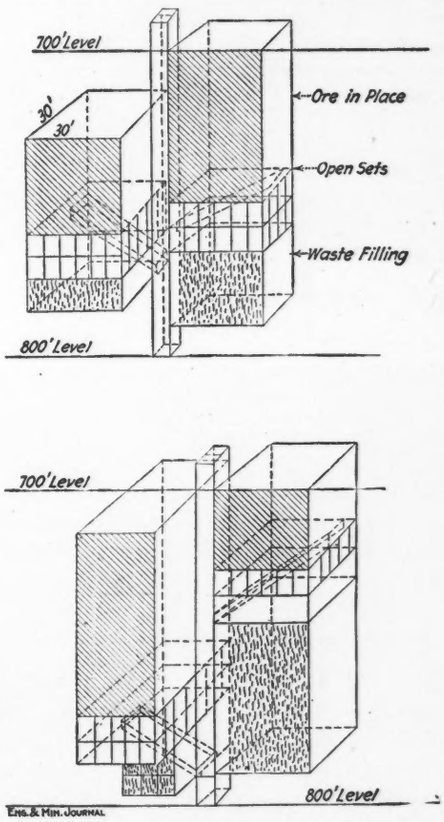
Case 2, $D = I - d$.

Case 3, $D = 180° - I - d$.

Case 4, $D = d - I$.

Square-Set Blocks at Copper Queen*

The general custom in the square-setting system practiced at the Copper Queen, Bisbee, Ariz., is to block the ore out in sections, numbering the sections consecutively, and mine, if possible, four sections around one central raise. This can often be done, but frequently the ground is of so heavy a character, and so much weight is thrown upon the timbers, that it is impossible to take out more than two or three sections in any one raise. These sections are laid out according to the local character of the ground, and are from two to four sets in width, and from six to ten in length. Great care must necessarily be taken in laying out the work to avoid making sections so large and so wide as to cause caving.



Two Stages in Removing a Square-Set Block

As stoping progresses from the sill upward the raise is usually sent through to the next level, to admit of the lowering of timbers, the proper ventilation of the stope and the dumping of filling; since it has been found necessary to carry the filling within about two floors of the back of the stope and keep it immediately below where the men are working. In many of the stopes, particularly in the oxide ores, a good deal of hand sorting is necessary. While this in many cases increases mining cost materially, yet the company believes it is cheaper than putting the waste in chutes, tramming, hoisting and paying transportation and smelting charges upon it. In

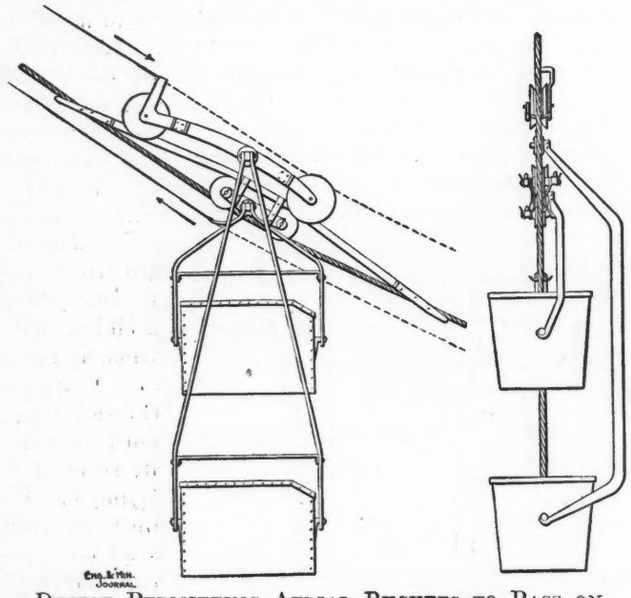
*From A. I. M. E. "Bulletin," August, 1914.

order that nothing may be mined but what shows a margin of profit, a system of minima is in effect, based upon the selling price of copper.

The figures illustrate different stages of extracting the ore by means of sections under the square-set system. The chutes are so arranged as to require the least amount of mucking.

Single-Track Double-Bucket Cableway

The accompanying drawing illustrates a communication received from Herbert K. Scott and published in the JOURNAL of Aug. 22, 1914, under the title "Single-Track Cableway in Sardinia." The device is similar to that described by E. Praetorius in the JOURNAL of Nov. 29, 1913, and no additional description is necessary more than the noting of the fact that in this case the carriers for the two buckets differ in design and the one shown on top always rides over the other whether it is descending or ascending.



DEVICE PERMITTING AERIAL BUCKETS TO PASS ON SINGLE ROPE

Hoisting Rope of Quarter-Inch Wires*

The Spanish-American Iron Co. operates a plane on the north coast of Cuba, which is 6716 ft. long and has a maximum grade of 25.13%. The hoisting machinery was designed to haul up this plane three loaded cars at a speed of 15 miles per hr., their weight and the weight of the rope causing a maximum pull of about 140,000 lb. The rope drums are 20 ft. in diameter. To handle this load required an exceedingly large rope, and in order to make it practicable to wrap this around the drums, it was found advisable to follow standard construction for small ropes, that is, six strands of 19 wires each, with the difference that a wire-rope center was substituted for the usual hemp center. Heretofore similar large ropes have been constructed of a greater number of wires, which remained small in diameter. To get the required total strength, it was found that the wires in the outside strands had to be extremely thick, ranging from 0.175 to 0.225 in. in diameter. The drawing of such wire, nearly a quarter of an inch thick, of the same strength, toughness and pliability as in the finer sizes, was a new problem in rope making. It was successfully solved by the John A. Roebling's Sons Co., by the use of skill and care and the application of recent improvements in heat treatment.

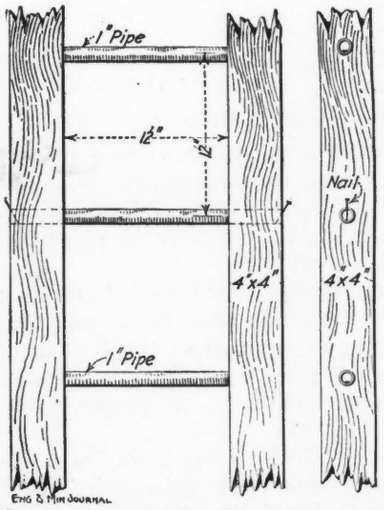
The completed rope is 3 in. thick, 7810 ft. long, weighs 123,360 lb., and has a breaking strength of 377 tons; it was made of plow steel. The wire-rope center follows the construction of ordinary hoisting rope, being 1⅛ in. thick and consisting of six strands of 19 wires each, twisted around a hemp core.

The shipping of the rope was almost as much of a problem as its manufacture. It had to be prepared for a railroad haul with trans-shipment to a steamer. For this it was wound on three reels in the following manner. About 200 ft. from the main reel, on which it had been coiled as stranded, an empty reel was set up and a little more than half the rope coiled off on this. This reel was then moved and another empty reel put in its place; the rope was so looped about this reel, that when it was revolved, rope was taken in equal lengths from the other two reels. In this way, about one-third of the rope was carried by each reel. The largest of the two reels was 10 ft. high by 9½ ft. wide; the other two were 8 ft. 10 in. by 7 ft. 2 in. The shipment was made on two flat cars, the rope being coiled on the car bottoms between the reels.

*From information furnished by the manufacturers.

Wood and Iron Pipe Ladder

An economical and serviceable mine ladder may be made of 4x4-in. timbers, with rungs of 1-in. pipe, the latter consisting of discarded pipe sawed into 20-in. lengths. The rungs are spaced 1 ft. apart, holes being bored through the timbers just large enough to receive them. Small holes are drilled through each pipe length, one near each end, before driving into the timbers, and when the rungs are in place nails are inserted into these holes and driven tight. This prevents the rungs from twisting or slipping sideways and holds the ladder securely together.



LADDER OF 4x4-IN. UPRIGHTS AND 1-IN. PIPE RUNGS

Such ladders cost more in the first place than ladders of the same length constructed of 2x4- and 1x4-in. lumber, but their cost may be kept at a minimum by using the better parts of discarded pipe and having the shop crews make up extra ladders during what would otherwise be spare time, while their great durability, which largely reduces the repairs necessitated by breakage and wear, makes it economical to use them instead of all-wood ladders, especially in more permanent manways.

Details of Milling and Smelting

Shaking Baghouse Bags

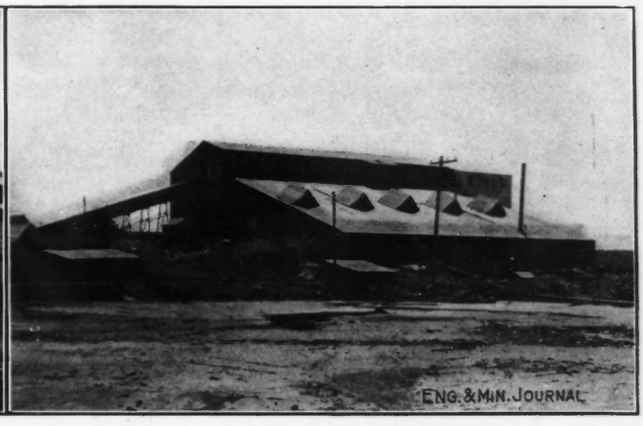
Hand shaking of bags has been supplanted in most large baghouses by either mechanical or differential-pressure shaking. The last named method was developed several years ago at Midvale, Utah, in an effort to save expense in the replacement of torn bags. It consists simply of cutting off the blast from a section and applying a slight vacuum, repeating the operation two or three times. It is not so efficient as hand shaking, or shaking by mechanical means, says L. Douglass Anderson, in the July Bulletin of the American Institute of Mining Engineers. However, it is not so unhealthful as hand shaking and is satisfactory when done often enough—every eight hours at Midvale—and the bags last longer.

New Arrangement of the Dome Mill

Enlargement and rearrangement of the Dome mill, South Porcupine, Ont., has been completed, under the direction of the Merrill Metallurgical Co., of San Francisco, materially increasing its capacity. An additional quota of 40 stamps, 1250 lb. each, has been placed at the rear of the mill bin, so that the stamps now stand back to back. The ore bin has been raised 6 ft. all round to accommodate a greater tonnage. Crushing is still to be performed in water, but there are no primary amalgamating plates. Plate amalgamation is performed after regrinding in the tube mills.

Pulp is separated in Merrill classifying cones and the

NEW ADDITION TO THE DOME MILL



GENERAL VIEW OF DOME MILL

LEACHING TANKS AT DOME MILL

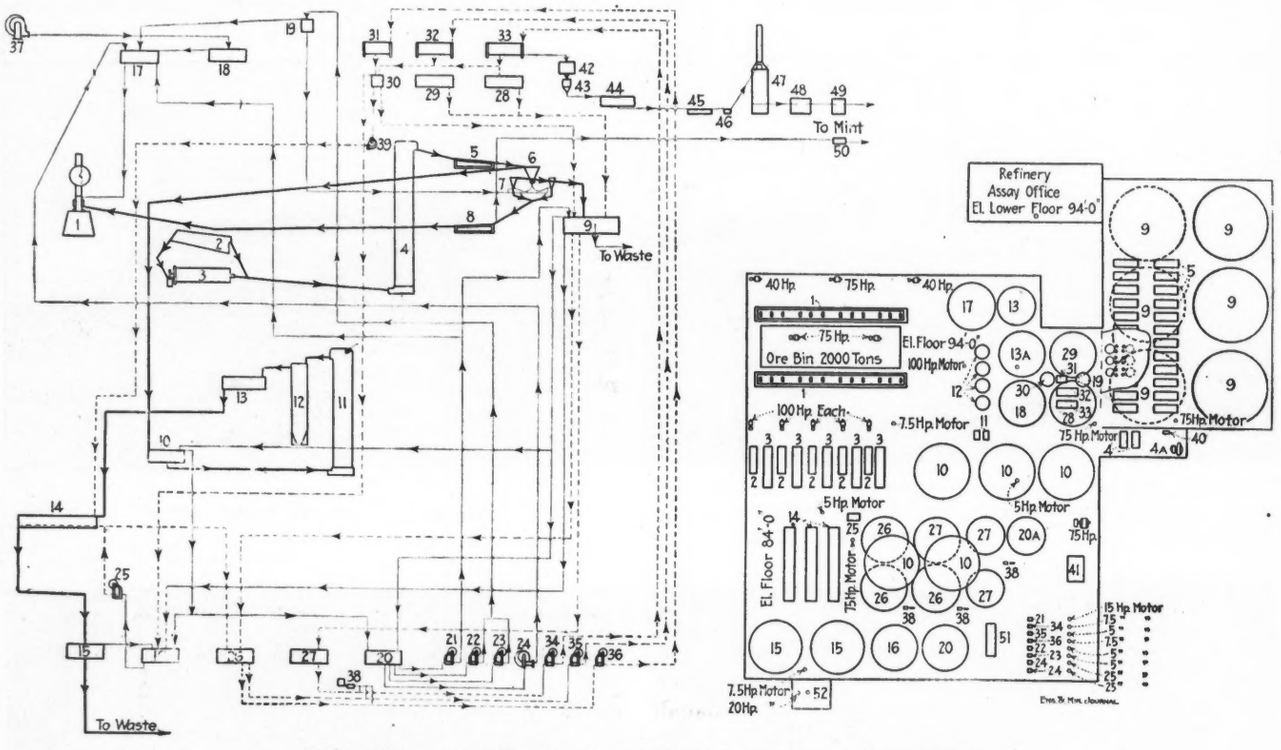
AMALGAMATING PLATES AT DOME MILL

slimes treated identically as they were before. The amalgamating plates have been removed from the lower part of the mill and placed in the upper part of the new addition where they are served with pulp from the elevators. Sands are passed through concentrating cones, the concentrates reground and the sands sent to the leaching tanks.

Precipitate presses have been removed from the lower part of the mill, and are now in the upper part, over the solution tanks. An arrangement which will facilitate the handling of precipitates is being installed. The presses will discharge into cars, which will be run across the trestle into the upper part of the refinery, convenient for placing in the acid tank without excessive handling.

A sampler of the automatic type has been installed to sample the pulp just before it reaches the amalgamating plates. Another is placed in the sluices leading to discharge for sampling the tailings. The accompanying flow sheet and plan of the mill shows the system of treatment in detail, and the arrangement of the equipment as it now stands.

As now arranged, the Dome mill is expected to treat a greatly increased quantity of ore, which is necessary in view of the low grade of the ore reserves. Regrinding costs will be much reduced, as will also the treatment costs, since simple leaching of sands is cheap, and slimes treatment will be reduced in cost because of the elimination of all sands from it.



FLOW SHEET AND PLAN OF THE NEWLY ARRANGED DOME MILL

Item	No.	Description
1	80	1250 lb. gravity stamps
2	5	4'x16' duplex Dorr classifiers
3	5	5'x22' tube mills
4	2	28"x9" bucket elevators (unclassified product)
4a	1	Robeson pump, spare to 4
5	24	54"x144" amalgamating plates
6	6	Merrill hydraulic classifying cones.
7	12	Merrill concentrating cones.
8	4	72"x108' amalgamating plates (for concentrates)
9	6	40" dia. by 8' 6" leaching tanks.
10	5	30'x10' Dorr thickeners. 3 tanks.
11	2	16"x7" bucket elevators (slime only)
12	4	8'x40' Pachuca agitators.
13	1	20'x10' mechanical agitator.
13a	1	25'x10' mechanical agitator.
14	3	90 frame Merrill slime presses
15	2	30'x10' Dorr thickeners for press residue.
16	1	25'x10' sluicing water tank.
17	1	25'x20' battery supply water tank.
18	1	25'x10' Porcupine Lake water storage tank.
19	1	8'x8' cone water supply tank.
20	1	25'x10' return battery water tanks.
21	1	9"x9", 350-gal. Aldrich triplex pump — Water for filling and sluicing water tanks
22	1	5"x7", 100-gal. Aldrich triplex pump — Water to tank No. 19 for classifying cones
23	1	6"x9", 175-gal. Aldrich triplex pump — Water to tank No. 19 for classifying cones
24	2	5", 700-gal. Gould centrifugal pumps — Return to battery water tank
25	1	11"x12", 700-gal. Aldrich triplex pump — Sluicing water for presses
26	3	25'x10' low sol. sump tanks.
27	3	1—25'x10' and 2—20'x10' weak sol. sump tanks
28	1	25'x10' bar. w.s. for leaching tanks.
29	1	25"x10" bar. s. s. for leaching tanks.
30	1	10"x10' bar. low sol. tank.
31	1	10 frame precipitation press for low solution
32	1	20 frame prescription press for low solution.
33	1	20 frame precipitation press for weak solution
34	1	6"x9", 175 gal. Aldrich triplex pump
35	1	6x9", 175-gal. aldrich triplex pump
36	1	5"x7", 100-gal. Aldrich triplex pump
37	2	750-gal. centrifugal pumps, Porcupine Lake
38	3	Zinc feeders (Merrill)
39	1	Slime press wash water booster pump, 4" centrifugal
40	1	Lime equipment
41	1	Air compressor
42	1	Acid-treatment tank, refinery
43	1	Monteju, refinery
44	1	Press, refinery
45	1	Drying pan, refinery
46	1	Briquetting press, refinery
47	1	Blast furnace, refinery
48	1	Cupel furnace, refinery
49	1	Tilting furnace, refinery
50	1	Amalgam retort, refinery
51	1	Heating boiler, refinery
52	2	Tailings pumps, refinery

The Assayer and Chemist

Determination of Hydrocyanic Acid and Alkali Cyanides

A new method for the determination of hydrocyanic acid and the alkaline cyanides has been worked out by G. E. F. Lundell and J. A. Bridgman (*Journ. Ind. Eng. Chem.*, July, 1914). Briefly, it consists of titrating an ammoniacal cyanide solution containing a small quantity of dimethylglyoxime with a standard nickel-ammonium sulphate solution until a permanent red precipitate is produced. The reactions involved are:

$$NiSO_4 + 4\,KCN = K_2Ni(CN)_4 + K_2SO_4$$

$$NiSO_4 + 2\,C_4H_8N_2O_2 = Ni(C_4H_7N_2O_2) + H_2SO_4$$

No permanent red precipitate is produced until all the cyanide has been used up. An ammoniacal solution is used since free sulphuric acid prevents the precipitation of nickel dimethylglyoxime.

The standard nickel solution consists of 15.3 grams of nickel-ammonium sulphate dissolved in one liter of water containing 2 c.c. strong sulphuric acid. The dimethylglyoxime solution consists of 8.9 grams dimethylglyoxime in one liter of 95% alcohol.

Standardize the nickel solution thus: 25-c.c. portions are diluted with distilled water to 200 c.c., treated with 0.2 gram tartaric acid, and heated to boiling. Glyoxime solution sufficient to precipitate all the nickel is then added. If the glyoxime solution has been made as above directed, 30 c.c. should be enough. After adding the glyoxime, make slightly acid with ammonia, boil for two minutes and then set aside to digest for half an hour. Filter on a tared gooch, wash with 200 c.c. hot water, dry for 45 min. at 120°C. and weigh. The weighed precipitate contains 20.31% Ni. From the equations given above the CN titer of the solutions can be calculated. If a chemically pure potassium cyanide is at hand, the titer can be determined directly by titrating weighed portions as directed below.

Five grams of the sample are dissolved in water and diluted to 500 c.c. Pipetted 50-c.c. portions of this solution are diluted with water to 100 c.c. and treated with 1 c.c. of ammonium hydrate and 0.5 c.c. of dimethylglyoxime solution and then titrated with the standard nickel solution until a permanent red precipitate is produced.

The color play toward the end of the reaction resembles the methyl orange end point observed in titrating an alkaline solution with an acid solution. The nickel-ammonium sulfate solution may be added rapidly at first, provided the cyanide solution is vigorously stirred; toward the end point the addition should be slower and the stirring more rapid. If more than 0.5 c.c. of glyoxime is used, the end point shows a tendency to appear too soon unless the addition of the standard solution is slow and the agitation of the solution very brisk. The cyanide dilution may be varied without serious effect; however the method works better when the volume is approximately 100 c.c.

A large excess of ammonium hydroxide delays the end point; the 1 to 5 c.c. in volume specified does no harm. A titration requiring 50 c.c. of the standard solution costs one-fifth of a cent. In titrating solutions which contain hydrocyanic acid, a measured volume of solution is made alkaline with ammonium hydroxide and then treated as above.

The method checks established methods well, and is remarkably free from interferences. KOH and $K_4Fe(CN)_6$ interfere when present in large amounts; the small quantities usually present in commercial cyanides have practically no effect at all.

It is accurate in the presence of the double cyanides commonly used in electroplating.

It is seen that the method gives only the "free" cyanide in silver- and copper-cyanide solutions. Experiments show that more than the free cyanide is obtained in zinc-cyande solutions, the end point occurring when the Zn:KCN ratio is approximately 1:0.6. In copper- and silver-cyanide solutions Liebig's method works the same as the new method. In zinc-cyanide solutions Liebig's method gives the total cyanide, that is, the free cyanide plus the cyanogen in the zinc-double cyanide. Hannay's method gives the total cyanide in all three cases. This is a disadvantage because only the free cyanide is ordinarily desired.

