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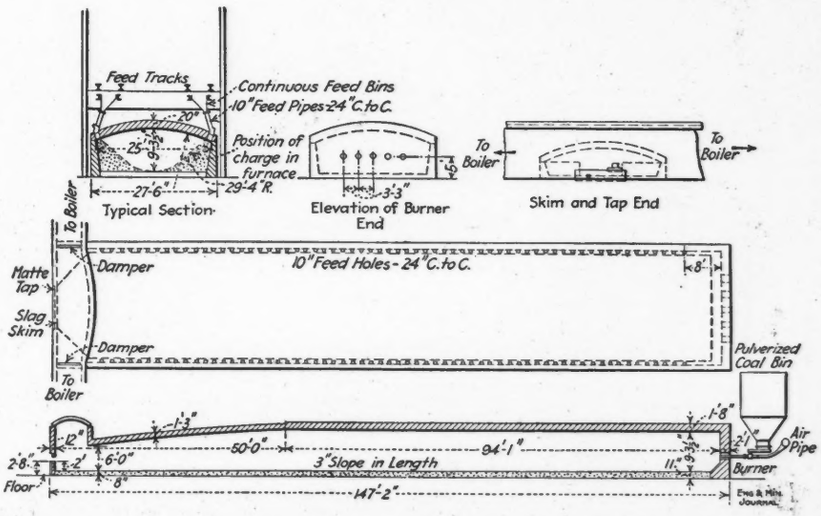
Coal-Dust Reverberatory Firing

By E. P. Mathewson*

SYNOPSIS—An account of the brilliantly successful introduction of coal-dust firing in connection with the copper matte smelting reverberatory furnaces at Anaconda, Mont.; an advance in copper-smelting practice that will result in tremendous savings to all smelting companies that can apply the process.

About 10 years ago, S. Severin Sörensen, then in charge of the Highland Boy works, at Murray, Utah, made several runs with a small reverberatory matting furnace, using coal dust as fuel, and claimed successful operation. For some reason not given, the experiments were abandoned. At this time the matter was considered by the management of the Washoe works, Anaconda, Mont., and an expert was sent to investigate the use of pulverized fuel in the cement industry. The report was not favorable to the introduction of the process in reverberatory matte-smelting, so it was dropped.



Sketch Plan and Sectional Elevations of the Proposed No. 5 Reverberatory at Anaconda

The late Charles F. Shelby, a few years afterward introduced pulverized fuel in reverberatories at Cananea; it ran fairly well, but was abandoned in favor of fuel oil, which then came on the local market. Copper smelters considered the question settled and ceased further experimentation, taking for granted that coal-dust firing was not economical in copper-matte smelting, for three reasons: namely, the amount of dust from ashes accumulating in flues and downtakes; the addition to the charge of the siliceous ash, in pulverized form; and the blanketing of the charge by unburnt coke from the pulverizers.

David H. Browne, of the Canadian Copper Co., studied the question a few years ago and came to the conclusion that coal-dust-fired reverberatories would meet his requirements at Copper Cliff, Ont. He had, at that time, basic ore to smelt, and he believed that the addition of the siliceous ash from the pulverized coal would be beneficial, rather than otherwise. He investigated the modern application of coal-dust firing in the cement and steel industries; and then, fully convinced that he was right, built a reverberatory furnace at Copper Cliff, to use coal dust as fuel. His investigations of the subject proved to his satisfaction that the drying of the coal, previous to pulverization, and the fine pulverization of the coal, were essential to success.

The apparatus selected by Mr. Browne was a Ruggles-Coles drier and a Raymond pulverizer, Sturtevant fans, a centrifugal separator and screw-conveying machinery for the pulverized product.

The reverberatory roof was raised to nearly 8 ft. above the bottom at firing end. The charge was dropped through holes in the roof along the sides, being conveyed from the hoppers on tramcars, running on tracks over the furnace roof. It was found that the best way to feed the charge was to pile it up to the roof, along both sides, very little being dropped from the old central hoppers.

Mr. Browne's furnace was a success from the start and soon attracted the attention of Western copper smelters, who sent their experts to study the problem at Copper Cliff, Mr. Browne most kindly giving them every facility for so doing, and furnishing them with figures showing the results of his operations.

Early in 1914, both the Garfield plant of the American Smelters Securities Co. and the Washoe Reduction Works of the Anaconda Copper Mining Co. equipped a reverberatory furnace with apparatus similar to that at Copper Cliff, for a trial of the process on Western ores

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The Garfield furnace was not remodeled and the charging arrangements were as theretofore; but the Washoe furnace was rebuilt entirely and hoppers were provided along both sides; also down the middle and across the firing end.

The Garfield furnace, according to W. D. Leonard, superintendent, has smelted approximately 400 tons of ore daily on the average, using 14.5% coal. The slag has averaged 42% SiO_2, 38% FeO and 13% CaO. Analysis of the coal used at Garfield is 7% moisture, 6% ash, 46% volatile combustible matter and 48% fixed carbon. Dry, it is of 13,500 B.t.u. in calorific value. The result reported with coal-dust firing is compared with

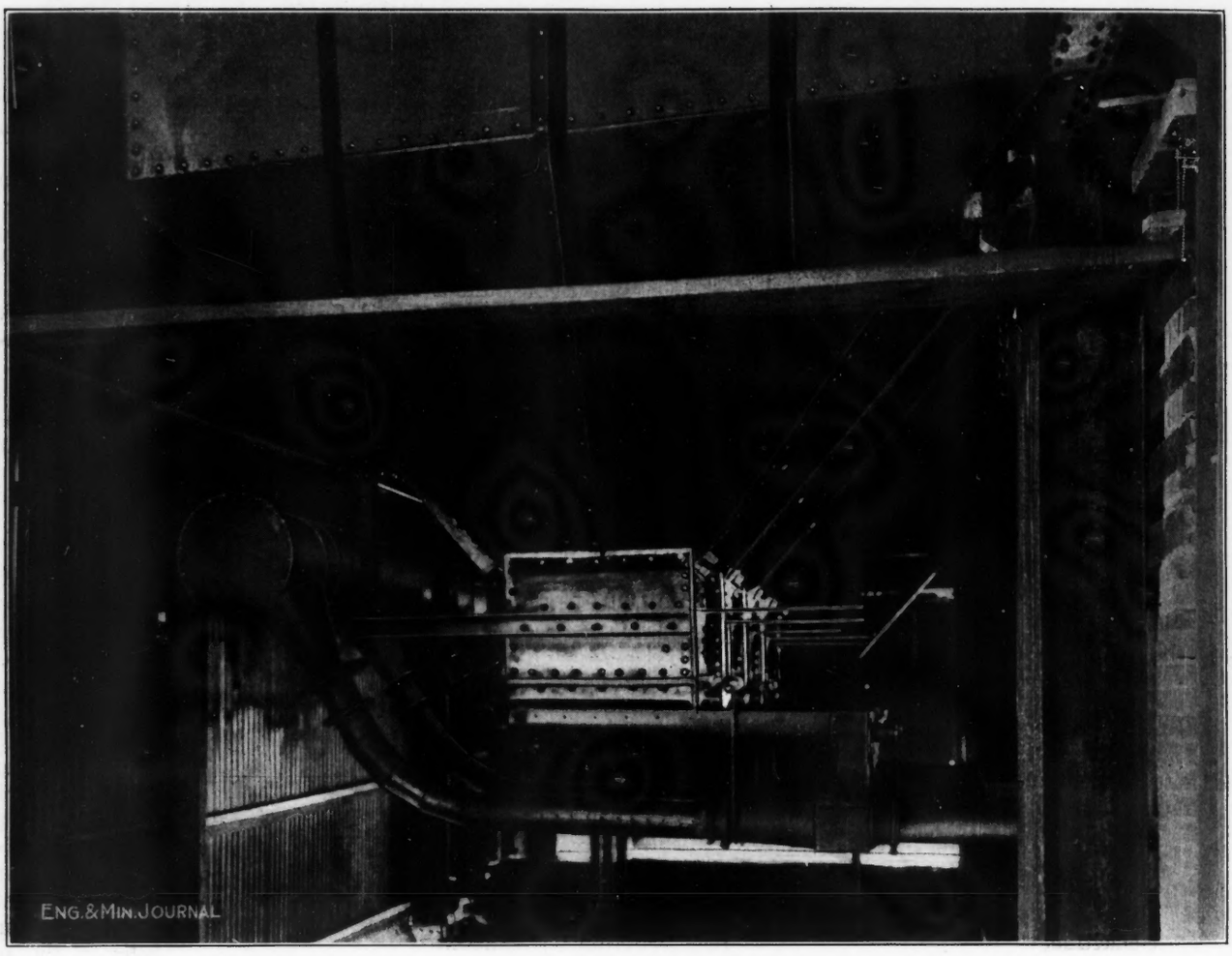
SMELTING RESULTS

	Duration of Test Days	Tons Smelted per Day	Fuel Ratio	Content of Slag % SiO_2	% FeO	% CaO	% Cu	Matte % Cu.	Analysis of Ash from Flue % SiO_2	% FeO	% CaO	% Cu
Lochray	12	409.4	5.38	37.8	42.1	5.0	0.41	39.5	39.8	13.4	5.6	1.7