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Separation of Titanium and Zirconium from Iron and Aluminum

William M. Thornton, Jr., and E. M. Hayden, Jr., have pointed out (*Am. Journ. Sci.*, February, 1914, p. 173, and May, 1914, p. 407) that titanium can be quantitatively separated from iron and aluminum (also phosphorus) by the ammonium salt of nitrosophenylhydroxylamine (cupferron) by throwing down the iron as ferrous sulphide in a solution containing enough ammonium tartrate to hold up the titanium, and after acidifying the iron-free filtrate, the titanium can be quantitatively precipitated by the cupferron reagent notwithstanding the tartaric acid, and that if the above mentioned filtrate be strongly acidified with sulphuric acid, and contains enough tartaric acid, titanium can be quantitatively separated from both aluminum and phosphoric acid in one operation.

The solution (about 100 c.c.) is treated with sufficient tartaric acid (at least 4 times the total weight of the four oxides) to prevent precipitation by ammonia, then neutralized with ammonia, acidified with 2 c.c. of sulphuric acid (1:1), and the iron reduced by hydrogen sulphide. An excess of ammonia is then added; the ferrous sulphide is filtered off and well washed with water containing ammonium sulphide. The filtrate is acidified with 40 c.c. of sulphuric acid (1:1), the hydrogen sulphide boiled off, the solution cooled, diluted to 400 c.c., and a 6% solution of "cupferron" added slowly with constant stirring. The precipitate is allowed to settle and the

supernatant liquid tested with a few drops of the reagent. The formation of a yellow turbidity shows the precipitation to be incomplete. The precipitate is filtered off and washed 20 times with dilute hydrochloric acid (1:10), the filter placed in a tared platinum crucible, dried at 110° C., ignited very gently at first, then over the blowpipe to constant weight and the residue weighed at TiO_2.

The same separation was tried for zirconium (*Am. Journ. Sci.*, August, 1914, p. 137), but apparently there is too much phosphate carried down by the zirconium precipitate so that phosphoric acid must be separated from zirconium by a preliminary fusion with sodium carbonate and a little sodium nitrate, after which the sodium phosphate can be leached out with water, leaving sodium zirconate behind, soluble in sulphuric acid. Following this zirconium can be separated from iron and aluminum by the cupferron reagent, just as titanium is.

Working Up Platinum Residues

The following method is recommended by the *Mining and Engineering Review* for working up the platinum residues from precipitation, etc., which accumulate in a laboratory. The residue liquors are evaporated to a small bulk, made alkaline with sodium hydroxide and sodium formate equal to half the weight of the platinum supposed to be present is added slowly, while the mixture is constantly stirred. The foaming which is liable to occur may be checked to some extent by adding more sodium hydroxide. The mixture is then heated on a water bath for about an hour, being occasionally stirred, then 25% hydrochloric acid is carefully added, until the mixture is acid, stirring all the time. The heating on the water bath is continued for another hour. The precipitated platinum is filtered off, washed with hot, weak (2%) hydrochloric acid, then with hot water until free from acid. The platinum is then separated from the filter, dried, ignited and weighed. To convert this into platinum solution, it is covered with five times its weight of 25% hydrochloric acid, heated on the water bath, and 50% nitric acid added, till no more gas is evolved. This requires about 1 c.c. of nitric acid for each gram of platinum. The solution is evaporated several times to get rid of the excess of nitric acid and the bulk of hydrochloric acid, diluted with water, filtered, the residue being dried, weighed and deducted from the previous weight of platinum; the difference gives the amount of pure platinum present. From this the solution may be made up to any desired strength.

Filtration of Barium Sulphate

It has been pointed out that barium sulphate can be filtered readily if the supernatant liquid is removed, 10 c.c. of a saturated, slightly acid solution of ammonium acetate added, and the mixture heated. The fine precipitate then changes to a coarse precipitate, which can be readily filtered by suction without any danger of passing through the filter. The theory of this action has recently been investigated, and the following explanation is given by Osborne (*Journ. Phys. Chem.*, p. 629, Vol. 17). Barium sulphate is soluble in ammonium acetate solution; therefore the crystals grow in a hot solution. If the barium sulphate is precipitated under conditions such that the crystals are already comparatively large, a short heating will cause sufficient growth to permit of filtration with suction. If the barium sulphate is precipitated cold, the crystals are small, and a much longer heating is necessary to give the required size. Ammonium chloride and hydrochloric acid retard the growth of the barium sulphate crystals, and should be got rid of; hence the necessity of the removal of the supernatant liquid.

Arsenic in Hydrochloric and Sulphuric Acid

A method for the determination of arsenic in hydrochloric and sulphuric acids is given by R. F. Tarbell (*Journ. Ind. Eng. Chem.*, p. 400, 1914).

In the process described, the arsenic is converted into hydrogen arsenide, which is passed through a solution of iodine in gasoline, whereby it is converted into arsenic tri-iodide. Twenty-five grams of the acid are treated with 35 grams of zinc and 1 c.c. of stannous-chloride solution (50 grams Sn per liter). The specific gravity of hydrochloric acid is first adjusted to about 1 : 1 and that of sulphuric acid to about 1 : 40 by addition of either water or arsenic-free acid. The reaction is allowed to proceed for about two hours, with warming if necessary, then 20 c.c. of sulphuric acid, of specific gravity 1 : 4 are added, and the reaction allowed to continue for one hour more. The evolved gases are passed through a solution of lead acetate to remove hydrogen sulphide, and then through a bulb tube containing 80 c.c. of purified 60° gasoline, 20 c.c. of water and 20 c.c. of a solution of iodine in purified gasoline (0.6773 gram per liter). (The gasoline is purified by washing twice with sulphuric acid, then with dilute sodium hydroxide and with water.) The contents of the bulb tube are subsequently shaken with 200 c.c. of sodium arsenite solution (0.264 gram arsenic trioxide, 1 gram sodium carbonate and 1 gram sodium bicarbonate per liter), the aqueous layer removed and the excess of arsenic titrated with iodine solution (0.6773 gram iodine and 1 : 2 gram potassium iodide per liter). The equations given are:

$$AsH_3 + 3\,I_2 = AsI_3 + 3\,HI;$$

$$2\,AsI_3 + 3\,H_2O = As_2O_3 + 6\,HI;$$

$$As_2O_3 + 2I_2 + 2\,H_2O = As_2O_5 + 4\,HI$$

1 c.c. of the solution of iodine in gasoline is equivalent to 0.00005 gram arsenic.

Separation of Scandium

Scandium was isolated from wolframite residues by dissolving the oxides in hydrochloric acid and precipitating with ammonium fluoride (J. Sterba, *Zeit. Elektrochem*, p. 289, 1914). To separate pure scandium salt from this precipitate, lead, copper, etc., were precipitated with hydrogen sulphide from acid solution of scandium chloride; iron and manganese from solutions of the double scandium-potassium carbonate, the former with potassium-hydrogen sulphide and the latter with iodine in potassium-iodide solution; molybdenum was removed as sulphide by precipitation in presence of formic acid; and thorium, yttrium and ytterbium by the precipitation of the double scandium-sodium carbonate, combined with the fractional crystallization of scandium formate. A spectroscopically pure scandium oxide was thus obtained. The observation of J. R. Meyer that scandium forms complex water-soluble fluorides was confirmed, and based upon this, a simple and complete separation of scandium from the other rare earths was devised.

The Klondike Pipe Line*

SYNOPSIS—Description of method of construction of the longest inverted siphon in the Yukon Gold Co.'s. main ditch system. Presence of "frost" necessitated special methods of construction. Description of setting expansion joints, anchors and foundations. Riveting by air. Pipe handled on tramway. Special difficulty at various points.

The Klondike pipe line was built during 1907 and 1908 by the Yukon Gold Co. at Dawson, Yukon Territory. It is an inverted siphon crossing the Klondike River valley, and was designed for a capacity of 125 sec-ft., which figure, however, has been slightly exceeded in operation. The maximum head on the pipe line is about 1100 ft. The total length of 15,760 ft. is made up of 2390 ft. of wood-stave pipe, 49 in. inside diameter; 5850 ft. of riveted steel pipe, 49 in. inside diameter, and 7520 ft. of lap-welded steel pipe, 43 in. inside diameter. The steel pipe ranged in thickness from $\frac{3}{16}$ to $\frac{11}{16}$ in., and came in lengths of from 15 to 30 ft. This is the largest of several inverted siphons along the line of the main ditch system of the Yukon Gold Co., 70 miles in length, which supplies water for hydraulic mining operations on Bonanza Creek.

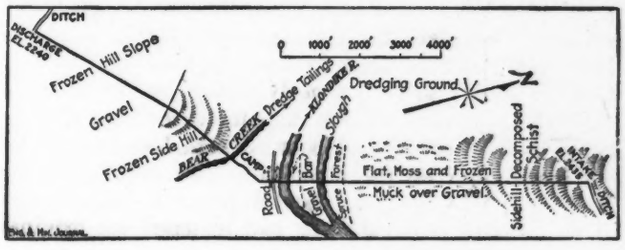
Character of Ground

The intake end of the pipe is on a comparatively steep side-hill. This hill is of decomposed schist covered by a foot or two of soil which supports a growth of bushes, poplars and a few spruce trees. The flat valley of the Klondike is here about 5000 ft. wide. It is covered with a blanket of Arctic moss from 1 to 2 ft. in depth. Below this there is a layer of frozen muck, or vegetable mold, generally about 5 ft. thick, and below this is generally found gravel. The moss blanket on the surface protects the muck from the summer heat, and whenever this blanket is undisturbed the ground beneath the moss remains frozen the year round. If the moss covering is removed, however, allowing air and water to act on the frozen muck, it soon melts. In places the "frost," as the frozen muck is called, has been built up by the seasonal thaws not penetrating fully through the winter's freezing, and extends to a known depth of 200 ft. and unknown further depths. This condition makes the question of foundations a serious one. The "frost" is a good foundation if it is not disturbed, but, if disturbed, the structure placed in it must be frozen in and the surface mossed over again to keep out the air and water absolutely. If this cannot be done, the structure must be carried through the frozen muck to good gravel or bed-rock foundation. Frozen muck was encountered all the way across the Klondike Valley and in spots along the pipe line up the side hill as far as the discharge box.

Fittings, Expansion Joints, Drains, Etc.

Only two horizontal angles were made in the pipe line, with the exception of those used in making a short offset around the base of a hill. Manholes, drains and air cocks were provided wherever necessary. Cast-steel expansion joints were put in every 500 ft. to allow for the expansion and contraction due to the extreme variation in temperature, from 80° F. in summer to —70° F. in winter. One three-span steel bridge, 295 ft. long, was necessary in crossing the Klondike River, and a total of several hundred feet of pile trestle or framed trestle were put in at various places along the line. The aim was to have the pipe supported at least once in every 16 ft. Whenever the conditions warranted it, as, for instance, when good foundation was deep, trestle bents were built every 32 ft. and king-post trusses were put in to give the intermediate bearing. In good material, sills were merely laid in the bottom of the pipe trench, and on these the pipe was supported. Whenever the foundation was within 3 or 4 ft. of the pipe, crib supports were used; if greater than 4 ft., framed bents were used.

One anchor was put in at least every 500 ft., about midway between expansion joints, and, where necessary, they were used more frequently. Each anchor consisted of a cable wrapped around the pipe in the form of a clove hitch, the ends being made fast to two "deadmen" on opposite sides of the pipe. Each deadman was set in the ground about 6 ft. below the surface.



PLAN OF THE PIPE LINE

On the side-hills drains were dug at frequent intervals to lead off seepage and leakage. At every drain a bulkhead was put in which fitted closely to the pipe and effectually intercepted the water.

Equipment and Power

In many ways conditions were unique for heavy construction. Common labor was paid $4 per day and board, which meant a total of about $5.50 per day. The working season was only five months, May 1 to Oct. 1. Some kinds of equipment were plentiful in the country, notably steam engines and boilers, but other kinds were sadly lacking. A well selected stock of equipment was ordered for the job, but breakages and unforeseen difficulties sometimes caused awkward situations because of the distance from a base of supplies.

Power was furnished from the Yukon Gold Co.'s hydro-electric plant on Little Twelve Mile River, about 50 miles from the pipe line. It was delivered at the main transformer house at 33,000 volts, and stepped down to 2300 volts. It was distributed at this voltage to the transformer banks at the several compressors and at the machine shop, where it was stepped down to 220 volts.

Construction was begun in 1907. The right of way was cleared and a small quantity of pipe trench was dug. The three-span steel bridge over the Klondike was erected. Foundation cribs were put in the river bed,

*Abstract of an article by W. W. Edwards in Proceedings of the A. S. C. E., May, 1914.

most of the work being done while the river was frozen over and the water low. Piles were driven in the river bottom and sawed off at the gravel surface, and on them the cribs were built. These cribs were then extended to a height of about 5 ft. above high-water level and filled with rock. They were sheathed with sheet iron on the up-stream end to protect them from ice. Derricks were used in assembling the steel spans. During this season also a pile approach to the bridge, 400 ft. long, was built, and several other smaller pile trestles and framed trestles. Construction was halted in the midst of the working season in 1907.

Careful Surveying

In the spring of 1908 construction was begun again. It was desired to have the job completed by the following Oct. 1, the end of the working season. All the pipe was not then on the ground and sections of pipe were missing here and there. As there were many different kinds of pipe in the line, and extra pieces were few, it was generally impossible to use sections of pipe interchangeably; therefore work could be started only at certain places. In the course of the work, it was necessary to start laying pipe at four different stations. An error in surveying would lead to awkward consequences where any of these headings joined, as well as at angle points in the pipe line. As there was in the country no heavy machinery or plate for making pipe of this size, and there would not be time to send "outside" for extras, it was necessary to be extremely careful in surveying.

All the pipe on hand was first measured up carefully and a relation established between actual measurements and those given on the blueprints. An offset line was then run parallelling the located line at a distance of 20 ft. As the seasonal thaw had loosened the original hubs so much that they could not be relied on, measurements were begun from a point on one of the bridge piers. Hubs were driven about 99 ft. apart, and measurements were taken from plumb-bob strings held from tripods. This was done on the side-hills as well as the flats. A standard pull of 15 lb. was used, the same that had been used in measuring up the pipe on hand. Corrections were made for temperature variations. Levels were run over the hubs, and horizontal distances were computed from the slope measurements and elevation differences. This system resulted in giving a first-class base line, which could be absolutely relied on in setting grades or starting points. Grades were shot in by transit. Points were set along the edge of the pipe trench, and were transferred to the bottom, when needed, by using a large wooden square and a carpenter's level. Bench-marks were set every 50 ft. in elevation. Levels were determined by running ahead for half a day and then tying back to the starting point.

In construction, it was frequently found advantageous to depart from the profile in order to avoid excessive excavation, and in these cases grade changes were made by shifting angle points.

Handling of Steel Pipe

Pipe was distributed along the line by a tramway. The cars were pulled by horses across the flat and by hoists on the hills. Of these hoists, two were run by steam and one by electricity. Signals were given by use of a wire attached to a spring pole. A telephone system also helped in signaling and in general communication. Turntables were installed on which to change the sections of pipe end for end when necessary. Steel-frame cars were used. In hoisting, a bridle was attached to the end of the pipe, and the cable was shackled to this bridle. When the pipe was at the spot desired, the cars were chained to the rail, and the pipe, with the hoisting cable still attached, was rolled into the ditch. This held the pipe from getting away on the side-hill, and the cable always had so much spring that no harm was done to the engine.

Riveting

Riveting, caulking and drilling were done with pneumatic tools. Air was furnished by 8x8-in. Clayton air compressors run by 15-hp. three-phase motors. One air compressor would furnish air enough to operate a riveting hammer, caulking hammer, drills and air dolly with not much to spare. The compressor outfits were mounted on platforms and moved from place to place as desired. The riveting of the holes in the bottom of the pipe was done from the inside, and of the upper holes from the outside. Air dollies were used in holding on inside the pipe and spring dollies on the outside. Each riveting gang consisted of a riveter, bucker-up, heater and passer. An average day's work was from 160 to 180 1-in. rivets, when conditions were good. Fitting-up bolts were used liberally and the joint was well sledged before driving each rivet. All castings were hand-riveted to the pipe, the riveting being done on the inside.

The expansion-joint castings were frequently found to be too large for the pipe. In such cases the pipe was heated by a blast lamp and belled out with hammers to fit the casting. Rivet holes in all castings were drilled in the field after assembling. All caulking was done with rounded-edge fullers, the square tool being dispensed with. The riveted pipe was caulked on the outside only, the lap-welded pipe was caulked both inside and outside. Rivets were inspected with a 1-lb. tapping hammer.

Protection of Line

The pipe was coated on the outside with a red-mineral linseed-oil paint and inside with a quick-drying black paraffin paint.

The wood-stave pipe was of California redwood staves thoroughly seasoned. It was laid in a trench 2 ft. deep, and, when completed, was back-filled to a depth of half the diameter of the pipe, so as to give a good bearing.

The intake penstock was equipped with overflow and turn-out, as was also the discharge box. The discharge box was located on a shaded side-hill on frozen clay. This condition made necessary considerable cribbing to protect it from the sloughing of the clay when it thawed consequent on the removal of its moss covering.

Timber was secured from adjoining leases and also from river drives. It was necessary to do considerable work to protect the river banks from undercutting in the vicinity of the bridge, as they were of loose gravel, loam and moss. Piles were driven and shear cribs put in along the river bank above the bridge. Protection cribs were also put in above the pile bents on the bridge to take the brunt of the ice pressure and to break up the ice stream.

Where frozen muck, reaching to a depth of 45 ft., was encountered at one point, shafts were dug to gravel foundation and trestle bents were put in at intervals of 32 ft. At another point a heavy cut through dredge

tailings and solid rock was necessary. This was just at the base of a hill which was covered with frozen muck. The digging of this section was delayed until as late as possible, so that the extreme cold would keep the overburden on the slope above from thawing on exposure and sliding.

A small spot of frozen clay was encountered at still another point., and the depth of good foundation being unknown, a corduroy of spruce trees was laid on the frozen clay in the bottom of the pipe trench, and this was covered with about 2 ft. of gravel. A bulkhead was built around the pipe above this place to shut off all seepage and leakage, and a drain was run off to the side. The pipe was back-filled and the surface covered with moss again. Apparently, the foundation remained frozen, as no settlement was noticed.

Although work was begun at the camp about Apr. 1, it was not until about May 15 that all the snow was off the ground and it was possible to work to the best advantage. A night shift was put on about May 15 and continued until Oct. 1, by which date the pipe was all laid. The long days of the extreme northern latitude made lights unnecessary on the work until Aug. 1. After that, a system of arc and incandescent lights was installed, which worked well. The missing sections of pipe began to arrive about July 1, and from that time onward operations were rushed. A force of 350 men was used to push the work to completion.

Connection of Sections and Anchoring

The different headings of pipe were connected up at the expansion joints. This was effected by sliding the outside ring of the expansion joint back on the pipe and then pulling it up to position after the pipe had been lined up. A tabulation was made showing the space to be left open at the expansion joints at various temperatures, so that they would not close during the hottest or open in the coldest weather. This was followed in setting the joints. Gages were wired on at each expansion joint so that unequal expansion or contraction could be noted and steps taken to prevent it. The coupling bolts for each expansion joint were set so that the lap in each joint could not be less than 1 in. Reference points were also put in on each 500-ft. section of pipe, so that movement could be detected. Anchors were put in at every angle point. These were generally either bulkheads of timber against the pipe, used as thrust anchors, or cables around the pipe attached to deadmen. When possible, at the angle points, a timber crib was put completely over the pipe and filled with rock. The high cost of transportation and the character of the foundation made concrete anchors out of the question. The only timber available was white spruce, which was soft and brittle, and had to be used with a high factor of safety in all structures.

Trouble Encountered

Some trouble was experienced from the lap-welded pipe. Two makes were used on the job. One, an American, was perfectly satisfactory, but the other, a German, was not. One section of the second kind cracked along the weld for a distance of 10 ft. on being dropped into the pipe trench. This was patched and reinforced, and gave no trouble in operation. Another section of this pipe burst in testing under 835 ft. of head. Examination showed a flaw in the metal. When it burst, the water was shot out to the side of the pipe line and little damage was done. This was the extent of the trouble with the line in testing.

In operation, the quantity of water flowing through the pipe fluctuated considerably. As the difference in elevation between intake and discharge was 195 ft., this variation caused great fluctuations in the water level in the pipe at the intake end, there being no regulating gate at the discharge end. When little water was flowing, it ran in a rapid stream down the bottom of the wood-stave pipe at the intake end. This had the result of rapidly wearing out the bottom staves, so that considerable patching had to be done.

Bulkheads were put in at each end of the pipe and all other openings were closed as soon as the pipe was thoroughly drained. Thus the air circulation inside the pipe was shut off and the snow formed a blanket which protected it from the extremes of the winter temperature. It was found that with an air temperature of —30° or —40° F. the temperature inside the pipe was only about —5° F. In operation, the pipe is drained at the close of the working season, about Oct. 1, and opened again about May 1.

Foundation Work

The peculiar and therefore the most interesting feature of this work was, as noted before, the study of foundations and the best styles of substructures to be used in the frozen ground. In places in the North, piles of sawdust have been placed on the moss and buildings put on this foundation. When water is kept away, this makes a good foundation, as the sawdust protects the moss and the frozen ground below from heat and consequent thawing, thus insuring stability. In flume substructures on the Yukon company's line on frozen sidehills, cripple bents were tried and discarded in favor of level mudsills set in the "frost," about 2 or 3 ft. below the surface at the down-hill end. These were mossed over and remained frozen unless excessive leakage thawed the ground.

Mr. A. C. Strong, of the Yukon Gold Co., developed a type of structure which well suited the foundation. He used piles driven into holes previously thawed out by steam points. As the surface moss is disturbed hardly at all in this process, the pile immediately freezes in and remains in this condition. At last reports, pile substructures, such as these, were giving good service. This appears to be the cheapest form of substructure as yet devised for use in ground frozen to any considerable depth.

Risk Not Assumed by Miner

An employee in an iron mine did not assume the risk of being injured in a shaft or raise into which he had been lowered to loosen ore, which had become clogged in a chute, caused by breaking of the chute partition above him when the ore was released, where he was inexperienced in such work. In reaching this decision in the recent case of Ranta vs. Newport Mining Co., 147 *Northwestern Reporter* 609, the Michigan Supreme Court said:

The plaintiff had nothing to do with the building, inspecting, or repairing of the raise, and he claims he was ordered to do this work by the shift boss, without any warning of the danger, and that he did not know of any danger. The duty to furnish a safe place was a duty which could not be delegated by the master; nor can it be said that the plaintiff assumed the risk.

Mechanical Underground Shovel

Although a great variety of machines and labor-saving devices is in use at mines, the hand shovel today retains its importance as a handler of broken ore. The reason is probably that no one machine has yet been built that will successfully compete with the hand shovel in all classes of mines. Of late years, however, mechanical engineers and practical mining men have been devoting more thought to the possibilities of mechanical underground shovels, with the result that some models have been placed on the market and others are being developed and experimented with.

The Lake Shore Engine Works, Marquette, Mich., have been working on mechanical loaders for the last five years, and are about to market a machine which has been patented by V. G. Halby, chief engineer of the company, N. D. Flodin, sales manager, and M. E. Richards, general manager of the Judson Mining Co., Crystal Falls, Mich. This machine was demonstrated at the Lake Superior Mining Institute meeting held on Aug. 31. The loader is designed for use in iron, copper and coal mines, in drifts 8x8 ft. and possibly smaller.

The machine has an extreme height of 5 ft. from the top of the rail, width of 3 ft. 9 in. and an extreme length of 14 ft., including the shovel, or 11 ft. without the shovel. It can be arranged for operation on any gage track, is self-propelled, compact and weighs 6500 lb. The rubber conveyor belt, 22 in. wide, is the only detail in the machine which is not either iron or steel. The capacity is 40 tons of material per hour. The loader may be arranged for operation by air or electricity although it is expected that air operation will be popular because the exhaust from the engine will help to clear the drift of smoke after a blast. It will be possible, however, to change the power, on any machine, in an hour's time when the necessary electric equipment is at hand. There are six different motions controlled by one operator. The machine propels itself forward and backward, the conveyor and shovel operate on a vertical arc of 30° and in a radial arc of 60° respectively; the conveyor belt is driven and there is the driving mechanism of the shovel. With this combination of motions a great deal will probably depend upon the ability of the operator to get the best output from the machine, and this in turn will depend upon his skill and experience in actual service with it.

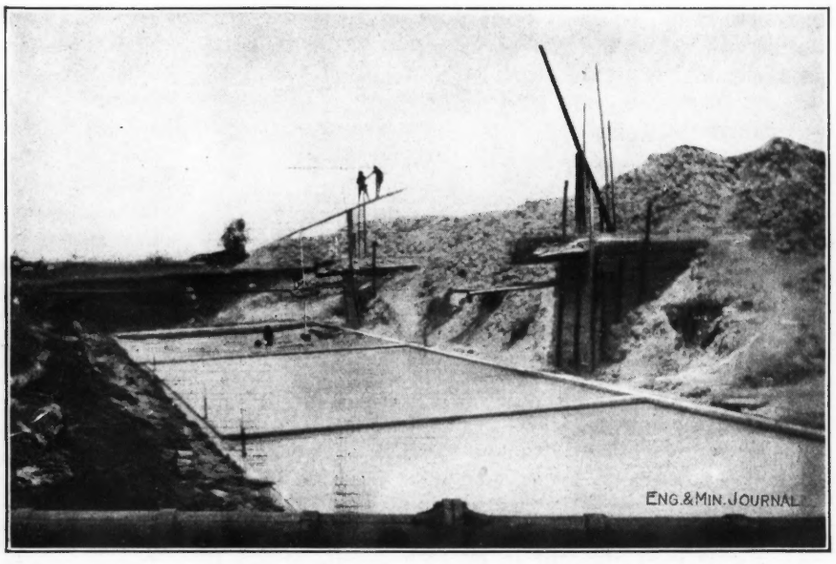
The loader consists of three distinct parts which may be disconnected with little difficulty when it is required to take the machine from surface to points underground, or from drift to drift. The truck constitutes one portion, the frame with driving mechanism another, and the conveyor belt and shovel the third. All chains for driving are heavy-construction automobile chains. The gear drive from the engine to the main shaft is of the Wuest patented herringbone type. All operating mechanism is completely inclosed, and securely covered so that no dirt can interfere with the operation of the drive.

The digging dipper, which is somewhat cup-shaped, is fitted with teeth on the cutting edge, and hinged at the back. After securing a load, the dipper is revolved through a vertical arc, and its load falls backward upon the rubber conveyor belt. This belt carries the dirt up an incline of about 30°, dumping it at the turn into an iron chute. The latter directs the dirt into the tram car, and both its angle and direction can be changed within certain limits.

It is the intention of the company to manufacture several sizes, adaptable to other mines where conditions are different The demonstrating machine will go into service soon at the Judson mine, at Alpha, on the Menominee iron range, Michigan. Mine operators on the Lake Superior ranges are much interested in this loader.

Slime Settling in India

With the highly perfected systems of slimes settling in use in most mining districts of the world today, it is difficult to realize that in some remote places the most primitive and laborious methods are still followed. This

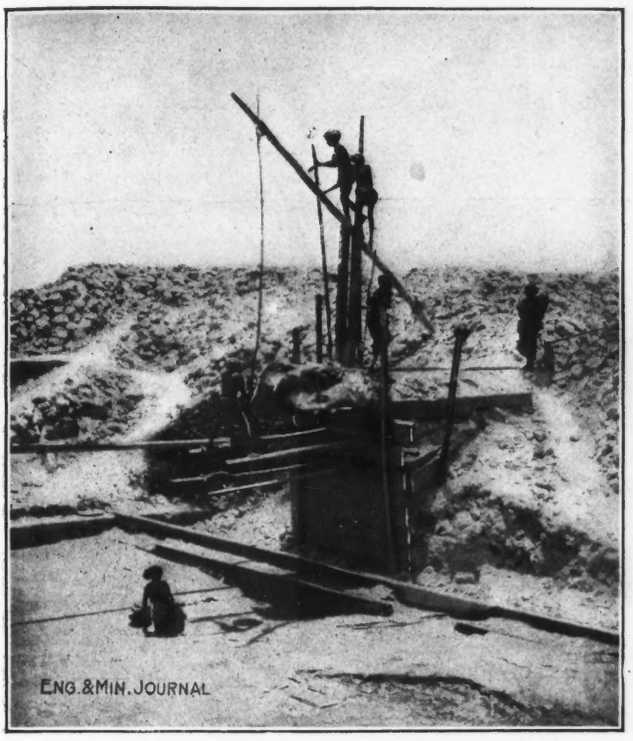


General View of Settling Tanks and Elevating Devices

circumstance is not due to ignorance, since the operators are unquestionably aware of the developments made in the art, but is on account of the conditions existing locally, which govern the possibilities in every case.

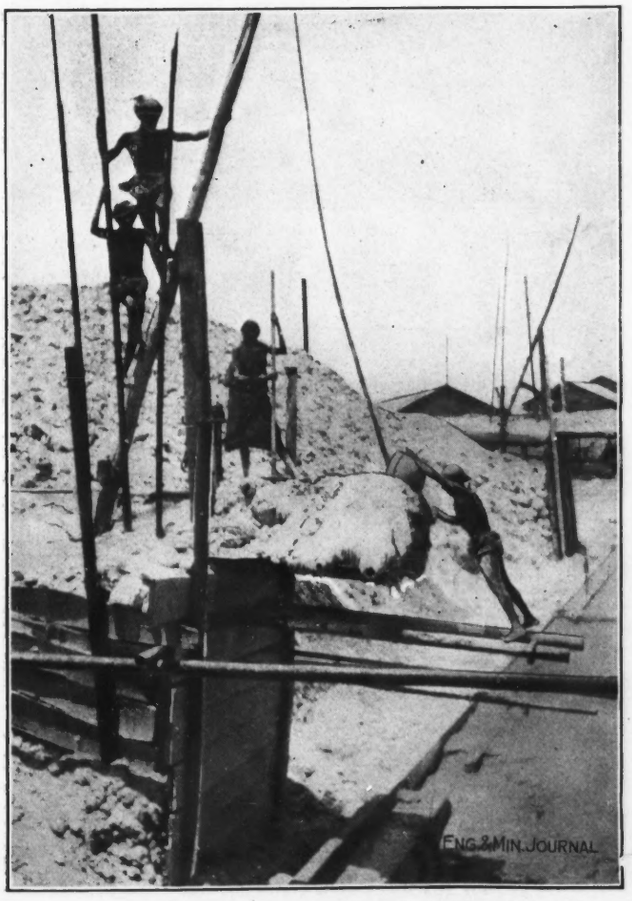
Among the most primitive of the settling systems now in use is that followed at the Nundydroog mines of India, where native labor takes the place of both machinery and power. In carrying out this method, the slimes are run into large masonry tanks built in the ground. Slime pulp is run into one of these until the overflow is muddy, when the stream is run into another tank. By alternately filling and settling in this manner, the tanks are filled with settled slime.

To extract the settled solids, native methods are resorted to. Into the slime mass a native woman is stationed, her duty being to fill an earthware pot by scraping the slime into it with a basket. The pot is hung by a rope from the end of a wooden lever, a kind of walking beam operated by two men, by means of which the pot full of slimes is raised to the level of a discharge



RAISING THE POT OF SLIMES

launder. Here two more women, each with a long-handled hoe, push the heavier pulp along to the discharge point. The accompanying photographs illustrate the operation fully.



DUMPING THE SLIMES

This seemingly barbarous procedure is followed for two reasons, the first being that it is cheaper than the most modern system would be, and the second that it is desired to employ as many of the natives as is possible, distributing the wage output widely so as to maintain the greatest possible number of people, a laudable object in a country so subject to poverty and starvation.

American Institute of Mining Engineers--Hadfield Research Prize

According to a circular just issued, through the generosity of Sir Robert Hadfield, honorary member, the directors of the Institute are enabled to announce the Hadfield Research Prize of $1000 for the best contribution to the publications of the Institute upon the general subject of "The Different Forms and Combinations of Carbon with Iron, including those in Iron Alloys." The prize will be awarded at the annual meeting of the Institute in February, 1916, to the best paper upon this subject which is presented to the Institute before Nov. 1, 1915, provided such paper is deemed worthy by the Iron and Steel Committee.

The following suggestions are added for the guidance of those who may take part in this research. While it is not desired to define closely the exact lines or scope of the proposed research, as it is advisable to make these as broad as possible, the object in mind may be said to be generally as follows:

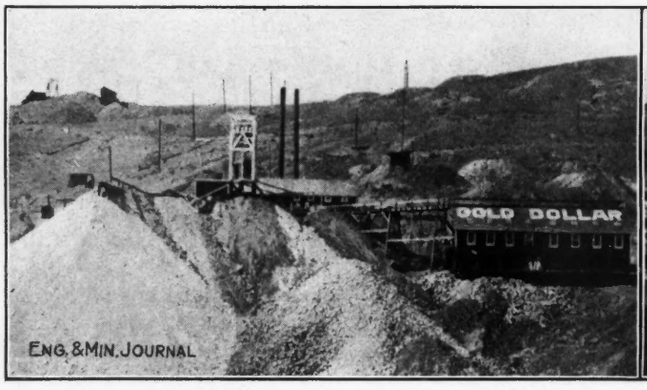
To elaborate and find out the best methods of determining the forms of carbon in steel or iron, including those in iron alloys. A portion of the work would probably be a continuation of the researches which have in the past been carried out by Jullien, Abel, Muller, Ledebur, T. Sterny Hunt, Akerman, Arnold, Stead, E. D. Campbell, Hogg, Parry, Upton and others.

In a generic way, metallurgists now speak of carbides, subcarbides, double carbides, special carbides, and other combinations. It is very desirable that these should be accurately defined and understood. It is also desirable to know whether there are other or new forms; if so, can these be separated and their characteristics obtained?

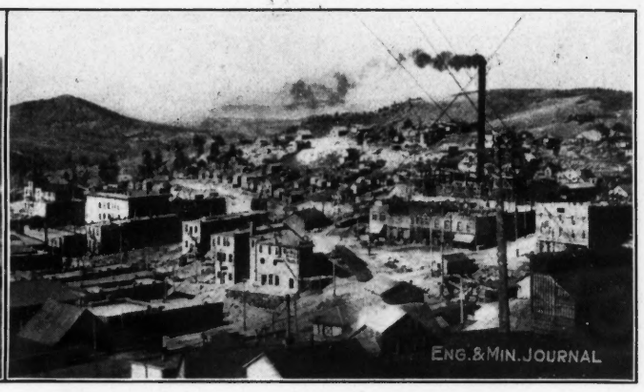
In addition to research work upon particular forms of carbide which have not yet been determined, it is also desirable and necessary to determine the state in which the carbon exists. For example, there exists what is termed a "missing form" of carbon, about which little is known or understood. More light is required about this form, as for many years very little has been added to our knowledge on this subject. It would be desirable, for example, to know whether the carbon not accounted for as carbide is "missed" in consequence of its being in so fine a state of division, or whether it is present in some special form or condition. It is also necessary, if possible, to ascertain the molecular constitution of the carbides.

The above seems to be an outline of the general direction which should guide those considering and taking part in this research. It is hoped that the results obtained will throw much light on the cause of the hardness of steel, also the nature and form of carbon combinations with iron and its alloys. Further information may be obtained from Bradley Stoughton, Secretary, American Institute of Mining Engineers, 29 West 39th St., New York.

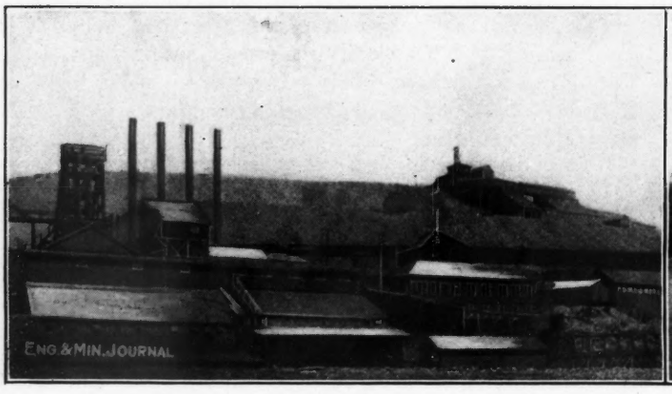
Photographs from the Field



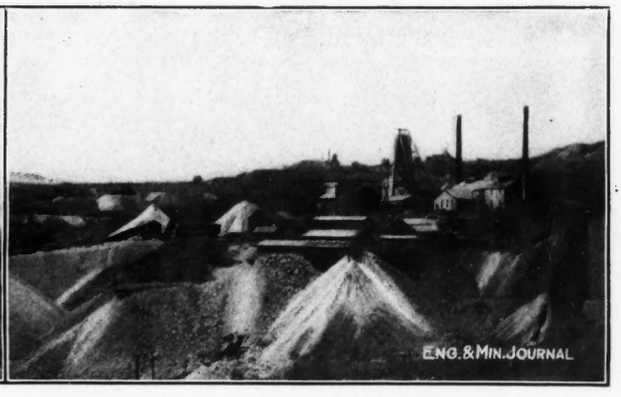
GOLD DOLLAR MINE, CRIPPLE CREEK, COLO.



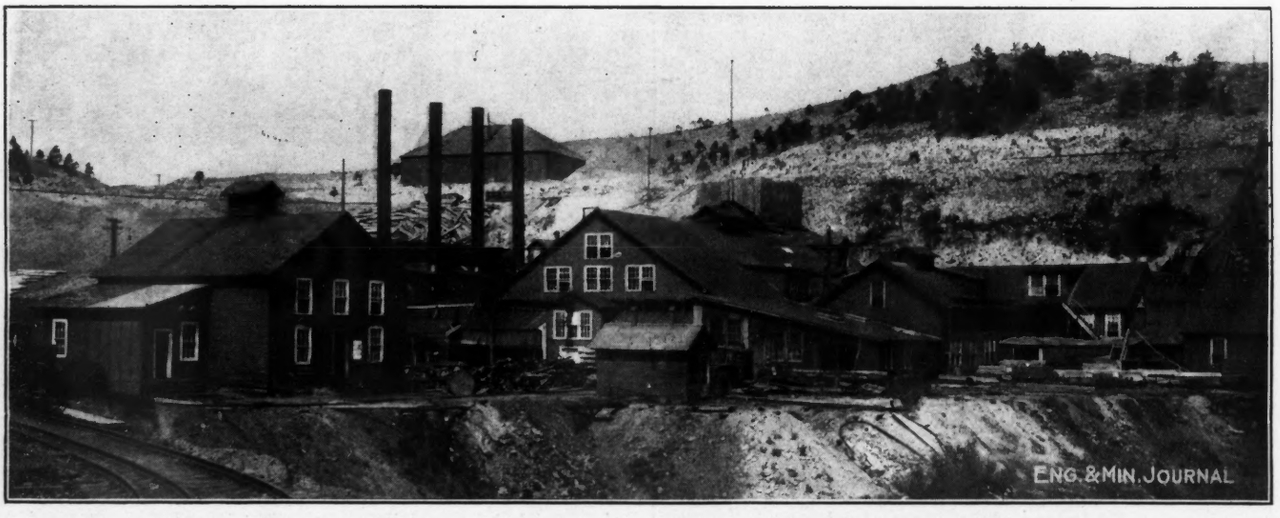
VICTOR, IN THE CRIPPLE CREEK DISTRICT



PORTLAND MINES, NEAR VICTOR



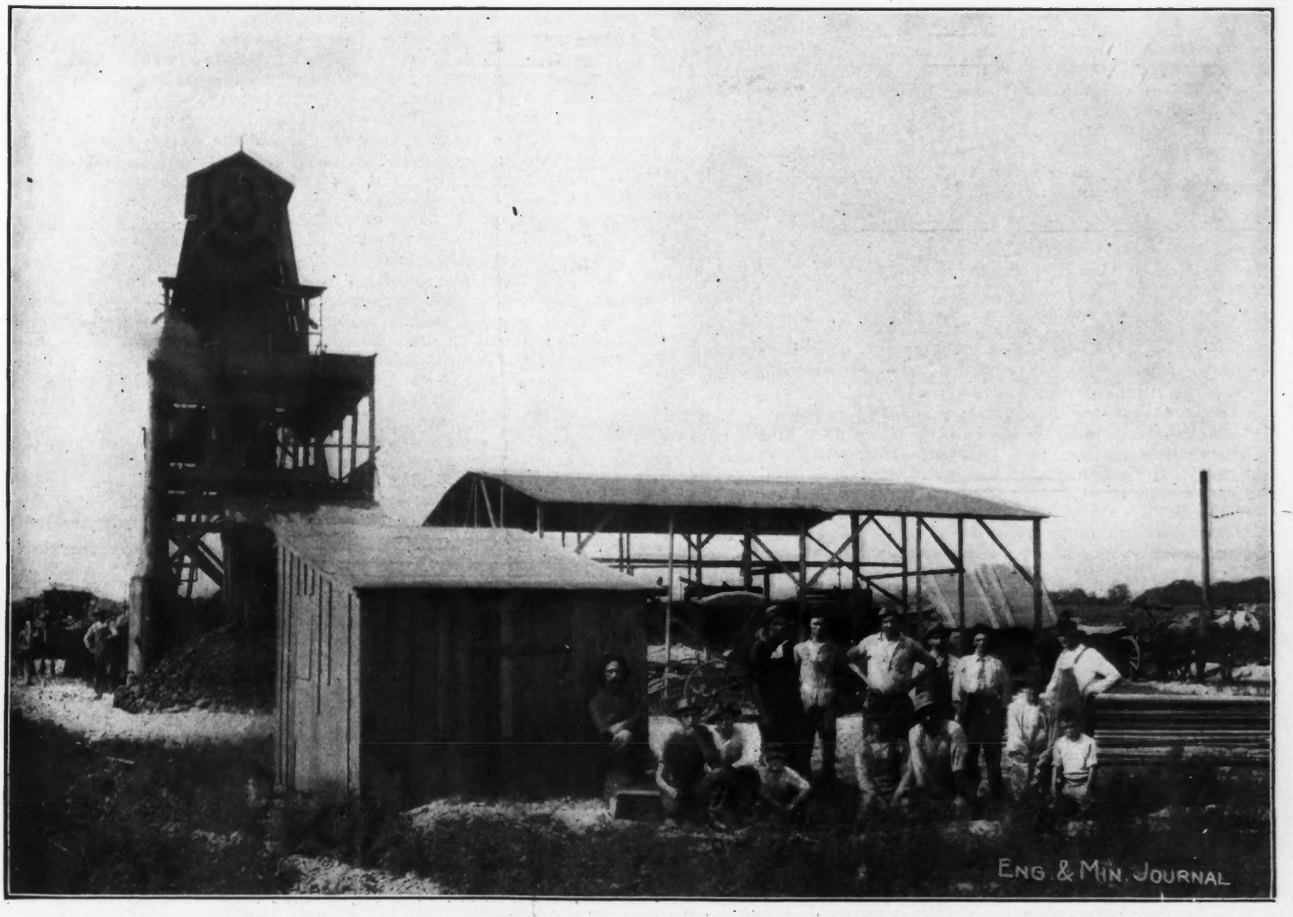
GOLDEN CYCLE MILL, CRIPPLE CREEK DISTRICT



HIGHLAND HOIST

One of the Homestake shafts, near Lead, S. D. The ore is delivered to four No. 6 B Gates breakers, and then to a 1000-ton bin, whence it is trammed to the mill.