Bear Crk.	18	406.7	5.57	38.8	40.8	4.7	0.42	38.9	38.5	11.5	7.2	1.8
Diamond.	30	475.8	7.24	38.1	40.8	5.2	0.42	39.8	36.5	10.3	7.0	3.1

SCREEN ANALYSIS OF PULVERIZED COAL TO NO. 8 REVERBERATORY

	% Plus 100	% Minus 100	% Plus 200	% Minus 200
Lochray	2.3	97.7	12.1	85.6
Bear Creek	4.4	95.6	21.8	73.8
Diamond	6.1	93.9	18.5	74.4

Under the new method of charging, the furnace has no appreciable bath of molten matte; the Anaconda furnace holding only about 40 tons, as compared with 150



FIRING END OF NO. 8 REVERBERATORY FURNACE AT ANACONDA, MONT.

oil-fired furnaces averaging 365 tons daily, with a fuel-oil consumption of 0.63 bbl. per ton of charge.

At Anaconda, the results for the entire month of September, 1914, were 475 tons of ore smelted daily, with coal consumption of 13.8%, including that used in the drier, against 260 tons and a coal consumption of 24.1% in the natural-draft coal-fired furnaces.

Tests have been run, using Lochray coal, Bear Creek coal and Diamondville coal. Analyses of these coals and the smelting results are given in the accompanying tables:

ANALYSES OF COALS

	Moisture %	V. C. M. %	F. C. %	Ash %	B.t.u. (Dry)
Lochray	8.0	29.3	41.8	20.9	10,350
Bear Creek	9.0	35.5	43.4	12.7	11,500
Diamond	5.6	41.4	44.9	8.1	12,960

tons and over in the old furnaces. The matte is tapped at the front of the furnace instead of at the side, because the matte is held in the front of the furnace by a dam of charge across the bottom; and also because more smelting surface of charge is exposed to heat. It should be noted also, that the charge protects the sidewalls so that no fettling is required.