CARBONATE HILL, LEADVILLE, COLO.



TWO BOBS LEAD MINE, SHERIDAN-ADAMS ROYALTY SYNDICATE, JOPLIN, MO.

NEW PUBLICATIONS

RAPID METHODS FOR THE CHEMICAL ANALYSIS OF SPECIAL STEELS, STEEL-MAKING ALLOYS, AND GRAPHITE. By Charles Morris Johnson. Second Edition, Rewritten. 6x9¼, pp. 436, illus.; $3. John Wiley & Sons, Inc., New York.

THE PRE-CAMBRIAN GEOLOGY OF SOUTHEASTERN ONTARIO. By Willet G. Miller and Cyril W. Knight. Pp. 151, illus. Vol. XXII, Part 2, Report of Bureau of Mines of Canada, Toronto.

ALASKA. ITS MEANING TO THE WORLD. By Charles R. Tuttle. 6x9, pp. 318, illus.; $2.50. Franklin Shuey & Co., Seattle, Washington.

This is wholly a compilation, as the author himself states. Its one virtue is its timeliness. The book contains nothing new of value but might prove serviceable to those without access to the original sources of information.

HANDBOOK OF MILLING DETAILS. Compiled from the "Engineering and Mining Journal" by the Editorial Staff. 6¼x9½, pp. 425, illus.; $4. McGraw-Hill Book Co., New York.

A couple of years ago, I reviewed in the "Journal" the companion-volume of this one, a "Handbook of Mining Details." The two are alike in plan, and equally satisfactory in execution. The present volume like the former professes to be the gossip of modern practice. It is a symposium of competent observers returned from trips of observation, and reporting what they have noted en route as interesting or valuable to their common profession. Simply to describe it is to praise it.

Compiled from the columns of the "Journal" during the past two or three years, it fills an important place in technical literature—namely, the place between the elaborate and comprehensive treatise and the casual paragraph in a weekly or monthly publication. And this it does by furnishing a series of such paragraphs, selected for their suggestive interest and authoritative value, grouped under their respective departments, carefully edited and adequately indexed.

Every instructor or practitioner knows the difficulty of keeping himself up to date. Precisely those items which have not yet been embodied in the text-books are the things he wants to know. He sees them in the swift "movie" of the periodical press, and wishes he could stop the machine to scrutinize them and, if they prove worth preserving, to keep them as permanent possessions. Perhaps he starts in with an ambitious set of envelopes, in which are to be filed the separate cuttings that interest him. But he is too busy to keep up the system regularly, and his stenographer is not able to carry it on with due discrimination. The envelopes are either too plentifully or too scantily filled; and their contents are not critically winnowed. There is room for a competent middleman, who shall select, test and arrange the scattered notes of progress. And such books as this are such middlemen as that.

Of course, this volume could not be expected to contain long expositions, even of novelties. It is intended for those who already almost know almost everything, and wish to have the latest comments and suggestions of practical details, if only as a guide to more thorough experiment and research.

The contents are arranged under the successive titles of Sampling; Ore-Dressing (Breaking, Crushing and Grinding, Washing, Separating and Concentration and Accessory Apparatus); Notes on the Equipment of Metallurgical Plants; Hydrometallurgical Processes; Smelting; and Refining. Under each head, there are interesting items, and occasionally more or less thorough discussions of single features of process or apparatus.

Occasionally, a brief note sheds much light upon the methods as well as the controversies of the day. For instance, the question of stamp-drop sequence in 5-stamp batteries has been voluminously treated, as we all know; and everybody admits that the stamp dropping in the order 1, 2, 3, 4, 5, would drive the charge to one end of the mortar, with obvious injury to the work of the battery, while by another arrangement both ends may be clogged while the center-dies are exposed, and their stamps "pound on iron." Avoiding both these confessedly bad sequences, the experts have been for years divided between two formulas: 1, 4, 2, 5, 3 and 1, 3, 5, 2, 4. The advocates of each have demonstrated the disadvantages of the other; and yet, as Mr. W. E. Storms points out, the two sets of figures represent the same succession, as counted from left to right or from right to left in the mortar. This amusing instance of intellectual confusion might be paralleled in other professional controversies.

During my service as U. S. Commissioner of Mining Statistics, from 1868 to 1876, such controversies were specially frequent concerning the apparatus of crushing and grinding. The patentees of grinding-pans stood belligerently for the "tractory conoidal" and other forms; and the multiplicity of rival constructions was bewildering. Dr. Percy, before issuing his volume on Silver and Lead, wrote to me in a tone of despair, asking for a general classification of pans; and I wrote him in reply that there were three great classes comprising respectively pans for grinding or amalgation alone and for both; that under each head there were two classes; the rickety and the durable; that there were also differences in material—stone, wood, iron, copper, and combinations thereof, and differences of size, and differences of speed; and that the practical effects of these differences was much greater than the theoretical effect of recondite forms, gears and motions. It was not until our mill-builders had learned to give us good materials, simple and durable constructions and adequate power, that the discussion of theoretical forms became pertinent and practicable.

But the importance of details is by no means to be underrated. It was impressed upon me very early in my work. In 1871, at the first meeting of the American Institute of Mining Engineers, I read two papers—the first two in its Transactions. One of them was on The Relation between the Speed and Effectiveness of Stamps—a subject concerning which I knew at that time very little, while I recognized its significance and ardently desired to interest western experts in its discussion. This and other tentative invitations had the effect of securing members from the Pacific slope and contributions from such members. For many years, the Transactions contained numerous brief notes, describing any simple devices or features of operation, furnished by practitioners who had not the time to prepare longer essays, or the experience, knowledge of technical literature and access to files and libraries necessary for such larger efforts.

The question of the relative value of such contributions to the Transactions did not arise. So far as I can recall, no pertinent and valuable paper of either class was ever rejected by the Institute. After the establishment of the Bulletin, when our Transactions had become crowded, we printed much in that publication which was not subsequently reprinted in the Transactions.

The last two years has shown an immense increase in the amount of the Institute's publications, and a great predominance of long and elaborate papers. This may tend to discourage the tender or the acceptance of the smaller notes of practice. In that event, the service rendered by the "Engineering and Mining Journal" both to young practitioners and to the profession at large, will be enhanced. For, like the rest of our generation, in whatever department of human endeavor, we want the news. Even the daily papers report to us things "important if true" in engineering and applied science. But in our line, as in all others, it may generally be assumed concerning such newspaper items, first, that they have a basis of fact; secondly, that they are incorrect in statement. They are not intentionally false; but they are not intelligent. We look, therefore, to our technical journals and societies for the real news, and finally, for the truth precipitated by boiling and filtering the news. Then comes the still more accurate measuring, weighing and testing of the new truth in its relation to other truths—a work performed by both the societies and the journals;—and finally the refined and defined result of these processes is incorporated into the appropriate science by those skillful critical compilers, "the leading authorities."

Every step in this evolution of an applied science is necessary; and at every step the exercise of critical inspection is welcome. It is a pity that even the news should be misleading; but it is a crime to pass on an item of such news until it is imbedded as a truth in books. We may well be gratified to those who competently edit our professional news at the very first stage, since we must have it, always read it, and are often called to act upon it, whether it be or be not a safe and sufficient guide.

The reader must pardon the discursive garrulity of an old man. But the pardoner need not expect penitence or apology. For I glory in the opportunity of vindicating the dignity of editors—under which turn I include every one who detects and corrects an error.

"Baby bye,
"Here's a fly!
"Let us swat him, you and I"

should be our amended version of poetic exhortation, from the nursery onward.

The moral of all this seeming, but not real, digression is, that the editorial staff of the "Engineering and Mining Journal," who arranged and revised the contents of this book, are entitled to our gratitude for this entertaining and useful book.

R. W. RAYMOND.

James B. Haggin

James Ben Ali Haggin died on Saturday, Sept. 12, at his summer home in Newport, Villa Rosa. He had been in poor health for some time. He was born in Harrodsburg, Ky., December, 1822. The name Ben Ali came to him from his mother, who was Adeline Ben-Ali, and was declared to have been a Turkish woman who was exiled because she embraced Christianity. Many other stories were told of her, but this one was generally accepted as fact, although Mr. Haggin always refused to confirm or deny any of them. That he had Turkish blood in his veins and Turkish sentiment in his heart was never doubted, and his son and grandson were named Ben Ali.

Little is known of Mr. Haggin's early life, except that he received his education in Danville, Ky., was prepared for the legal profession and admitted to the bar in his native state. He began practicing in Shelbyville, Ky.; later went to Natchez, Miss., and then to New Orleans, where he became inspired by the tales of gold in California, and in 1849 started for the Pacific Coast, by way of the Isthmus of Panama, arriving in San Francisco in 1850. For a time he practiced his profession, his first partner being Milton S. Latham, who afterward became Governor of California. Later he was a partner of Lloyd Tevis, who became known as the most successful lawyer in San Francisco.

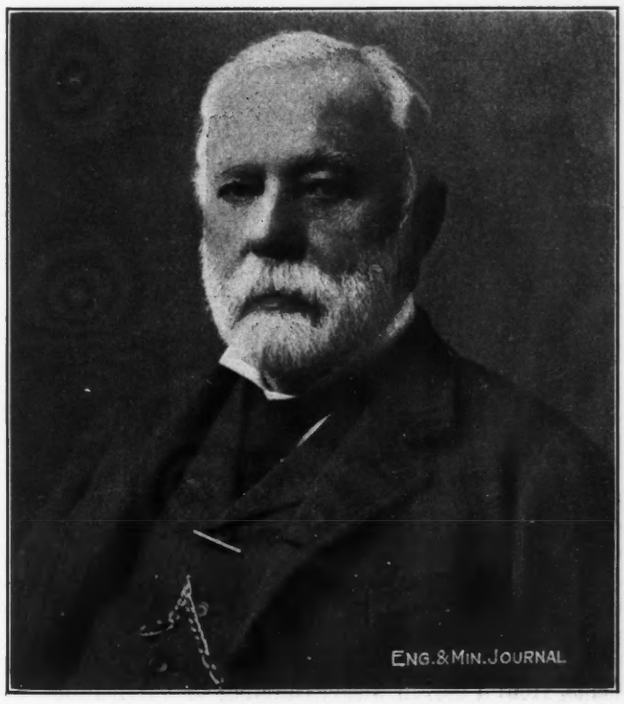
At the time of his arrival on the coast there was much need for active and competent lawyers in the settlement of individual and property rights, and the demand for Mr. Haggin's services was so great and the payments so large that he made a great deal of money, all of which went into mining investments.

Although at this time he possessed no technical knowledge of mining, his investments proved so good that it was only a short time after he formed his partnership with Tevis that he was obliged to abandon the practice of law and devoted himself to his mining interests. From that time onward and for many years the firm of Haggin & Tevis was one of the greatest factors in the mining industry west of the Rocky Mountains. They then began the series of fortunate investments which landed them among the foremost capitalists of the United States.

Nor was their system of investment by any means haphazard. This firm was the prototype of the modern exploration and development companies. Stock-jobbing was in no way their guiding principle. Rather was it the development of mines for what they would yield in ore, and especially was it the development of "prospects," not the purchase of developed mines. Their theory was that out of a large number of well chosen "prospects" the majority would prove to be worthless, but some would earn a little, fewer would be profitable in a small way and perhaps one would turn out to be very rich and would more than pay for the losses in all the others. In fact, they had the marvelous fortune to develop not only one phenomenal mine, but three of them, and these no less than the Ontario, the Anaconda and the Homestake.

In carrying out their mining business they had a small army of engineers, scouts and prospectors in the field. Their methods were in short about the same as those of some successful concerns of the present day, but they were operating in a more primitive time and in a more virgin mining country, in a time and with conditions when discoveries were more easily made than they are now. They operated in the days when mines were found that paid from "the grass roots down," and in that era they were not confronted with the problem of $10,000,000 financings before one cent of return could be expected.

In many of their operations, George Hearst, that sterling old pioneer and prince of prospectors, was associated with them and the syndicate was often referred to as Haggin, Tevis & Hearst, although we believe there was never any formal partnership except in individual ventures. However, Hearst participated in the three great successes and was the predominant factor in the Homestake and a very important one in the Anaconda. Hearst became connected with the mining interests of Haggin & Tevis in 1870. Upon the discovery of silver ore at Park City, Utah, he went there in the interest of his firm, and after watching developments, in 1872, purchased the Ontario mine for $33,000. The sum of $500,000 was put into this property, in exploration of the vein and construction of the mill, before any return was received, but in 1877 it paid its first dividend. This brief record of the Ontario development sufficiently exemplifies the methods of Haggin & Tevis in their mining operations. In 1876, Hearst bought for the firm the great Black Hills group of gold mines, the most famous of which is the Homestake. In a similar way Marcus Daly cooperated with the firm.



JAMES B. HAGGIN

Marcus Daly, an old Comstocker, had been in Utah whence he went to Butte to open the Alice mine for the Walker Brothers. There he saw the Anaconda outcroppings and obtained an option on the property, having some vision of its magnitude, although at that time he regarded it as a silver mine, not copper. He knew George Hearst and through him Haggin and Tevis. He laid his plans before them, explaining that he should need a great deal of money, but impressed Mr. Haggin, who told him to go ahead. This was in 1881. After two years,

during which he had expended large sums of money, he wrote to Haggin & Tevis that he would not draw for any more until one or both of them had visited Butte and seen what use had been made of their money. So Mr. Haggin went there for the first time, and having looked over things is quoted as remarking:

"Daly, you make me a vast amount of trouble. I'm getting old, but you drag me here and race me through your mine for days, though it was all unnecessary. The property is bigger than you ever led me to believe, which I suspected before I left home. Hereafter, please keep in mind what I told you in the first place. When you need money draw, and keep drawing."

After the development of the Anaconda mine, Mr. Haggin rather retired from the active making of mines, although he ever maintained his lively interest in the business, until only a few years ago he took up the Cerro de Pasco property in Peru. This was one of the modern kind of mining enterprises, the old mine with great resources of ore too low in grade for the ancients, the conversion of which was dependent upon the provision of immense mining and metallurgical plant with an initial outlay of many millions of dollars. This enterprise was eventually brought to fruition and was a great achievement for a man who was already much upward or three score and ten years. Even after this he kept his scouts in the field, sending them all over the world. Once we asked one of his confidential engineers why the old man sent him off on such adventurous journeys.

"Well," he replied, "he likes to read the reports."

"There are plenty of people who would send him reports," we suggested.

"Yes, but they would not be like his own."

While Haggin was in partnership with Tevis, he bought farm lands in California, until at one time he was the owner of a solid block of 400,000 acres, practically the whole of Kern County, and was the head and front of the great irrigation contest between the individual settlers on farm lands in California and Miller & Lux, who owned 750,000 acres of land in different counties and hundreds of thousands of head of cattle. The cattlemen objected to the diversion of rivers to flumes and ditches for the purpose of irrigation in the San Joaquin valley, which had turned it into orchards, vineyards and alfalfa fields, from a barren waste, claiming that irrigation was unconstitutional and quoting the old English law, "Water ought to flow as it has been accustomed to flow."

They wanted the water for the use of their herds and the the watering of their pastures. Haggin and his partner came to the defense of the small farmers, and fought the issue successfully through courts and legislature. Had the battle been lost, and it would have been had the individual settlers been left to fight it out against the cattle interests, southern California and the fertile San Joaquin valley might have, to this day, remained "bad lands." Mr. Haggin's enormous holdings in California are now managed on scientific principles. They are cut up into workable ranches, some of them leased to farmers and some exploited by his own men. The wheat fields are large enough to supply all California, the sheep herds are the largest on the coast, and more hops are grown there than by any one man in the United States.

When Mr. Haggin had reached the height of his prosperity, and had advanced in age, he began to devote a little time to play. Coaching appealed to him at first, and he drove a four-in-hand with William C. Ralston and Milton S. Latham as his constant associates. After Ralston's death and Latham's financial troubles, he lost all interest in that sport, and turned to the breeding of thoroughbred horses. He started a small establishment near Sacramento with one sire, Langfield, and a few mares, and a year or two later his colors began to appear on the turf. For many years he was a great figure in racing and he was the owner of some famous horses. On the death of his son, Ben Ali, he withdrew from racing and devoted himself to breeding only for some years. When Mr. Haggin's Rancho del Paso stock farm was at the height of its greatness, in 1905, he concluded to dispose of it and retain only his Elmendorf farm, in Kentucky.

Mr. Haggin was president of the Homestake Mining Co. and of the Cerro de Pasco Mining Co., vice-president and director of the Jalapa Railway & Power Co., and director in the American Car & Foundry Co., International Steam Pump Co., Oriental Consolidated Mining Co., and Oyamel Co.

While living in Natchez, Mr. Haggin married Miss Saunders, who died in 1894. On Dec. 30, 1897, he was married again, in Versailles, Ky., to Miss Pearl Voorhies, of that city, who was more than 35 years his junior, being a niece of his first wife. She survives him, together with Louis T. Haggin and Mrs. Richard P. Lounsberry, children of his first wife. The artist, Ben Ali Haggin, is Mr. Haggin's grandson.

Albert Grothe

Albert Grothe died in the American Hospital at Mexico City on Aug. 19, 1914. Mr. Grothe was one of the best known of the veterans of mining in Mexico and died in his 74th year. He was born at Hagen, Prussia, in 1841, and educated as a civil engineer at the technical college at Utrecht, Holland. He went to Java and was on railroad construction from Samarang to the interior, and later became chief engineer of the Batavia Tramway Co. He returned to Europe in 1870 and superintended the construction of a number of bridges on the railway from Tamboff to Saratoff on the Volga in southeastern Russia. He was in charge of the construction of the bridge across the Tay in Scotland, the largest in the world at that time. In 1879, Mr. Grothe was manager of the Tharsis Sulphur & Copper Co.'s works in Spain. In the '80's, he became manager of the United Mexican Mines, a British corporation which took over some of the most famous old mines in the Guanajuato district, among which were the San Cayetano and Cubo groups. The company was the first foreign one to enter Guanajuato and prospered under Mr. Grothe's management. He later had charge of the Tepezala copper mine, near Aguascalientes, and one of the Pachuca properties. About a decade ago, Mr. Grothe became a partner in the firm of Grothe & Carter, which he formed for the purpose of dealing in milling machinery, particularly promoting the well known Pachuca tank, which Mr. Grothe patented and introduced into Mexico, making the first installation at his Pachuca mill. His firm carried the representation for Dorr machinery, Deister concentrators and many of the best known appliances in the milling field. Mr. Grothe was widely known and highly respected. His absence will be sincerely felt and regretted by most of the mining profession in Mexico.

Editorials

The Situation in Cyanide

The conflagration in Europe has brought the American people face to face with the fact that we do not produce many of the substances necessary for our commercial comfort, and further, that some of them are produced only in Germany. Finding the latter nation effectually out of communication with us, and likely to continue so for some time, a mild panic has been caused, due to the apparent necessity for the abrupt cessation of some of our industries, with the consequent loss of occupation by a large number of workmen. In general industry, the most prominent item in the class under consideration is dyestuffs; in the mining field it is cyanide.

There seems to be a good deal of uncertainty about the manufacture of cyanide, but there is no uncertainty about the proposition that if we do not get it, a large number of men will be thrown out of employment and the supply of precious metals will be materially reduced. As to why it is not more largely manufactured in the United States, there is a difference of opinion. Independent chemists maintain that it can be manufactured cheaply almost anywhere, but that the present output is in the hands of a German monopoly, which has effectually throttled all attempted competition. The producers deny this, and state that they are producing it as cheaply as possible, and that the lack of competition is purely through economic reasons. Be that as it may, the fact remains that the most of the cyanide used in precious-metal recovery is made in Germany, and the supply in this country is decidedly short.

One factory only is in operation here, that of the Roessler & Hasslacher Chemical Co., important producers, at Perth Amboy, N. J. Its owners say that they are prepared to supply all contract holders with their necessities; also that regular customers will probably be taken care of up to their normal requirements, but that no increase of consumption can be provided for and no new demands met. Many cyanide users, foreseeing a shortage, have made efforts to secure advance supplies sufficient to secure them from idleness. The producers have refused to comply with these requests, and this fact has done more than any one thing to give a greater impression of stringency than that which really exists.

Aside from the German cyanide factories, there is a good production in England, but that will be of little use in America, since it is likely to be claimed for South African use. The Rand properties are of great value to Great Britain in the present circumstances, and it is likely that every effort will be made to keep them at work.

That cyanide is not made more largely in the United States is not through lack of knowledge or material, but on account of either or both of the conditions already mentioned. Now that the necessity is so great, several movements are on foot to institute its manufacture on a commercial scale. One such movement was instituted four or five years ago in Mexico, where a French syndicate had perfected plans to manufacture sodium cyanide in Mexico City. Civil war in that country prevented the materialization of the project at that time, and it is not known whether it has been since considered. The American Cyanamid Co. has been considering cyanide production for some time, and has, in fact, ordered the necessary machinery to make it, with the idea of marketing cyanide not later than January, 1915. Since the machinery was ordered in Germany, there is a strong factor of doubt about the time manufacturing means will be completed, unless the machinery had left Europe previous to the outbreak of war. In any event, new American cyanide seems a practical certainty some day. In addition to those mentioned, there are two other movements to produce cyanide here for the mining industry. Neither of these, however, has progressed to the point of giving definite information as to when production will be started or how much will be offered. Late advices point to a notable increase on the part of the English factories, so that those who contemplate production here are hesitating, keeping a careful eye on those movements.

Interesting Features of the Spelter Market

In these days of uncertainties and radical changes in industrial conditions, all markets possess features of unusual interest, and the spelter market is no exception. American smelters having been helped out of a desperate hole and the price of spelter having advanced more than a cent a pound within 30 days, especially under the influence of buying from England, together with the operations of outside speculators, there ensued a relapse in price almost as rapid as the previous advance had been.

The recession in the price started with the discontinuance of demand by England, which at first was considered to have overbought immediate requirements, the export sales of American smelters during August having been very large. Now, however, it appears from late advices that England has been able to obtain spelter from Holland or Belgium, via Rotterdam.

The situation of the Belgian smelters is an uncertain factor. We have heard from Europe, but not directly from the company, that about a half of the Vieille Montagne plant at Angleur, near Liege, had to be destroyed to clear a line of fire. Presumably, this plant, as well as the other smelteries farther up the River Meuse, are idle. On the other hand, the works of Beer, Sondheimer & Co. at Lommel and Overpelt were in operation up to Aug. 18, according to advices of that date. These works are near the Dutch frontier, and rather outside the zone of fighting. If they were in operation as late as the middle of August, they are probably still running. The spelter offered in England may come from them, or what is more likely, may be a part of the accumulation of stocks in Belgium. We imagine the latter to be the case, inasmuch as we hear from Italy that the mining companies of Sardinia are unable to market their output, which normally goes to Belgium. Consequently, those mining companies are seeking to find a market among Amer-

ican smelters. Similarly are the Australian producers trying to find here a market for their ore, which normally goes to Germany.

The arrival of Belgian spelter in England is apparently a very late development, inasmuch as the last British papers received here said nothing about it and were discussing the desirability of enlarging the zinc smelting industry of Great Britain. Some of the English zinc-mining companies are said to be considering the establishment of smelting works of their own, but as yet nothing definite has been done, for the reason that the conditions are not now auspicious for the financing of them, and moreover, no plans are ready. Another difficulty of zinc smelting in Great Britain is said to be the labor question. A correspondent of the London *Mining Journal* remarks: "It is very difficult to get on with Welsh labor; the uncertainty of compliance with contracts once entered into and their general truculence have hitherto 'flattened us out.' Whether we can select another neighborhood in this country, where labor is more disposed to comply with its agreements is another question." Also, we may add that the design and construction of a modern zinc-smelting works is a matter of a year or so of time, and if British consumers have to await such a development, they are likely to starve in the meanwhile. Far more likely is it that an augmented business in the smelting of ores from oversea will develop in the United States, where several of our plants, especially three in Virginia and two in Pennsylvania, are not unfavorably situated for the handling of ores received through Atlantic seaports.

The "Journal" Transfers an Editor to Chicago

In order to better serve the interests of its subscribers and readers, the JOURNAL has transferred one of the members of its editorial staff to its office in the Monadnock Building, Chicago, L. E. Ives, mining engineer, going to that post. This will enable us to give better attention to the great mining and metallurgical districts—the copper and iron mines of Michigan, the iron mines of Minnesota, the zinc mines of Wisconsin, the lead mines of Missouri, and the zinc mines of the Joplin district—which are easily reached from Chicago. With resident editors in San Francisco and Chicago, and with regular staff correspondents in Denver and Salt Lake City, besides its correspondents in nearly every important mining district of the United States, the organization of the JOURNAL enables it to give the necessary attention to all of the important branches of the widespread and diverse mining industry of the United States.

The Open Shop at Butte

The declaration of the "open shop" at Butte, on Sept. 9, was the logical sequence of the labor troubles that have developed there. The companies have been for many years willing to recognize the unions and enter into agreements with them, but when the unions fell out among themselves there was no longer any party of the second part, and the companies could not very well do anything but say: "A plague on both your houses!" and decide hereafter to do business on the basis of a free community, in which anybody may work who wants to.

The companies have no intention of reducing wages. They will have to maintain wages in order to obtain the kind of miners they want. Nobody knows any better than the managers of these companies that the laborer is worthy of his hire, and that it is more economical to employ good men and pay them high wages than it is to have poor men at low wages. However, the companies now propose to be the masters in their own houses. Let us hope that the opening of Butte will extend to the unions of artisans and mechanics, and that no longer will it be a cause for a strike if a pipe fitter bores a hole through a wooden partition, or if a carpenter picks up a monkey wrench.

No evidence of opposition to the operators' decree has yet been manifested in Butte and all the mines are being worked with full complement of men. Perhaps the laboring men of Butte are themselves tired of the excesses of unionism in that town.

One of the Last of the Forty-Niners

Assuming an Argonaut to have been 20 years old when he went to California in 1849, the survivors must be now at least 85 years of age, which is equivalent to saying that not many of them are left. One of the most distinguished of them, James B. Haggin, died last week. He was a man who made a great mark in the mining industry and acquired a great fortune thereby, which he thriftily increased.

We have had many mining millionaires who have made a great fortune out of some rich mine, as did Mackay, Fair, DeLamar, Stratton, Walsh and many others, but to few was it given to be in three such bonanzas as the Ontario, Homestake and Anaconda, as was Haggin. To match such a chain of successes we have to think of Jackling and the Guggenheims of our own day. That they have been able to do what they have done shows that opportunities were not exhausted by the pioneers.

Haggin and his partners were the prototypes of the modern great mine developers. Apart from his achievement of a great fortune for himself and his praiseworthy participation in some public movements, we think that Haggin's greatest claim to fame was his demonstration that mining for gold, silver, lead and copper could be conducted on a thorough-going business basis.

One of the most annoying conditions into which a mill operator can fall is the sudden and complete failure of some step in the metallurgy. This is just what happened to the McIntyre mill, Porcupine, Canada, recently. Due to the treatment of a different ore, light slimes accumulated in the pregnant solution. There being no provision for clarifying, zinc-shaving precipitation suffered to such an extent that it was absolutely useless, the shavings being covered with an adherent coating of slime. Precipitation by zinc dust seemed the only salvation for the situation, but that would have necessitated much time and more money than the company could dispose of. Just at this time the JOURNAL of May 17, 1913, appeared with an article on the use of canvas bags as zinc-dust filters at the Lluvia de Oro, Mexico. This alternative required

only canvas and pipe fittings so that in two days and at a cost of $1500, the mill was equipped with clarifying and precipitation filters that would have cost several months and many times the money to do any other way. The JOURNAL in this case undoubtedly saved a long shut-down and consequent money loss. The Merrill Co. is said to consider this appliance an infringement of their zinc-dust precipitation patents.

BY THE WAY

The Boston *Herald* sensibly remarks that with the "buy a bale of cotton" movement to take care of the cotton crop becoming so popular that even the President is reported to have bought a bale at 10c. per lb., some of the copper producers are becoming enthusiastic over a proposed "buy a ton of copper" movement. They figure that if enough people could be enlisted in a campaign for each to buy a ton of copper, at 20c. per lb., and take it out of the market, it might well insure prosperity for the copper producers and the miners for some time to come. And they say there is as much financial and economic sense in the latter as in the former proposition.

⁂

When a mine manager makes a mistake he usually likes to cover it up. Sometimes a subordinate (with the best of intentions and with the desire to promote general efficiency) points out the error; only to get a "can tied to him," lest in his zeal he bark so loud that the directors will hand the manager his. At a certain mine the manager had conducted elaborate tests over a period of several months to determine what class of fuse was best for stoping. A high-priced American fuse was finally selected as being safe and reliable. The next manager, striving to make a low cost-per-ton record, canceled the E. M.'s requisition for American double-taped fuse and substituted an equal number of cases of cheap tarred German fuse. The E. M. protested against the use of the cheap stuff in damp ground; proving by tests that the time of burning was always irregular and that a fuse once bent either delayed a shot or else caused it to fail entirely. His protest was ignored. Result, one Finlander hopelessly mangled within a week. Official report on accident stated that the "squarehead" was careless. Unofficial note by E. M. stated the truth, putting the blame on the fuse. Result, one E. M. looking for new job. Ultimate sequel of such policies, combined with payroll padding, general grafting, stock rigging, and depreciation in market price of product; mining company busted, reorganized and busted again. On the whole, quite a "successful failure" for those on inside.

⁂

A hunger strike is something new for the mining engineer to contend with. Some of them may have entered upon one involuntarily, but few had experience with the voluntary variety, which is, of course, "made in England," not Germany. H. C. Hoover, who has been prominent in the work of relieving stranded American tourists in London, was recently confronted by a hunger strike on the part of a young American woman who started to starve to death in the American relief committee's headquarters rather than return to America in the steerage. According to a London despatch, the young woman stuck obdurately in the committee's headquarters for some hours after all other visitors had left. Mr. Hoover finally offered her four shillings with which to buy a meal and succeeded in breaking the strike. Excellent work has been done under Mr. Hoover's direction by the American relief committee in London, but with the limited funds available, it was not possible to send stranded tourists home in cabins *de luxe*. All have had to travel third class except the aged, the sick, or those with very small children. Mr. Hoover has been quoted in an interview as saying that doubtless some tourists will be dissatisfied with these accommodations, and, in fact, some have already threatened to voice complaints on their arrival in the United States. We think that those who are unable to rough it for once in their lives will receive but short shrift on presenting their complaints in this country.

⁂

S. R. Guggenheim is quoted as saying:

> The copper-producing trade will be affected, but copper-manufacturing industries should be greatly stimulated. Contracts for our Chile Copper Co., placed in Germany, will be transferred to America. The great German electric manufacturing companies are bottled up tight, and we alone are the only country in position to step into the gap.
>
> We shall not stop development work on any of our properties.
>
> In South America the colonization by Americans following development of American trade will further stimulate demand for American goods. In addition, there will be thousands of buyers in this country this year who ordinarily spend millions each year abroad.

⁂

Bartholomew F. Griffin, one of the editors of the *Boston News Bureau*, contributed this fine poem to his paper, just before the European war broke out:

IF!

Suppose 'twere done!
The lanyard pulled on every shotted gun;
Into the wheeling death-clutch sent,
Each millioned armament,
To grapple there
On land, on sea, and under, and in air!
Suppose at last 'twere come—
Now, while each bourse and shop and mill is dumb
And arsenals and dockyards hum—
Now all complete, supreme,
That vast, Satanic dream!—

Each field were trampled, soaked,
Each stream dyed, choked,
Each leaguered city and blockaded port
Made famine's sport;
The empty wave
Made reeling Dreadnaught's grave;
Cathedral, castle, gallery, smoking fell
'Neath bomb and shell;
In deathlike trance
Lay industry, finance;
Two thousand years'
Bequest, achievement, saving, disappears
In blood and tears,
In widowed woe
That slum and palace equal know,
In civilization's suicide,—
What served thereby, what satisfied?
For justice, freedom, right, what wrought?
Naught!—

Save, after the great cataclysm, perhap
On the world's shaken map
New lines, more near or far,
Binding to king or czar
In festering hate
Some newly vassaled state;
And passion, lust and pride made satiate;
And just a trace
Of lingering smile on Satan's face!

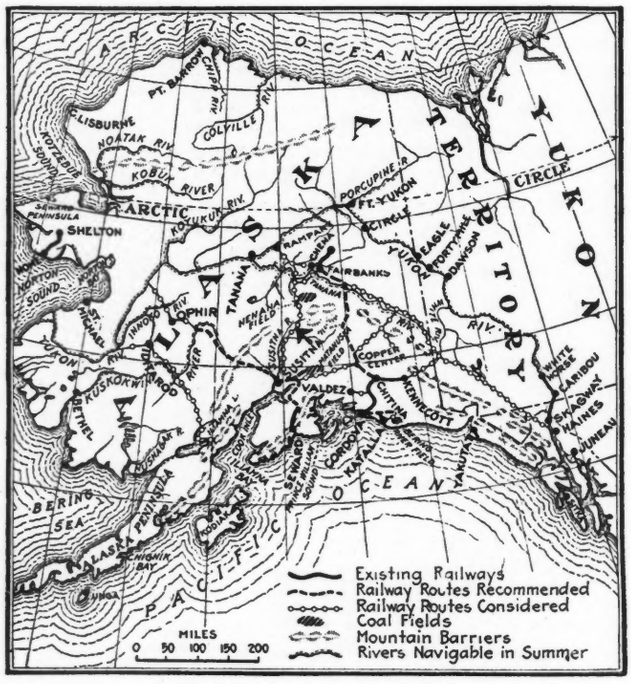
Great Gold Find in Alaska

The following article, telling of a great gold find in Alaska, was printed by the New York *Sun*, on Sept. 14:

Daniel Guggenheim, head of the Guggenheim interests, received a telegram yesterday from Stephen Birch, managing director of the Morgan-Guggenheim Alaskan mining syndicate, confirming the reports of a remarkable gold discovery in Broad Pass on the Susitna River, Alaska. Mr. Birch said he was on his way to this city with samples of the ore.

The discovery, it is predicted, will create a new era of prosperity in this country and already has started another rush of prospectors to Alaska. News of the find spread like wildfire through the region and hundreds of gold seekers have poured into the pass during the last week to stake out claims.

"The news of the discovery is true," said Mr. Guggenheim last night, "and Mr. Birch is on his way to this city with complete information regarding it. He did not care to trust the information on the wires and consequently is making this journey from Alaska to convey the news in person. We have expected this news for some time, for every geologist who has ever been to that region knows that it is extremely favorable for gold and other valuable minerals.



MAP OF ALASKA

Broad Pass, mentioned in the reports of new gold discoveries, is shown by the arrow north of Susitna, along the line of the proposed extension of the Alaska Northern Ry., but there has been prospecting and discoveries during the last season in a great semicircle from Broad Pass in the Alaska Range to Kennecott in the Wrangell Mountains.

"The discovery will afford employment to hundreds of men, for the recovery will not be made by placer mining, as in the Klondike, but by smelting and cyanlding. This means getting back to the old pick and shovel game, and hundreds of prospectors already have entered the region with their kits to stake out claims and start operations.

"Many will want to get into the gold region. The Government must recognize this fact now and prosecute the construction of the railroads in Alaska. The discoveries will not be available until this is done. I believe they contemplate constructing 1000 miles of railway in the country to open the region. The work should be pushed at once because for every hundred miles of railroad built the country surrounding it will be opened up ten hundred miles."

According to reports from the regions in the Northwest, the strike was made where there are gold ledges 100 to 2000 feet wide. One of the 100-foot ledges assays $15 per ton straight across. A fourteen foot pay streak on the hanging wall averages better than $250 per ton.

This announcement in the daily press of this "greatest gold discovery ever made" is doubtless exaggerated, but no definite announcement can be obtained at this time from the principals mentioned. The reports must, in consequence, be scrutinized with the usual reservations when reading of scientific or technical discoveries in the daily press, whose reporters feel constrained to make "an interesting story." What influence these discoveries may have on the building of railways in Alaska cannot be determined until more is known as to the exact situation of the gold finds. At one end of the great semicircle in which prospecting has been active during the last season the projected extension of the Alaska Northern Ry. would be the natural outlet, while for discoveries in the Wrangell Mountains, the Copper River & Northwestern would be the most convenient line.

Upon being interviewed by a representative of the JOURNAL, Mr. Birch, who has just returned from Alaska, refused to make a statement for publication, and declined either to confirm or deny the accounts published in the daily press. Engineers of the Guggenheim staff, however, have been in the country mentioned, and there has been much activity during the last summer in a great semicircle extending northward, from Kennecott, in the Wrangell Mountains, to Broad Pass, in the Alaska range. Ever since the Shushanna strike, there have been many prospectors in this region, and only the inaccessibility of the country and the lack of transportation has delayed its actual development.

Copper developments have been active in the Wrangell Mountains during the last season, the Alaska Syndicate having developed some rich ore in the Jumbo, which may now be regarded as a rival of its famous Bonanza mine. The tramway to the Jumbo is being completed and the property is expected to come into production about the first of the year. The same interests are completing at the Beatson copper property on Latouche Island a 700-ton concentrator, which will also be ready for production about Jan. 1, 1915. A smelting operation will probably be undertaken on the coast of Alaska in the vicinity of Cordova, when the Bering River coal fields are open to development. This would afford an outlet for the copper production of the Guggenheim properties in Alaska and for such developments as may take place in the Wrangell Mountains and in the Alaska range, when the proposed Governmental railroads have become a reality.

*

A. S. & R. Semiannual Report

Notwithstanding unsatisfactory conditions in Mexico, the American Smelting & Refining Co. and American Smelters Securities, according to the semi-annual reports, issued recently, earned a surplus over both preferred- and common-stock requirements during the six months ended June 30, 1914. The surplus available for dividends on the common stock was $1,956,691. This compares with $2,017,894, in the corresponding period of 1913, and is equivalent to 3.91 per cent. earned, against 4.03 per cent. in 1913. Gross earnings amounted to $6,782,254, an increase of $110,642 over the same period in 1913. The directors charged off $764,918, for depreciation, an increase of $176,717 over the first six months of 1913. The net income for the first six months of 1914 was $4,966,692, a decrease of $61,202, compared to last year.

PERSONALS

Morton Webber has gone to Porcupine, Ontario.

Dr. O. Susmann is expected home from Europe shortly.

Homer L. Carr has gone to Honduras on examination work.

C. B. Lihme, of the M. & H. Zinc Co., La Salle, Ill., has returned from Europe.

F. D. Weeks has returned from Chile where he has been engaged on metallurgical work.

Walter Pickering, of New York, is in the Mogollon district of Socorro County, New Mexico.

Edwin J. Collins has returned to Duluth from an examination trip in Montana and California.

M. W. Porterfield, general manager Mangas Development Co., is in Silver City after an Eastern trip.

E. N. Barbot de Marny, of Petrograd, has been in Alaska for several weeks in the interests of the Lenskoie Mining Co.

George H. Garrey has spent the last three months examining zinc and lead bearing properties in Tennessee and Virginia.

R. C. Canby, of the Miami Copper Co., is back in New York, his extensive experimental work in Arizona being nearly completed.

Walter Harvey Weed has returned to Houghton from a professional trip to the Seward Peninsula, Alaska. He will be in New York about Sept. 25 for a few days.

George St. Clair Douglas, formerly in charge of mining operations in Zacatecas, Mex., has gone to Pinos Altos, N. M., where he will operate the Silver Hill mine. Mr. Douglas is accompanied by W. G. Jude, of London, Eng.

Arthur Thatcher, of St Louis, visited the properties of the Empire Zinc Company in New Mexico during the first week of September. He was accompanied by R. B. Paul, of Denver. C. A. Schmidt, of Tucson, and C. T. Brown, of Socorro, N. M.

William Thum, superintendent of the lead refinery of the United States Metals Refining Co., at Grasselli, Ind., was called to Newark, N. J., last week, by death of his father, Frederick A. Thum, who had for many years been in charge of the Balbach works at Newark.