NEW 144-FT. FURNACE TO BE BUILT AT ANACONDA

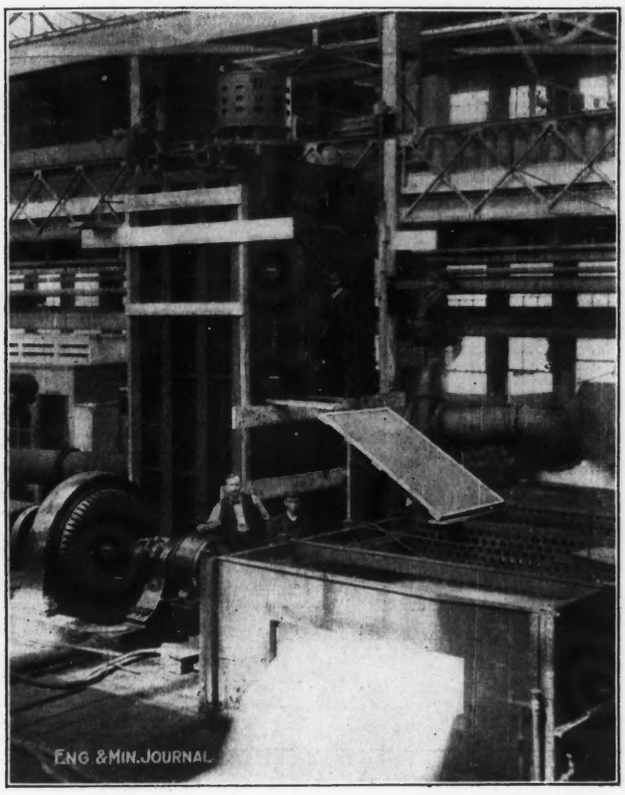
The results at Garfield and Anaconda are so satisfactory that both companies have arranged to fit all their reverberatory furnaces for coal-dust firing without further delay. The Anaconda Copper Mining Co. is designing a longer furnace, with hearth 144 ft. by 25 ft.

inside measurements. It expects to smelt in this furnace 800 tons daily, with a fuel consumption of 13.33%, or better.

Western smelters are agreed that the work of David H. Browne, in reintroducting coal-dust firing, in reverberatory copper-matte smelting, will result in tremendous savings to all smelting companies that can apply the process.

Pumping Machinery for Leaching at Chuquicamata*

The Chile Exploration Co., at Chuquicamata, has installed a novel pumping equipment to handle the acid solution in this plant, in which it is planned for the electrolytic refinery to handle 340,000 lb. of copper per day.

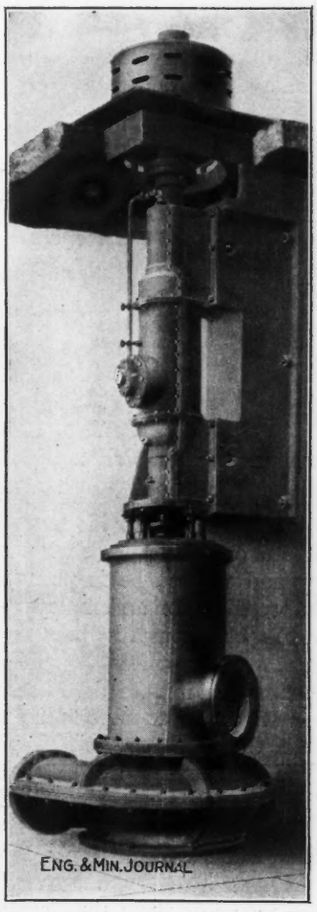


9-In. Acid-Solution Pump

The ore is handled by steam shovels and transported about 2½ miles to the mill. At the plant, the ore is crushed and put through rolls until product is about 4-mesh. From the crushing plant the ore is carried by belts to the leaching vats. The size of each vat, of which there are six, is 110x160x16 ft. high. The leached and washed residue is handled by buckets and finally disposed of by belts to the dumps.

The tanks are of reinforced concrete and lined with mastic asphalt. The main solution is pumped through 9-in. and 16-in. lead-lined pipes and from the bottom of the leaching tanks the solution will be removed through 6-in. lead-lined pipes. The pumping plants consist of 13 H. R. Worthington vertical centrifugal boot-type pumps: three 15-in.; six 9-in.; and four 6-in. pumps. Each 15-in. pump will handle 5500 gal. per min. against a total head of 52 ft., and is fitted with a 200-hp. synchronous motor.

Each 9-in. pump will handle 1200 gal. per min. against a total head of 60 ft. and is fitted with a 50-hp. synchronous motor. Each 6-in. pump will handle 250 gal. per min. and is fitted with a 15-hp. synchronous motor.