John R. Stanton has been elected president of the Wolverine and Mohawk Copper Mining companies to succeed Joseph E. Gay, who retired after serving as president for eight years. Frank M. Stanton has been chosen treasurer and George W. Drucker secretary of the concerns.

Chas. E. Coxe, secretary of the Rosario Mining Co., near Sombrerete, Zacatecas, who came to the States about a year ago on account of the disturbances in Mexico, and has been in Reading, Penn., his old home, most of the time since then, expects to return to Mexico shortly.

E. R. Wash, who for the last three years has been chief engineer of the Mascot Copper Co., as well as the Western Finance and Associated Copper Companies of Dos Cabezas, Ariz., has tendered his resignation in order to engage in private engineering practice with headquarters at Tombstone, Arizona.

Prof. A. L. Walker writes from Japan that he has had to abandon his trip around the world to see metallurgical works and things in general, having no desire to find himself tied up in some out-of-the-way place and not be able to get out. Consequently he proposes to return directly from Japan to the United States.

J. W. H. Hamilton, of the firm of Hamilton & Hansell, has recently returned to America after having spent more than a year in Europe. During this time he has visited most of the mining districts of Scandinavia and continental Europe and has been instrumental in establishing several Greenawalt sintering plants.

H. Parker Willis, who was the author of the original draft of the Reserve Bank act, has been appointed secretary of the Federal Reserve Board. Mr. Willis is a native of Massachusetts, 40 years of age, and was educated in the Western Reserve and Chicago Universities with post-graduate work in the Universities of Leipsic and Vienna. For several years he was Professor of Economics and Political Science in Washington and Lee, and George Washington Universities. For a good many years, previous to a few weeks ago, he acted as Washington correspondent of the "Engineering & Mining Journal."

OBITUARY

John Armstrong Rawlins, vice-president and director of the American Grondal Co., died on Aug. 27.

Henry Bratnober, a mining engineer who was prominently identified with the Klondike rush, died on Sept. 14 in California.

Dr. C. A. Stewart, professor of Geology at the University of Idaho, died on Long Island on Aug. 29, after an illness of several months' duration. He was born in New York on Dec. 1, 1885, but his early years were spent in Franklin, Mass. He graduated from Columbia University in 1906, and remained there until 1908 as a graduate student and instructor in geology, receiving his master's degree at the end of that time. From 1908 until 1911 he was instructor in geology at Cornell University, and while there made a trip to Arizona where he made a detailed geological survey and examination of the Silver Bell camp, as material for his doctor's thesis, which was published in 1912 in the Transactions of the American Institute of Mining Engineers. He received his doctor's degree from Columbia University in 1912. In 1911 he was appointed professor of geology at the University of Idaho, which position he held until his death.

SOCIETIES

Mining and Metallurgical Society—The New York Section held its first meeting of 1914-5 at the Engineers' Club, Sept. 15. Howard F. Wierum gave an account of the development of the Hall process of desulphurization. This excited lively discussion. Officers of the section for the ensuing year were elected as follows: Sydney J. Jennings, chairmar; Allen H. Rogers, vice-chairman; Donald M. Liddell, secretary and treasurer.

The San Francisco section of the Society held a meeting on Sept. 14, at which Mr. Colby gave a talk on the Kennedy Extension-Argonaut case.

Chemical, Metallurgical and Mining Society of South Africa—At the meeting on Aug. 15, the following papers were presented for discussion: "Notes on Hydraulic Classifiers and Classification," by Prof. G. H. Stanley; "The Detection of Platinum Metals in Cupellation Beads by Means of the Microscope," by C. O. Bannister and G. Patchin; "The Relation of Falls of Roof in Collieries on the Middleburg Coalfield to Weather Changes," by Chas. J. Gray; "Rock Temperatures," by E. J. Moynihan; "A Method of Assaying Concentrates and Battery Chips for Gold and Platinum Metals," by Andrew F. Crosse; "The Blue Iron-Cyanogen Compounds," by H. E. Williams; "The Witwatersrand Earth Tremors," by H. E. Wood; "The United Patents Bill," by A. L. Spoor and W. E. John.

NEW PATENTS

United States patent specifictaions may be obtained from "The Engineering and Mining Journal" at 25c. each. British patents are supplied at 40c. each.

ALKALI METALS—Improvements in the Electrolytic Manufacture of Alkali Metals and Alkali Metal Compounds. E. A. Ashcroft, London, S. W., Eng. (Brit. No. 10,980 of 1914.)

BORIC ACID—Process for the Production of Boric Acid. Alfred Burger, New Brighton, N. Y. (U. S. No. 1,108,129; Aug. 25, 1914.)

CLASSIFIER—Ore-Pulp Classifier. Joseph T. Terry, Jr., San Francisco, Calif. (U. S. No. 1,109,485; Sept. 1, 1914.)

CONCENTRATOR—Dry Concentrator. John F. Hiltscher, Fullerton, Calif. (U. S. No. 1,108,499; Aug. 25, 1914.)

CRUSHING ROLLER—James C. Reid, Bluefields, Nicaragua, assignor, by mesne assignments, to Allis-Chalmers Manufacturing Co. (U. S. No. 1,108,850; Aug. 25, 1914.)

CRUSHING — Improvements in Crushing and Grinding Mills. J. Mohs, Dessau, Germany. (Brit. No. 14,222 of 1913.)

CRUSHING—Rock Crusher. Samuel C. Arnold, Denver, Colo., assignor to Denver Quartz Mill & Crusher Co., Denver, Colo. U. S. No. 1,109,158; Sept. 1, 1914.)

DRILL CHUCK—George W. Emrick, Brooklyn, N. Y. (U. S. No. 1,109,121; Sept. 1, 1914.)

DRILL—Electric Drill. William O. Duntley, Chicago, Ill., assignor to Chicago Pneumatic Tool Co., Chicago, Ill. (U. S. No. 1,109,325; Sept. 1, 1914.)

DRILL—Mine Drilling and Channeling Machine. Longfellow J. Daft, Seattle, Wash. (U. S. No. 1,108,342; Aug. 25, 1914.)

ELECTRIC FURNACE. James W. Moffat, Toronto, Ont. (U. S. No. 1,108,924; Sept. 1, 1914.)

Editorial Correspondence

SAN FRANCISCO—Sept. 10

Necessary Economy in Operations on the Comstock has resulted in the resignation of A. M. Walsh, superintendent of the United Comstock Pumping Association, and Charles Liddell, surveyor. Mr. Walsh has been succeeded by Thomas F. McCormick, who will perform these duties in addition to his superintendency of Con. Virginia and Ophir. The chief interest is still in the Belcher and the Union. Although the ore in the Belcher does not run high there are indications of improvement. The face of the drift in the 2400-ft. level of Con. Virginia shows improvement. Aggressive development is in progress on the 2650-ft. level of the Union. Altogether there is a general advancement and the practice of economy insisted upon has lent encouragement to stockholders.

More than 90% of Natomas Consolidated First Mortgage Bonds had been deposited under the reorganization plan at the end of August, amounting to $12,731,000. Of the second mortgage bonds, $2,450,000 had been deposited, leaving only $50,000. There had been deposited 147,700 shares of stock, which will be augmented by 5000 more that were delayed, leaving only 10,690 shares of the total of 163,390. Security holders who have been unavoidably delayed will be given further time to make deposits. But after the reorganization has progressed to a certain point fixed by the committee it will not be within the power of the committee to accept further deposits so that first mortgage securities then still outstanding will receive only their pro rata under bankruptcy sale of the Natomas properties. Holders of second mortgage bonds and stock, not deposited at that time, it is understood will receive only what is due them under the reorganization plan.

Nevada and Amador Counties Ranked First and Second Respectively in gold production in California in 1913. Nevada County produced $2,945,275, Amador County, $2,922,942. The two largest deep gold mines are in these counties, the North Star and the Kennedy. Three other counties produced each over $2,000,000: Sacramento, $2,503,633; Yuba, $2,491,505; Butte, $2,269,849. The bulk of the gold in these three counties was from the dredges. Three counties producing over $1,000,000 each in gold were Shasta, $1,208,870; Calaveras, $1,175,208; Sierra, $1,006,573. Shasta County ranked first in the total value of minerals produced, being credited with a total yield of $5,354,875, including gold, silver, copper and lead. Shasta produced 27,044,297 lb. of copper, 741,773 oz. silver, 19,295 lb. lead, being first in production of copper and silver and third in production of lead. Calaveras County was second in production of copper, with 5,823,226 lb. Inyo County ranked first in production of lead, with 3,246,432 lb.; San Bernardino County produced 237,480 lb. of lead.

Application of the Government for Appointment of Receiver pending final decision of the General Land Office in the application for patents to oil claims known as the Hawk locations in Kern County has been denied by Judge Dooling in the U. S. District Court. The property is operated by the General Petroleum, Pacific Midway, J. D. Spreckels, Obispo and Queen companies, who are the defendants in the hearing before Judge Dooling. The several oil claims were located by G. W. McCutchen and others in 1912 for the purpose of securing further title to lands originally within the area of the Lone Star location. It was contended by the Government that the filing of the Hawk location was irregular and invalid because of the use of the names of dummy locators. Judge Dooling attached but little weight to the contention of the Government attorneys, and was evidently convinced that no fraud had been practiced; holding that if there had been fraud in the McCutchen locations, that would be no excuse for denying patents to the companies now in possession, which have in good faith developed the lands, relying on the long established custom of the Government, and have expended large sums in development. The court would not impose the hardship on the operators of placing the lands and operations in the hands of a receiver pending such decision as the land office might make. Judge Dooling, of course, did not decide as to validity of the application for patent, but made it plain that he doubted if the purchasers of the land in good faith could be made to suffer for the error or fraud of the locator, especially since the development of the lands had proved their value as mineral oil lands.

DENVER—Sept. 11

Two Different Events of Nation-wide Importance interest Colorado mining men vitally. Announcements have come by press almost simultaneously of President Wilson's proposal of terms for the restoration of peace in the Colorado coal-mining districts and of the Butte mine operators' ultimatum declaring for open shop. Analysis of each of these policies shows that their successful operation will leave no function for unionism. The operators of Colorado, both in coal mining and in metal mining, await the outcome of these two issues for establishing equilibrium between employers and miners. Officers of the United Mine Workers are reported as ready to accept the terms of Mr. Wilson's request although why this is so cannot be understood except from the viewpoint that a gracious compliance is the only safe attitude for unions to display at this time. Coal operators will also probably accept the terms. If Butte operators succeed in their open-shop policy, Colorado metal-mine managers will undoubtedly take advantage of such victory over tyrannical unionism and will place the entire state upon the same non-union basis as prevails in the Cripple Creek district.

BUTTE—Sept. 10

Butte Labor Situation—Butte and Silver Bow County are under martial law. Military authority has reigned supreme since Sept. 1. Major Dan J. Donohue, commanding officer of the 10 companies of the Second Regiment of the National Guard of Montana who arrived in Butte Sept. 1 has issued the following proclamation, printed copies of which were posted at conspicuous places in the city and county:

Headquarters National Guard of Montana.
In the Field, Sept. 1, 1914.

Proclamation by commanding officer:

(1) Silver Bow County, in the state of Montana, is now in the possession of the military forces of the state of Montana, who have come to restore peace and order and to enforce the laws of the state, under the authority and by command of the governor.

The undersigned, commanding the said military forces, therefore makes known and proclaims the object and purposes of the state in thus taking possession of the said Silver Bow County, and the rules and regulations by which the laws of the United States and the state of Montana will be, for the present, and during the state of insurrection, maintained. This information and these rules are for the guidance of all good citizens, as well as for others who are or may have been in insurrection.

(2) There exists in Silver Bow County insurrection against the laws of the state, and a state of lawlessness and defiance of authority. The commanding officer of the national guard of Montana, the undersigned, therefore, will cause the said Silver Bow County to be governed, until further orders, by military authority. This measure is deemed necessary because of the facts previously recited.

(3) The persons and property of all well disposed citizens will be protected and safeguarded.

(4) All persons who have heretofore engaged in insurrection, or who have given aid and comfort to those in insurrection against law and the civil authority, but who shall return to peaceful occupations and preserve quiet and order, will not be disturbed in person or property by the military forces, except where the exigencies of the military government may render it necessary. All rights of property will be held inviolate. All shops and places of business, except those hereinafter mentioned, may be kept open as usual.

(5) All saloons and places where intoxicating liquors are sold at retail as a beverage will be closed at once and kept closed until further order. The stock of liquors of any person or persons violating this rule will be destroyed and all violations severely punished.

(6) Misdemeanors will be punished by the summary court. Maj. Jesse B. Roote is hereby appointed and constituted summary court of the military forces in said Silver Bow County. Violations of state and Federal laws, other than misdemeanors, will be referred to a proper military commission for trial and punishment; civil causes will await the ordinary tribunals.

(7) No publication, either in newspaper, pamphlet, handbill or otherwise, in any way reflecting upon the United States, the state of Montana or their officers, civil or military, or tending to influence the public mind against them, will be tolerated.

(8) All good citizens are requested to render all possible and proper aid to the military authority and forces.

(9) All assemblages in streets and highways are forbidden. Assemblages in other places can only be held after the permission of the commanding officer is given.

(10) Children under 18 years of age will not be permitted on the streets after 7 o'clock p.m., nor before 6 o'clock a.m. Women are requested to not appear on the streets after 8 o'clock p.m., nor before 6 o'clock a.m.

(11) Vagrancy will not be tolerated.

(12) It is hoped that martial law in Silver Bow County

will be mild and gentle; but it will be quickly and vigorously exercised when occasion requires.

Given this 1st day of September, 1914.

DAN J. DONAHUE, Major Commanding.

Official:

JESSE B. ROOTE, Major and Adjutant.

The 600 men of the militia made their headquarters in the large courthouse on Granite St., where are also the offices for the administration of the affairs of the city and county, the functions of the municipal and county officers having automatically ceased with the announcement of martial law. Major Jesse B. Roote, of Butte, was appointed as judge of the summary court and Frank Conley of Deer Lodge, provost marshal in charge of the police department of Butte and of the forces of Sheriff Driscoll.

While the great majority of citizens welcome the presence of the militia, objections to the governor's action in declaring martial law have been raised in certain quarters. No official attempts were made to interfere with the military authority, except that on Sept. 4 steps were taken by the attorneys of certain prisoners to test the right of the military authorities to try offenders. Writs of habeas corpus were asked of the Federal court for three miners arrested by the marshal's forces for having arms and ammunition in their possession. Judge Bourquin of the Federal court to whom the matter was presented, issued order to show cause on the governor and the military authorities. The petitioners represent that they were unlawfully and against their will imprisoned and restrained of their liberty by respondents. In the petitioners' complaint it is set forth that the conditions did not warrant the governor's action of declaring martial law, resulting in depriving citizens of their rights guaranteed under the constitution. On Sept. 7 the governor and the military authorities filed their answer in which the laws are quoted authorizing the governor to declare martial law and to call upon the militia of the state to aid him in maintaining order and enforcing said laws. In the answer are also reviewed the incidents which led up to the necessity of sending troops to Butte, such incidents being interpreted by the governor as constituting a state of affairs compelling him as a last resort to exert the rights vested in him by the constitution. Judge Bourquin took the matter under advisement and later decided against the plaintiffs.

One of the first effects of the establishment of martial law and of the arrival of troops was the starting of the mines closed down temporarily on account of local disturbances. Threats and intimidations caused such a large number of men to fail to report for work at these mines that they were forced to stop operations. Since the arrival of the militia, members of the jurisdiction committee in charge of enforcing membership in the new union and requiring men working in the mines to wear the union's button, have been kept away from the mines, a number of them having been arrested by the military authorities and put in jail awaiting trial for kidnapping and deporting men who refused to join the new union.

The placards posted at the mines previous to the arrival of the troops, containing the rules which the new union attempted to impose upon the mines, have been removed and destroyed and all men applying for work, regardless of their affiliations are put to work when needed and are protected from interference by agitators or delegates from labor unions. In all instances married men are given the preference.

This, in connection with the closing of the saloons, has resulted in fewer men failing to report for duty at the mines than has been the case in the entire history of the operations of the Anaconda company's mines. The number of minor accidents has likewise shrunk below the usual percentage.

Another salutary effect of martial rule has been the arrest of a large number of vagrants and toughs who floated into Butte and for months plied their trade of holdup and burglary without any interference whatever on the part of the city or county authorities. The men so far arrested were tried in the summary court, convicted and sentenced to fines and imprisonment in jail with sentence suspended 12 hr. to permit them to get out of town. Almost every one of the prisoners availed himself of this chance. William O'Brien, candidate for the presidency of the Butte Mine Workers' Union, who drew up the platform of the organization, being an advocate of the I. W. W. and a member of the socialist party in Butte, was arrested Sept. 6 by the military authorities at Divide, as he was boarding a train for Salt Lake to avoid service of a warrant issued for his arrest. He is charged with participating in the kidnapping of members of the Western Federation and with making inflammatory speeches prior to the arrival of troops.

Muckie McDonald, president of the new union, and Joe Bradley, vice-president, who up to the arrival of the troops had been brave in defying local authorities and bragged about the fact that the authorities did not dare to arrest them or interfere with their designs regarding the doings of the new union, made for the tall timber as soon as the troops entered the city. Two members of the union who attempted to take food and money to the fugitives were intercepted by the military and arrested. The ill feeling stirred up among the members of the new union by McDonald's showing the white feather, jumping the town and leaving others to take the punishment, led to the election of John Doran, a well known miner, as the new head of the union. No new vice-president has as yet been selected. President Doran upon assuming his new duties issued a manifesto in which all members of the union are requested to assist the local and military officials in maintaining order and in preventing acts of violence.

On Sept. 5 a petition was presented to Major Donohue asking that a grand jury be called to inquire into the affairs of the city and county and the acts of their officers prior to the arrival of the militia. In the petition it was set forth that there would never be a feeling of public security after the militia left Butte so long as Mayor Duncan and Sheriff Driscoll remained in office and that they should therefore be removed from office if found guilty of having violated their oath of maintaining order and enforcing the law; that others should be appointed able and willing to perform their duties. The petition was signed by a number of citizens. Major Donohue thereupon signed an order allowing Judge Lynch to open court to hear this matter, to call a grand jury or to permit the petitioners to file direct charges against Duncan and Driscoll. This petition was fathered by Western Federation interests.

On Sept. 8 representatives of all the Butte companies but one held a meeting, as reported in the "Journal" of last week, and issued a statement to the effect that they would not thereafter compel any of their employees to join either of the miners' unions and that no committee or representatives of either union would be permitted to visit mines to inspect cards, buttons, etc., that working hours and scales of wages would be maintained as theretofore; but that the companies felt absolved by events from living up to their contracts with the old union, while recognition of the lawless new union was impossible. The statement was signed by the Anaconda, North Butte, Butte & Superior, Butte-Ballaklava, Butte & Zenith, Elm Orlu, Timber Butte, Butte-Alex Scott, Pilot-Butte, Tuolumne, East Butte, Rainbow and Butte-Duluth companies. The Davis-Daly signature is missing, the company representative not being in the city.

It was stated on Sept. 4 that 8000 men were at work for the mining companies.

Muckie's capture several days after he had beat it, has been reported. The city is now quiet and orderly. With the exception of the closing of the saloons, business and amusements are carried on as usual without interference by the military authorities.

SALT LAKE CITY—Sept. 10

Utah Copper Has Been Experimenting With a Flotation process at its Magna mill for some time. On Aug. 24, fourteen flotation cells were in use cleaning the second-class concentrates. These cells are cylindrical in shape, 3 ft. in diameter by 3½ or 4 ft. deep, and have a spitzkasten fastened on the side near the top. About 250 to 300 tons of material per day is treated, and a good recovery is made. The mine is producing between 9000 and 12,000 tons of ore per day, working with about half forces. Operations are carried on six days a week, and at the Boston Consolidated end, three days a week. The office and engineering forces have been reduced, though an effort has been made to retain old employees and men receiving small salaries, especially those with families. It is understood some of the officials have asked for a reduction in salary, to continue while the unsettled markets last.

At Present Other Properties at Bingham are operating as follows: Utah Apex is working about as usual, treating 300 to 350 tons of milling ore per day, concentrating four or five into one, making 70 to 95 tons of concentrates. The company is also shipping about 100 tons of crude ore daily. The United States mines are operating as usual since the curtailment. Lead ore chiefly is being mined. The Utah Consolidated is working at about the normal rate on lead ore, but the copper output has been materially cut down—half normal or less. Ohio Copper is running with full forces and has been working on a flotation process. Bingham Mines is working, as is also the Yampa, the latter shipping about a car of ore daily. The Bingham-New Haven is again operating with regular forces, and is mining chiefly lead and gold. The mill is treating about 100 tons of lead ore per day, and shipments of 100 to 150 tons of first class are being made daily.

Settlements on Lead and Silver are being made in full, and the lead-smelting plants in the valley are operating at nearly normal capacity. There has been a slight decrease in shipments from smaller producers. Only one of the large silver-lead producers in the neighboring camps has temporarily suspended operations. This mine shipped to the International, which has a large tonnage of lead ores stockpiled, and can operate as usual. The lead smelteries of the A. S. & R., at Murray, and the United States Co., at Midvale, have been receiving enough ore to keep all furnaces operating that were in blast under normal conditions, though for a time there was some falling off from small shippers, who did not appear willing to take chances on the metal quotations. These are again shipping, since daily quotations on lead and silver have been established. The copper plants of the International and at Garfield are operating, though at reduced capacity. The Garfield plant has been affected by the reduction of shipments of concentrates by the Utah Copper, but has not yet reached 50%. At present there are two blast furnaces and three reverberatories in use. There are six reverberatories at this plant; on an average four to four and a half furnaces are operating at the same time. One of the reverberatories has been equipped to burn coal dust instead of crude oil, and the tests and experiments carried on have shown that powdered coal is efficient, and there has been a considerable saving from its use. The principal difficulty has been in the feeding, on account of the coal at times being damp, though this is a minor point and can easily be remedied. Castle Gate coal is used. All of the reverberatory furnaces will be equipped to burn powdered coal, as soon as possible.

HOUGHTON—Sept. 12

Among the Workingmen of the District the Calumet & Hecla's plan for partial operation was received with satisfaction, in the belief that it is the most drastic action that will be taken for at least six months, provided the war continues that length of time, and that the company has assurance of financial arrangements to carry through the three-quarters time system for that period. During the suspense, while all the men knew something had to come, there was general fear that it would be at least half time. So that the announcement, when it did become public, was cheerfully received.

The Chaotic Conditions of the European Copper Market have developed one new field for Lake Superior copper that was not suspected of possibilities up to this time. This is the market in China. Fairly large orders from China have been received at Lake Superior plants lately and two large orders for carload lots of finished copper wire have reached refineries. These orders all carry with them the possibility of future business. With the commercial expansion which seems to be developing in China since the establishment of the republican form of government the demand for copper has become a factor. Europe furnished all of the refined copper necessary up to date.

DULUTH—Sept. 12

Great Activity in Ore Shipments from local docks, was witnessed during the past week, 21 ore cargoes clearing in one day, Sept. 9. This is due simply to a clearing of accumulated tonnage, since shipments from the ranges correspond about to the season's averages.

The Cuyuna Range in August saw no additions to the list of shipping properties, although development work was active. The Rowe and Thompson pits, with the Kennedy and Armour No. 2 underground mines, continue to furnish the bulk of the tonnage. Cuyuna-Mille Lacs and Ironton shafts are the only other shippers on the range. Tod-Stambaugh keeps a shovel at work on the Pennington pit but has not shipped thus far this season. The Armour No. 1 and Meacham shafts continue idle.

In an exploratory stage, the Duluth-Brainerd shaft is attracting most attention with its high manganese assays, running well over 40%. The John A. Savage Co. has a large crew at work on the Croft mine, which it is sinking on contract for the Merrimac Mining Co.

On the South Range, the Patterson Construction Co. is opening up the Wilcox shaft underground for the Canadian-Cuyuna Ore Co., having a contract to deliver the property to the mining company in an operating condition.

After many vicissitudes, the Brainerd-Cuyuna mine, at Brainerd, is now sinking a timber drop shaft, which is down about 25 ft. Two ordinary shafts failed completely, because of quicksand and water. The new shaft is going down under the supervision of the Patterson Construction Co.

At Barrows the Barrows Mining Co. will shortly begin sinking a modern steel and concrete shaft on its property recently leased from the Northwestern Improvement Co. The Adams Mine, at Oreland, is stockpiling a small production.

SPOKANE—Sept. 10

Dividends Have Been Declared by two Inland Empire mining companies, the Bunker Hill & Sullivan, at Kellogg, Idaho, and the Standard Silver-Lead, near Silverton, B. C. The Bunker Hill & Sullivan will pay at the regular rate of 25c. per share, or $81,750, making disbursements for the current year $735,750 and increasing the grand total to $15,465,000; but the Standard directors decided to cut in half, and its stockholders will receive 1½c. per share, or $25,000, instead of $50,000. The payment will be made Sept. 10 to stockholders of record Aug. 31, making the disbursements for 1914, $475,000, and increasing the total to $1,550,000. The reduced dividend of the Standard is due to the suspension of shipments at the mine, and, while the officials state there is a considerable amount in the treasury, it is probable that no further dividends will be declared until shipping is resumed, unless there is a marked advance in the price of lead and silver, since the directors have decided that it is advisable to keep the surplus funds to finance development.

On Aug. 4 the Standard was notified by the Consolidated Mining & Smelting Co. that no more custom ores could be treated at its Trail plant, owing to the demoralization of the general metal situation. This resulted in suspension of shipments and all but 90 men, who were retained to continue development, were laid off. Small shipments of zinc are being forwarded to the smelters at Bartlesville, Okla., and the lead-silver ore extracted in development is being stored at the mill.

Charging that the Stewart Mining Co. has entered upon the Ontario claim at Kellogg, Idaho, and knowingly taken out ore to the probable value of $40,000, the Ontario Mining Co., lessor, and Jonathan Bourne Jr., of Portland, Ore., owner of the property, have filed suit in the district court of Shoshone County, Idaho, asking that the Stewart company be restrained from continuing its alleged practice and that an accounting be made for the ore which it is charged was wrongfully taken. The complaint alleges that the Stewart company knew that it was entering on the Ontario ground, and states that the alleged entry was made from the Stewart's Switchback claim and that the ore was extracted for 120 ft. east and west along the vein and for about 18 ft. in width. It is charged that the ore lay just along the north boundary of the Ontario. The Ontario claim, it is set forth, has been owned by Mr. Bourne since 1892, but that in April, 1911, it was leased to Stanley A. Easton, who shortly after assigned his interest to the Ontario Mining company. This lease was to have expired July 1, 1914, but was extended until July 1, 1915. It is charged that the Stewart company has been removing ore from the property since June 1, 1914. That there is no chance to maintain such a suit is the opinion expressed by Manager W. M. Bacon of the Stewart company. "Our engineers have carefully gone over the ground and tell us we are within our boundaries," said Mr. Bacon. "The trouble is that we are both working parallel along the boundary of the claim. I am sure we do not want any of their ore, and I don't think they want any of ours. Of course one cannot mine to an edge, because the ore breaks one way or the other from a vertical plane. It seems that the only thing is a difference of opinion and it will take more surveys to determine which is right."

RENO—Sept. 10

Mine Rescue and First-Aid Instruction in Nevada by the government mine-rescue car, was to be finished the week of Sept. 1, the car having been in Nevada since July 1. The work was in charge of E. Steidle, junior mining engineer of the Bureau of Mines, and George W. Riggs, first-aid instructor. Instruction has been given and teams drilled in mine-rescue and first-aid work at Ely, Virginia City, Goldfield, Tonopah, Blair, Round Mountain, Wonder, Fairview and the University of Nevada. In addition to this work, Mr. Steidle gave Friday-night lectures on the rescue division of the Bureau of Mines and its purposes and on the use of the oxygen helmet. A total of 4400 miners attended these lectures. Two contests were held, one at Ely, July 4, in which eight teams participated, the other at Tonopah, Aug. 9, in which five teams took part. Several thousand spectators were present at these contests. The oxygen helmets in the state were examined and found in excellent condition. These are 41 in number, distributed as follows: Ely district, 6; Virginia City, 7; Goldfield, 6; Tonopah, 13; Round Mountain, 2; Wonder, 2; Fairview, 2; University of Nevada, 1; office of state mine inspector, Carson City, 2. Deep interest was shown in the work by the miners, and the mining companies assisted greatly by furnishing transportation to camps off the railroads, providing subsistence to crew of car, giving miners time off for instruction at full pay, and furnishing smoke and gas areas in which to practice mine-rescue work.

The Mining News

ARIZONA

Greenlee County

ARIZONA COPPER (Clifton)—Copper production for August, 1869 tons. Directors instruct production be reduced as from Sept. 1.

SHANNON (Clifton)—After present supply of coke and smelting materials is consumed, in 10 to 15 days, mine and smelting plant will be closed.

Pinal County

RAY CONSOLIDATED (Ray)—Quarterly dividend, due Sept. 30, deferred.

Santa Cruz County

ORO BLANCO DISTRICT—Important discovery on Switzerland and Republic group, near Austerlitz boundary. Strong north-and-south vein appears to be formed by junction of Austerlitz and Montana veins.

CALIFORNIA

Amador County

CENTRAL EUREKA (Sutter Creek)—Recent development work shows orebody discovered on 3000-ft. level extensive and carrying good values. Reported that flume will be constructed to carry tailings to land recently secured for dumping purposes; 30 stamps in mill are dropping.

Calaveras County

COMET (Railroad Flat)—Mill reported destroyed by fire, entailing loss $1000. Machinery badly damaged.

LIGHTNER (Angels Camp)—Company purchased and cancelled 33,000 shares outstanding stock, assessments delinquent.

Inyo County

CERRO GORDO (Keeler)—Permission asked of state water commission for power rights on Lone Pine Creek. Erection of power plant contemplated to furnish power for operation of mine and tramway.

Plumas County

ENGELS COPPER (Taylorsville)—New mill machinery being installed. Capacity 400 tons. Smelting plant, inadequate to handle ore, disposed of; flotation to be installed instead. Present mill can be enlarged when required. Should be ready Nov. 1. Power plant well under way; Allis-Chalmers impulse wheel now under 400-ft. head will drive a.c. generator built by same company. Walter H. Brown, engineer-in-charge of installation.

Shasta County

MIDAS (Harrison Gulch)—Gold Hill shaft unwatered, machinery found uninjured. Midas shaft being rapidly cleared of immense volume of water which accumulated after destructive fire last April.

COLORADO

Boulder County

U. S. GOLD CORPORATION (Sugar Loaf)—Company will reopen and operate Sphinx and Livingston properties. Estimated that ore reserve is ample to supply 125-ton cyanide mill now nearing completion. Sphinx tunnel and Livingston shaft will be repaired and equipped; 400-ft. shaft will be unwatered. Concrete foundations for roasting furnace and cooling hearths in place and await arrival of steel work.

San Juan County

CONCENTRATES WERE SHIPPED FROM SILVERTON in August, as follows: From Gold King, 750 tons; Iowa-Tiger, 700 tons; Sunnyside, 525 tons; Barstow, 200 tons; S. D. & G. Leasing Co., 125 tons; Arastra Leasing Co., 100 tons; Aspen, 100 tons; Mears & Wilfley, 75 tons; Frisco Tunnel, 50 tons; Intersection, 25 tons; 350 tons of ore shipped during month.

KITTIMAC (Middleton)—Mill being completely remodeled under direction of Mr. Card. Huff separators and Card tables being installed.

Teller County

DEERHORN (Victor)—Property being developed and operated by Hobson & Sutton, of Cripple Creek. Sublessees recently opened orebody, third level of Deerhorn shaft.

C. O. D. (Crippple Creek)—Electrically operated compressor will be installed at shaft house in Poverty Gulch as soon as foundations, now being laid, are completed. Active development contemplated.

GRANITE GOLD MINING CO. (Goldfield)—Water in Gold Coin shaft now under control. Dillon shaft sunk to 1260 ft. without interference from seepage water and sinking continues; will be sunk to water level, approximately 150 ft. deeper. Laterals will be driven from new 1400-ft. station as soon as sinking is completed.

IDAHO

Coeur d'Alenes

TUSCUMBIA (Wallace)—Good progress being made on contract recently let for raise of 300 ft. from the Idora or No. 3 tunnel to tunnel No. 2. First of last week 107 ft. had been made. Raise is vertical to reach the oreshoot in upper levels; should make accessible 450 ft. of ore along dip of vein. Owners have under consideration several propositions for working property, but this raise will be completed first.

MICHIGAN

Iron

OTTOWA (Hurley)—A 2000-ft., direct-connected, electric-driven compressor ordered for this mine from Sullivan Machinery Co., Chicago.

RICHMOND (Palmer)—This openpit property, mining siliceous ore, will ship about 150,000 tons this season, breaking record for mine. It is one of few pit mines in Michigan and has been shipper for several years. Force is working 12 hr. per day, seven days per week.

MAAS (Negaunee)—No ore shipped from large stock on hand; more trestles are being constructed to take care of ore that will be mined during winter. Other mines in district will also have to make provision for additional stocking ground if they are to continue work.

CASCADE MINING CO. (Palmer)—Three drifts have reached ore on bottom level of Isabella property. Main drift east from shaft struck ore several weeks ago. Crosscuts were extended from that drift and two of them now in ore. Drift extended north from shaft reached good ground after little drifting, but water came in so fast that work had to be stopped temporarily to allow it to drain. Mine has small stockpile at present and will enter shipping list next year.

MINNESOTA

Cuyuna Range

ROWE (Riverton)—Shipments resumed after suspending for several weeks.

DULUTH-BRAINERD CO. (Ironton)—Company continues to report encountering high-manganese ore in underground exploratory work. Late assays said to show 45% manganese ore. Negotiations under way looking to transfer of this property to M. A. Hanna company, which abandoned Barrows mine, on south range of Cuyuna, some months ago. It is considering Duluth-Brainerd property solely from manganese viewpoint.

Mesabi Range

BURT (Hibbing)—Oliver has suspended all work. For month past one shovel was working and little ore was sent out.

ALPENA (Virginia)—This Oliver mine has already shipped 800,000 tons this year. By close of navigation, better than 1,000,000 tons will have been shipped. Mine is largest shipper of Steel Corporation in Virginia district and this year will be one of largest shippers on range. Big properties that send from 1,000,000 to 3,000,000 tons in good years will fall far below this year.

MONTANA

Silver Bow County

DAVIS-DALY COPPER CO. (Butte)—Rumors of orders received to close the mine emphatically denied by the company officers. Shaft sinking and development work still in progress, will be continued in spite of curtailment of work in other mines of camp. Due to prompt response to recent assessment, sufficient funds provided to carry on work for some time to come.

PILOT BUTTE MINING CO. (Butte)—Morning Sept. 3, fire discovered in boiler room of company's plant, which made such headway that it threatened entire surface equipment. For a while was feared fire might extend into shaft and underground workings. With prompt assistance of Elm Orlu and Butte-Superior fire department, however, flames were got under control without further damage.

NORTH BUTTE MINING CO. (Butte)—In reply to inquiries when company would resume operations, Manager Pope pointed out that though company was prepared to do so at any moment, present conditions did not warrant it. Cost of copper production up to shutdown was 13¼c. per lb., which with credit of 3½c. for silver and gold, leaves net cost of 9¾c. With curtailed output, costs would be considerably higher, and North Butte would be losing money on 12½c. copper, and losing ore, too. Hence shutdown and unlikelihood of resumption until work at full blast possible. During the shutdown, repair program being assiduously carried out, including repairs in Speculator shaft and underground renovation of entire property. [Late reports are that operations were to be resumed Sept. 15 at 90% normal capacity, employing 900 men.—Editor.]

NEVADA

Esmeralda County

GRANITE MOUNTAIN MINE (Bonnie Clare)—Crosscut tunnel driven 1670 ft. and west drift on vein now being driven. Force will be increased and development work done to east.

Nye County

GOLD STRIKE AT NORTH TONOPAH made, it is stated. Strike four miles north of Tonopah and rush followed to scene of discovery. One ton of ore assaying $84 taken from discovery shaft at depth of 10 ft. and shipped.

COMMERCIAL MINES & MILLING CO. (Manhattan)—Bond taken and property being examined. Mine sampled and large amount of surface trenching done. Two Cyclone drills will be used in development.

Washoe County

PARRY MINE (Pyramid)—Mine buildings and a residence destroyed by fire night of Sept. 2. Cause unknown.

White Pine County

ELY LEASING & MILLING CO. (Lane City)—Smelter returns on first shipment of ore from Macon City mine received; ore ran $15.51 in gold, silver and lead. Mill will be built, it is stated.

NEVADA CONSOLIDATED (McGill)—All holdings of Steptoe Valley Smelting & Mining Co. transferred to this company. Property transferred includes smelting plant and all buildings connected with it at McGill, railroad tracks and rolling stock, electric power transmission line to Copper Flat, Veteran property, block 46 of Park addition to Ely, several water rights in Duck Creek section, Calcite, Dolomite, Toothache and Sorehead placer claims, and Steptoe group of claims. Six roasters, one-third roaster capacity at Steptoe plant, will be closed down on account of curtailment of capacity to one-half. No further reduction contemplated. Almost full quota of men on payroll, one-half force working every other day.

NEW MEXICO

EXEMPTION OF MINING CLAIMS FROM ASSESSMENT for 1914 meeting with approval of claim holders in every mining district in state who have been thrown out of work on account of European crisis or who can find no market for ores at custom smelters. Bill introduced in Congress by Hon. H. B. Fergusson, this state, receiving widespread endorsements and petitions to members of both houses being circulated.

Grant County

CHINO (Santa Rita)—Quarterly dividend reduced from 75c. to 50c., payable Sept. 30.

MOGOLLON MINING DISTRICT has suffered destructive floods. Business houses of camp affected more than mines. Second slide of tailings from Socorro Mining and Milling Co. formed dam below Maud S mill destroying part of native camp. Traffic blocked on account of wash-outs. Greatest hindrance to progress in Mogollon is its inaccessibility, over 90 miles of deplorable highways. Many plans under way for betterment of this condition, latest being route from Silver City via Bear Mountain which would shorten distance seven miles and eliminate steep grades. Methods of financing this highway are under consideration by Silver City Chamber of Commerce. Government has asked for bids for delivery of mail from Tyrone N. M. via Mangas Valley to Mogollon.

SOUTH DAKOTA

Lawrence County

ALAMEDA (Trojan)—Messrs. Manion and Harris have taken a lease and have force at work taking out ore for shipment to Mogul mill.

ORO HONDO (Lead)—Auxiliary hoist placed in position on 1000-ft. level. Ore broken in sinking will be placed in bin on this level and removed to surface at leisure. Shaft now down over 1100 ft.

TITANIC (Carbonate)—Plans outlined for future development call for 1000-ft. tunnel under present workings. Most of ground traversed by tunnel has never been prospected. Tunnel will drain entire mine.

Pennington County

HOME LODE (Silver City)—Development by drifts and crosscuts continues in No. 1 shaft. Ore complex carrying gold, silver, lead, zinc and antimony. Oil flotation will be installed.

HILL CITY DEVELOPMENT (Hill City)—In main shaft, which attained depth of 100 ft., crosscut was driven and shows width of orebody to more than 16 ft. Drifts for 50 ft. show good-grade milling ore.

UTAH

Beaver County

LEONORA (Milford)—Zinc ore, 14 in. and upward in width, recently opened.

NOON DAY (Milford)—Work being done at this property adjoining Cave mine on southeast; 7 ft. of hematite cut in sinking shaft, and this being followed. Drifting will be done on 200 level.

CROFT MINE (Milford)—Property to be equipped with electric hoist, and work resumed in near future. Power line recently completed into Minersville crosses property. Five cars of ore shipped from development.

SOUTH UTAH (Newhouse)—Since closing of mine in April, some shipments of high-grade chalcopyrite-tetrahedrite ore made. Few weeks ago, cloudburst washed out mile of branch line from Milford, and since then all work suspended. In May and June, after the closing of the mill, ore shipped carried 120,921 lb. copper, 2192 oz. silver and 29 oz. gold.

Juab County

TINTIC SHIPMENTS for the week ended Sept. 4 amounted to 100 cars by 16 shippers. In August, 371 cars were shipped, and in July, 459 cars.

HOMANSVILLE MINING (Eureka)—Manganese deposits of this company southeast of Eureka have been examined and sampled.

TINTIC ZINC (Eureka)—Property adjoins Scranton on south; main tunnel is in 550 ft. in limestone, showing considerable iron. Raise from tunnel level at 500-ft. point shows rock slightly mineralized with zinc.

MAY DAY (Eureka)—Orebody opened under former lease found to extend into adjoining claim of Chief Consolidated, and May Day company obtained lease on this ground. Substantial royalty will be paid the Chief.

CENTENNIAL-EUREKA (Eureka)—Sinking being done on gold ore recently encountered above main working shaft; and ore taken out in the work being piled. Tunnel will be driven to cut this body at greater depth.

SCRANTON (Eureka)—New body of ore opened on 500 level this property, North Tintic. Ore is of low grade, carrying excess of iron; has been drifted on for 50 ft.; higher grade looked for. Car of silver-lead ore was shipped week ended Sept. 4.

VICTORIA (Eureka)—As soon as repair work now in progress has been completed, night shift will be added and output increased. Work in ore being done on 1000- and 1200-ft. levels. Shaft sinking from latter level being considered. Reduction has been made in overdraft since first of year.

CHIEF CONSOLIDATED (Eureka)—Foundations for experimental mill are being built. Site is near Plutus property, east of Chief, near the D. & R. G. switch to Eagle & Blue Bell. Dump at Chief Consolidated contains several thousand tons low-grade ore, and much ore of same character left in stopes and in place.