Details of 9-In. Pump

These pumps are of special interest, owing to their novel design, in that they contain no stuffing-boxes. All parts of the pumps are lined with antimonial lead. The type is a single-suction vertical acid-pump, fitted with self-adjusting oil-pressure thrust bearings. The pressure of the oil for balancing and lubricating is maintained by special oil pumps, driven by bevel gears from the main shaft. The entire thrust arrangement and alignment are adjustable, as well as is the position of the impellers, from the outside. Before shipment, each pump was run by its own motor for 48 consecutive hours in order to develop any weakness or defects in motors and pumps.

The general cycle of operations, as now planned, is given in the Journal of Apr. 25, 1914, page 865.

*From data furnished by the manufacturers.

Metal-Mining Accidents in the United States

"It is gratifying to note that the fatality rate in the metal mines of the United States was lower in 1913 than in 1912," says Albert H. Fay, engineer of the Bureau of Mines, in a technical paper just issued. The total number killed in the metal mines in 1913 was slightly greater than in 1912, but the number of men employed during 1913 was 193,088, as compared with 169,199 for 1912. The fatality rate was therefore 3.54 per 1000 men employed as against 3.91 per 1000 for the year 1912 and 4.19 for 1911.

The important mining states showing a continuous reduction of fatality rates during 1911, 1912 and 1913 are Idaho, Michigan, Montana, Nevada, New Jersey, South Dakota and Utah, representing in 1913, 38% of the mining industry. Of the states showing a decreased fatality rate during 1913, as compared with 1912 only, may be mentioned Alaska, Alabama, Colorado, New York, Oklahoma, Tennessee, Wisconsin and Wyoming.

"This gradual reduction is to be accounted for largely by the introduction of safety appliances, better supervi-

sion and a more strict enforcement of rules and regulations of the mining companies, and a closer observance of the state laws. Practically all of the larger companies and many of the smaller ones, have done much in safeguarding their employees. By first-aid treatment many slight injuries have been cared for, pain relieved, and a cure effected in a short time, so that many of these injuries have been of short duration and kept out of the 'serious injury' or 'fatality' class."

The number of men employed and the number of men killed in and about the metal mines in the United States during 1911, 1912 and 1913 is shown in the accompanying table.

	Metal Mines		
	Number	Number Killed	Per 1000
Year	Employed	Total	Employed
1911	165,979	695	4.19
1912	169,199	661	3.91
1913	193,088	683	3.54
Average for three years	176,089	680	3.86

Fatal Cave in Prospect Shaft

SPECIAL CORRESPONDENCE

The carelessness of the prospector in his mining operations is a matter of common knowledge. In his haste to accomplish a maximum amount of telling work with the least expenditure of energy and money, he is prone to take chances which, were he working for an employer or a company, would lose him his job, though he be a most competent and skillful miner.

An example of this carelessness and its attendant hazard was had recently near Butte. As described in the mining-news columns of the JOURNAL, Oct. 3, three men, Martin, Rodda and Bailey, were killed by a caving prospect shaft at Maiden Rock. They were all skillful miners and the accident was the direct result of practices of which they would never have been guilty when working for a large company.

The manner in which the men lost their lives cannot be known positively, there having been no eye-witnesses. The prospect at which the accident occurred is situated on a steep hillside. A short distance from the mouth a previous landslide had choked up the tunnel leading to an incline sunk on the vein. This necessitated the sinking of a vertical shaft 25 ft. to meet the incline. The men were working at the bottom of the incline; they had failed to timber it properly or to protect the collar from the loose rock and dirt left by the old landslide. This was apparently loosened by the jar of the drilling and blasting, so that it fell on the men without warning.

The rescuers were six Butte boys who were camping near the prospect, and during their stay cooked for the prospectors. On the day of the accident, the latter failed to return to camp at the usual time for the evening meal. The boys went to the prospect, about a mile and a half from their camp, and saw at once that a cave-in had taken place and had buried the miners. Using a windlass and a bucket, they began the rescue work, and after laboring nearly all night recovered the bodies. When found, Martin held a hammer in his hand. He had evidently been drilling when the fall of ground occurred. Rodda had on a glove and apparently was turning the drill. Bailey was found close by in an upright position, caught against the hanging wall.