Summit County

PARK CITY SHIPMENTS for the week ended Sept. 4 amounted to 2,526,960 lb. August output, 4355 tons.

DALY WEST (Park City)—Expected new mill will be ready for operation this fall. Several thousand tons milling ore stockpiled, awaiting treatment.

REVELATOR MINING (Park City)—Development work being done at this property in Snake Creek district; ore-bearing fissures followed 40 ft. Country rock, quartzite and limestone.

SNAKE CREEK TUNNEL (Park City)—During August, new record of 419 ft. was made by J. A. McIlwee & Co., contractors, working two shifts. Air-line, telegraph line, ventilating pipe, permanent ties and track were kept up to the face. Hard drilling ground encountered. Tunnel 7½ ft. wide by 6½ ft. high, and has waterway 3½x4 ft. Two machines are used in breast. Total length is to be 14,000 ft.; more than 9000 ft. completed.

SILVER KING CONSOLIDATED (Park City)—Regular quarterly dividend 10c. per share declared, payable Oct. 1 and amounting to $62,000. Third of like amount to be paid this year; total dividends to date are $495,000. During August, 933 dry tons shipped, bringing net smelter returns in neighborhood of $40,000. Most of ore taken out in development. In July, 834 dry tons shipped. Company recently opened large bodies high-grade silver-lead ore, extent not yet determined. These of the same character as those in adjoining Silver King Coalition, which has production valued at over $30,000,000 and has paid $13,000,000 in dividends. Silver King Consolidated now second largest shipper in camp.

WASHINGTON

Stevens County

DOUBLE EAGLE MINING CO. (Valley)—Organized locally to prosecute active development on high-grade silver and lead property formerly known as Silverine or Kaiser mine, about 12 miles west of Valley. After first discovery of float in 1898, by John H. Lutjen, said to assay 120 oz. of silver, property was worked at intervals by Lutjen, Kindorf and Kaiser, partners in number of mining properties. Death of two partners left property unworked for two years prior to sale to present company Several shipments of ore made, netting original owners about $70 per ton. New company plans tunnel to tap vein at much greater depth, with expectation of striking large body of high-grade ore. New buildings erected and work on tunnel will begin at once.

WYOMING

Crook County

WARREN PEAKS MINING & MILLING CO. (Sundance)—At meeting of board of directors, decided to complete mill started over year ago and have it in operation by first of year. Mill will employ both amalgamation and cyanidation, crushing being done by stamps. Most of machinery is on ground, but has never been set up. Mill will start operations at capacity of 30 tons per day.

CANADA

Ontario

TOUGH OAKES (Kirkland Lake)—Good progress being made on mill. Butters-Johnston syndicate retained as consulting engineers; supervision of building to be under control of James Johnston, now in charge of Nipissing mills.

DOME (Porcupine)—Monthly statement for August shows largest production of gold since January, and greatest tonnage milled since operations began. Value of gold produced was $90,893; tonnage treated, 20,170; average value of ore milled, $4.50.

McINTYRE (Porcupine)—Negotiations for transfer of controlling interest to Nipissing interests concluded, stock to the amount of $1,500,000 having been deposited in escrow, pending examination of property to verify statements made by vendors.

BEAVER (Cobalt)—Company notifies stockholders of shutdown following refusal by smelter to accept shipments. After two weeks, mill resumed, working on surface dump. Company is ready to resume any time and hopes to soon. Company in excellent condition.

HOLLINGER (Porcupine)—The four-weekly report for period ended Aug. 12 shows gross profits of $171,975 from treatment of 16,456 tons; average value, $15.46 per ton. Approximate extraction, 94.4% and working costs, $4.16 per ton. During the four weeks there was expended on plant, $30,546. Profits from Jan. 1 to Aug. 12, $1,015,451, of which $720,000 was paid out in dividends. Sixty stamps are now working and underground work continues to show good results. Winze has been started below 675-ft. level, and 800-ft. should be reached about end of October. Vein on the 675-ft. widened to 20 ft., averaging $10.90 per ton over that width.

MEXICO

A. S. & R.—Plans for resumption of operations continue. Monterey and Chihuahua plants have each three furnaces in blast. Aguascalientes should be ready to blow in part of furnaces soon. Labor situation unsettled and men scarce.

The Market Report

METAL MARKETS

NEW YORK—Sept. 16

All of the markets have again been provokingly dull and none of them has exhibited any particularly interesting feature.

Copper, Tin, Lead and Zinc

Copper—There are signs of coming events, but except for these the situation remains substantially unchanged. Producers naturally welcome such orders as come to them, but as yet they have made no effort to reëstablish a competitive market of buyers and sellers, the still existing conditions rendering the sale of the current production, not to speak of the accumulated stocks, quite impossible. Europe seems to be taking copper more freely on the old contracts, and probably will want to enter into new ones before long, as will also domestic manufacturers, but the requirements of the last appear to be reduced by a real diminution in the rate of consumption.

Exports of copper through the port of New York up to the middle of September were 8788 long tons. Exports of copper from Baltimore for the week ended Sept. 5, were 740 tons, for the week ended Sept. 12 were 969 tons, of which 633 tons were destined for London and 336 tons for Copenhagen.

Base price of copper sheets is now 17½c. for hot-rolled and 18½c. for cold-rolled. The usual extras are charged. Copper wire is now 13¾c. per lb. for carload lots at the mill.

Tin—Supplies are more liberal but demand is more restricted; hence the further sharp recession.

Lead—This market has been even weaker than at the time of our last report, sellers at concessions being found in several quarters, although the leading interest maintains its former price. The reported transactions amount to a moderate tonnage. Independent producers have sold at 3.80@3.85c., New York, with free offers at the higher figure, while lead has been easily purchasable at St. Louis at 3.65@3.70c. right through the week.

Spelter—The recession that we chronicled last week went further, this time with some real pressure to sell, some producers offering at sharp concessions in order to find the point where business could be developed. At 5.20@5.25c., St. Louis, some fair lots were turned over, but there was no general interest excited among domestic consumers, who seem to be well supplied generally and responded to offers of spelter at 5.22½c with the intimation that 5c. might be an interesting figure. However, toward the close of the week England once more bought some spelter here, and there is some expectation that the demand from there may soon develop further.

Butte & Superior in August produced 10,346 tons of blende averaging 54% Zn. Timber Butte produces about 3500 tons per month, giving a total for the district of about 14,000 tons.

Exports from Baltimore during the week ended Sept. 5 included 20 tons of Spelter.

DAILY PRICES OF METALS

NEW YORK

Aug. Sept.	Sterling Exchange	Silver, Cts. per Oz.	Copper	Tin	Lead		Zinc	
			Electrolytic, Cts. per Lb.	Cts. per Lb.	New York, Cts. per Lb.	St. Louis Cts. per Lb.	New York, Cts. per Lb.	St. Louis, Cts. per Lb.
					3.80	3.65	5.55	5.40
10	*	55	*	†33	@3.90	@3.70	@5.60	@5.45
					3.80	3.65	5.40	5.25
11	*	55⅛	*	†32	@3.90	@3.70	@5.50	@5.35
					3.80	3.65	5.35	5.20
12	*	55	*	†31½	@3.90	@3.70	@5.40	@5.25
					3.80	3.65	5.35	5.20
14	*	54⅛	*	†31⅛	@3.90	@3.70	@5.40	@5.25
					3.80	3.65	5.35	5.20
15	*	52⅝	*	†31⅛	@3.90	@3.70	@5.40	@5.25
					3.80	3.65	5.35	5.20
16	*	53⅛	*	†31	@3.90	@3.70	@5.40	@5.25

*No quotations. †Nominal.

The quotations herein given are our appraisal of the markets for copper, lead spelter and tin based on wholesale contracts; and represent, to the best of our judgment, the prevailing values of the metals specified as indicated by sales by producers and agencies, reduced to basis of New York, cash, except where St. Louis is given as the basing point. St. Louis and New York are normally quoted 0.15c. apart.

Some current freight rates on metals per 100 lb., are: St. Louis-New York, 15½c.; St. Louis-Chicago, 6c.; St. Louis-Pittsburgh, 12½c.; Chicago-Baltimore, 10½c.; Chicago-New York, 13½c.

Other Metals

Aluminum—The market is quiet, 20@20½c. per lb. being asked for No. 1 ingots.

Antimony—There were almost no transactions in this metal this week; prices are nominal, Cookson's, 12@12½c.; U. S. 11½@12c.; outside brands, 10@10½c. per lb.

Quicksilver—This metal continues strong, with prices at $75@80 per flask, New York. No London quotations are available, stocks being held for government use.

Gold, Silver and Platinum

Gold in the United States, on Sept. 1, is estimated by the Treasury Department as follows: Held in Treasury against gold certificates outstanding, $989,314,869; in Treasury current balances, $228,183,437; in banks and circulation, $627,104,376, a decrease of $42,667,982 from Aug. 1, 1914.

Platinum—The situation is not materially changed. Dealers ask $50 per oz. for refined platinum and $57.50 per oz. for hard metal.

Silver—Owing to limited orders, the price of silver has declined slightly. The mint in London has been the principal buyer, but has taken only moderate quantities.

Shipments of silver from London to the East, Jan. 1 to Sept. 3, as reported by Messrs. Pixley & Abell:

	1913	1914	Changes
India	£5,108,500	£4,464,500	D.£644,000
China	572,000	42,000	D. 530,000
Total	£5,680,500	£4,506,500	D.£1,174,000

Zinc and Lead Ore Markets

PLATTEVILLE, WIS.—Sept 5, 1914

The base price paid this week for 60% zinc ore was $45@47 per ton; 80% lead ore sold at $45 per ton.

SHIPMENTS, WEEK ENDED SEPT. 5, 1914

	Zinc ore, lb.	Lead ore, lb.	Sulphur ore, lb.
Week	4,495,190	143,000	177,500
Year	106,520,840	3,721,500	24,819,070

Shipped during week to separating plants—3,721,500 lb. zinc ore.

IRON TRADE REVIEW

NEW YORK—Sept. 15.

The Steel Corporation's statement of unfilled tonnage at the close of August was unexpectedly favorable, showing an excess of bookings over shipments in August of 54,742 tons, equal to about 5% of capacity. The shipments were slightly less than 70% of capacity and the bookings slightly more than 70%. Prospects for the Steel Corporation and also the independents, are that September shipments will not be much above 60% of capacity, bookings being 50% of capacity or less.

The iron and steel market has become absolutely flat throughout. No export business of any consequence has developed, and domestic trade has fallen off so that producers are now more interested in prospects of this trade being restored to normal, than they are as to whether the war will result in the development of a large export trade. The early

anticipations reported in some quarters of a large steel export trade springing up as a result of the war now appear more or less ridiculous, for after six weeks of war conditions it has not been possible to restore even the small export trade in iron and steel that was being conducted before.

The mills have received a few releases on export orders booked before the war and have shipped a few cargoes, but on the whole the condition is, that much of the business already on the books is not filled and new orders in the export market are very light.

PITTSBURGH—Sept. 15

Domestic demand has so decreased as to indicate an extremely conservative attitude on the part of all buyers. There are practically no new projects as no new financing is being done. The railroads have practically withdrawn from the market.

Pig Iron—The market is extremely dull and prices are generally quoted at the levels formerly prevailing. Several merchant furnaces have gone out of blast in the last two weeks and the trend remains in that direction. We quote: Bessemer, $14, basic, $13, malleable and No. 2 foundry, $13@13.25; gray forge, $12.50@12.75, at Valley furnaces, 90c. higher delivered Pittsburgh.

Ferromanganese—There is relatively little interest in the market, as the steel mills have fair stocks in most cases and have received shipments from England at rates not much below those involved in their contracts, nearly all of which run to the end of the year. The steel corporation has sold a few lots of prompt material at about $85, but the tonnage involved does not seem to have been of consequence. The English producers have reduced their quotation from $100 to $80, f.o.b. Baltimore, but consumers do not seem disposed to buy, being covered for the present and having fewer requirements.

Steel—Prices for billets and sheet bars continue at $21 and $22, respectively, at mill, Pittsburgh or Youngstown. A few lots have been sold at these prices, but not enough to indicate that consumers generally are willing to pay such advances over prices on current shipments. Rods are $26, Pittsburgh.

PETROLEUM

The monthly statement of the "Oil City Derrick" gives new wells completed in August as follows: Pennsylvania grade, 516; Lima-Indiana, 133; Central Ohio, 74; Kentucky, 20; Illinois, 142; Kansas-Oklahoma, 732; Texas-Louisiana, 142. This shows a total of 1760 wells completed, a decrease from the July report of 283. New production figures 125,273 bbl., a decrease of 6676. There were 309 dry holes, 33 fewer than in July, and 185 gas wells, a decrease of 42. At the close of August the new work amounted to 2480 rigs and wells drilling.

CHEMICALS

NEW YORK—Sept. 16

Arsenic—The market is decidedly stronger with prices at 4½@5c. No importations have been received lately and stocks are light.

Copper Sulphate—Business continues moderate with fair domestic demand but little export trade. Quotations remain unchanged at $4.50 per 100 lb. for carload lots and $4.75 for smaller parcels.

Nitrate of Soda—This market is exceedingly quiet, with prices nominally 1.95@2c. for both spot and futures.

Assessments

Company	Delinq.	Sale	Amt.
Alameda, Ida	Sept. 5	Sept. 29	$0.005
Alta, Nev	Sept. 10	Sept. 28	0.03
Argenta, Ida	Sept. 1	Oct. 3	0.0005
Best & Belcher, Nev	Sept. 15	Oct. 6	0.05
Big Elk, Ida	Aug. 25	Sept. 25	0.001
Black Bear, Ida	Sept. 1	Oct. 1	0.01
Blue Star, Ida	July 28	Sept. 25	0.03
Cedar Creek, Ida	Sept. 10	Oct. 10	0.003
Columbine, Colo	Sept. 15	Oct. 20	0.02
Con. Virginia, Nev	Sept. 3	Sept. 24	0.10
Copper Plate, Ida	Aug. 29	Oct. 3	0.002
Davis-Daly, Mont	Oct. 15	.....	0.25
Duluth, Ida	Sept. 5	Oct. 3	0.001
Eagle Mountain, Ida	Aug. 22	Sept. 22	0.001
Emerald, Utah	Sept. 15	Oct. 10	0.0033
Four Timbers, Ida. (post.)	July 29	Sept. 29	0.0015
Hub, Ida. (post.)	Sept. 5	Sept. 29	0.001
Idaho & Los Angeles, Ida	Sept. 7	Sept. 25	0.005
Idaho-Nevada, Ida	Sept. 7	Oct. 1	0.001
Laclede, Ida. (post.)	Aug. 21	Sept. 28	0.005
Lucky Calumet, Ida	Aug. 21	Sept. 21	0.005
McNamara, Nev. (post.)	Sept. 4	Sept. 28	0.03
Monarch-Pittsburgh, Nev. (post.)	Sept. 14	Oct. 19	0.01
Mullan, Ida. (post.)	Sept. 8	Sept. 30	0.002
N. Bunker Hill, Ida. (post.)	July 18	Sept. 26	0.002
Ophir, Nev. (post.)	Aug. 31	Sept. 24	0.10
Oreano, Ida. (post.)	July 24	Sept. 25	0.002
Royal Copper, Ida	Sept. 3	Oct. 3	0.001
Saltese, Ida	Sept. 1	Oct. 1	0.002
Tuscumbia, Ida. (post.)	Aug. 20	Oct. 1	0.002
Utah Metal, Utah	.... ..	Oct. 1	0.05

Monthly Average Prices of Metals

SILVER

Month	New York			London		
	1912	1913	1914	1912	1913	1914
January	56.260	62.938	57.572	25.887	28.983	26.553
February	59.043	61.642	57.506	27.190	28.357	26.573
March	58.375	57.870	58.067	26.875	26.669	26.788
April	59.207	59.490	58.519	28.284	27.416	26.958
May	60.880	60.361	58.175	28.038	27.825	26.704
June	61.290	58.990	56.471	28.215	27.199	25.948
July	60.654	58.721	54.678	27.919	27.074	25.219
August	61.606	59.293	54.344	28.375	27.335	25.979
September	63.078	60.640	.....	29.088	27.986	.....
October	63.471	60.793	.....	29.299	28.083	.....
November	62.792	58.995	.....	29.012	27.263	.....
December	63.365	57.760	.....	29.320	26.720	.....
Year	60.835	59.791	.....	28.042	27.576	.....

New York quotations cents per ounce troy, fine silver; London, pence per ounce, sterling silver, 0.925 fine.

COPPER

Month	New York		London			
	Electrolytic		Standard		Best Selected	
	1913	1914	1913	1914	1913	1914
January	16.488	14.223	71.741	64.304	77.750	69.488
February	14.971	14.491	65.519	65.259	71.575	70.188
March	14.713	14.131	65.329	64.276	70.658	69.170
April	15.291	14.211	68.111	64.747	74.273	69.313
May	15.436	13.996	68.807	63.182	74.774	67.786
June	14.672	13.603	67.140	61.336	70.821	66.274
July	14.190	13.223	64.166	60.540	69.446	64.955
August	15.400	.....	69.200	.....	74.313	.....
September	16.328	.....	73.125	.....	78.614	.....
October	16.337	.....	73.383	.....	79.250	.....
November	15.182	.....	68.275	.....	73.825	.....
December	14.224	.....	65.223	.....	69.583	.....
Year	15.269	.....	68.335	.....	73.740	.....

New York, cents per pound, London, pounds sterling per long ton.

TIN

Month	New York		London	
	1913	1914	1913	1913
January	50.298	37.779	238.273	171.905
February	48.766	39.830	220.140	181.556
March	46.832	38.038	213.615	173.619
April	49.115	36.154	224.159	163.963
May	49.038	33.360	224.143	150.702
June	44.820	30.577	207.208	138.321
July	40.260	31.707	183.511	142.517
August	41.582	.....	188.731	.....
September	42.410	.....	193.074	.....
October	40.462	.....	184.837	.....
November	39.810	.....	180.869	.....
December	37.635	.....	171.786	.....
Av. year	44.252	.....	206.279	.....

New York in cents per pound; London in pounds sterling per long ton.

LEAD

Month	New York		St. Louis		London	
	1913	1914	1913	1914	1913	1914
January	4.321	4.111	4.171	4.011	17.114	19.665
February	4.325	4.048	4.175	3.937	16.550	19.606
March	4.327	3.970	4.177	3.850	15.977	19.651
April	4.381	3.810	4.242	3.688	17.597	18.225
May	4.342	3.900	4.226	3.808	18.923	18.503
June	4.325	3.900	4.190	3.810	20.226	19.411
July	4.353	3.891	4.223	3.738	20.038	19.051
August	4.624	3.875	4.550	3.715	20.406	.....
September	4.698	.....	4.579	.....	20.648	.....
October	4.402	.....	4.253	.....	20.302	.....
November	4.293	.....	4.146	.....	19.334	.....
December	4.047	.....	3.929	.....	17.798	.....
Year	4.370	.....	4.238	.....	18.743	.....

New York and St. Louis cents per pound. London, pounds sterling per long ton.

SPELTER

Month	New York		St. Louis		London	
	1913	1914	1913	1914	1913	1914
January	6.931	5.262	6.854	5.112	26.114	21.533
February	6.239	5.377	6.089	5.228	25.338	21.413
March	6.078	5.250	5.926	5 100	24.605	21.460
April	5.641	5.113	5.491	4.963	25.313	21.569
May	5.406	5.074	5.256	4.924	24.583	21.393
June	5.124	5.000	4.974	4.850	22.143	21.345
July	5.278	4.920	5.128	4.770	20.592	21.568
August	5.658	5.568	5.508	5.418	20.706	.....
September	5.694	.....	5.444	.....	21.148	.....
October	5.340	.....	5.188	.....	20.614	.....
November	5.229	.....	5.083	.....	20.581	.....
December	5.156	.....	5.004	.....	21.214	.....
Year	5.648	.....	5.504	.....	22.746	.....

New York and St. Louis, cents per pound. London, pounds sterling per long ton.

PIG IRON IN PITTSBURGH

Month	Bessemer		Basic		No. 2 Foundry	
	1913	1914	1913	1914	1913	1914
January	$18.15	$14.94	$17.35	$13.23	$18.59	$13.99
February	18.15	15.06	17.22	14.12	18.13	14.08
March	18.15	15 07	16.96	13.94	17.53	14.10
April	17.90	14.90	16.71	13.90	16.40	14.13
May	17.68	14.90	15.80	13.90	15.40	14.27
June	17.14	14.90	15.40	13.90	15.10	13.96
July	16.31	14.90	15.13	13.90	14.74	13.90
August	16.63	14.90	15.00	13.90	14.88	14.90
September	16.65	.....	15.04	.....	14.93	.....
October	16.60	.....	14.61	.....	14.80	.....
November	16.03	.....	13.91	.....	14.40	.....
December	15.71	.....	13.71	.....	14.28	.....
Year	$17.09	.....	$15.57	.....	$15.77	.....