Rodda, the owner of the prospect, was a familiar figure on the streets of Butte, and was known as the blind miner. He had lost his sight 24 years ago by a premature blast in a limestone quarry, near the prospect where he later lost his life. In spite of this misfortune, he had kept on mining. Bailey was connected with the Clark properties for 12 years and was at one time foreman of the Original mine in Butte. Martin had been mining all his life and had worked in the Butte mines four years.

United States Gold and Silver Production

The Director of the Mint, in connection with the Geological Survey, has completed the revision of the statement of gold and silver production in the United States in 1913. As compared with the preliminary statement issued early in January last, the revised figures are larger by $583,377 in gold, and less by 799,611 oz. silver, the differences in both cases being smaller than might be expected in an early estimate. The figures by states are given in the following table, comparisons being made with the corrected figures for 1912:

U. S. GOLD AND SILVER PRODUCTION

	Gold (Value)		Silver (Fine Oz.)	
State:	1912	1913	1912	1913
Alabama	16,400	9,200	200	100
Alaska	17,198,600	15,201,300	539,700	366,700
Arizona	3,785,400	4,101,400	3,445,500	3,912,000
California	20,008,000	20,241,300	1,384,800	1,421,500
Colorado	18,741,200	18,109,700	7,933,100	8,989,700
Georgia	10,900	13,300	200	100
Idaho	1,401,700	1,244,300	7,862,900	9,477,100
Illinois	.....	.....	1,800	2,300
Maryland	1,200	700	700	.....
Michigan	.....	.....	543,500	333,700
Missouri	.....	.....	30,000	38,900
Montana	3,707,900	3,320,900	12,524,000	12,540,300
Nevada	13,575,700	11,977,400	13,851,400	15,657,400
New Mexico	754,600	892,000	1,460,800	1,666,900
North Carolina	156,000	115,200	2,300	1,700
Oklahoma	.....	.....	.....	800
Oregon	759,700	1,477,900	54,000	172,200
South Carolina	15,400	4,100	.....	.....
South Dakota	7,823,700	7,214,200	205,800	172,600
Tennessee	11,500	7,700	112,000	109,000
Texas	2,200	200	379,800	429,800
Utah	4,312,600	3,570,300	13,076,700	11,282,300
Virginia	300	200	700	200
Washington	682,600	657,500	350,800	218,700
Wyoming	24,300	17,500	300	1,200
Continental U. S.	$92,989,900	$88,176,100	$63,761,000	$66,796,200
Philippines	461,600	707,200	5,800	5,300
Porto Rico	.....	1,100	.....	.....
Total	$93,451,500	$88,884,400	$63,766,800	$66,801,500

The total decrease from 1912 in gold won was $4,567,100, or 4.9%. California and Colorado, both with small changes from 1912, remained first and second among the gold producers. Alaska's gold output decreased nearly $2,000,000, but it still held the third place. Nevada was fourth in rank, South Dakota fifth, Arizona sixth, Utah seventh and Montana eighth. The losses, as compared with 1912, were distributed over a number of states, those of Alaska—$1,997,300—and Nevada—$1,598,300—being the largest. The only large proportional gain was in Oregon, which nearly doubled its production last year.

The production of silver in 1913 shows an increase over 1912 of 3,034,700 oz., or 4.8%. Nevada remains the largest silver producer, Montana being second, Utah third, Idaho fourth, Colorado fifth and Arizona sixth. Nevada showed a larger increase than any other state, and Utah reports the greatest decrease of the year.

As is well known, silver is produced in combination with other metals for the most part, lead, copper and gold being the chief argentiferous ores. Thus the large production of copper in 1913 was doubtless chiefly responsible for the increase in silver.

The Uwarra Mill, Candor, N. C.

By Percy E. Barbour*

The Uwarra Mining Co. owns and is operating a gold mine about 2½ miles from Candor, Montgomery County, N. C., and has just completed and put in operation a modern fine-grinding and cyaniding plant of 50 tons capacity, which has several interesting points of divergence from general practice. Not the least interesting feature of this property is its location in an agricultural, cotton and peach-raising country. The points of technical difference are considered by the company to be strides forward in the practice of the treatment of gold ores; the extraction now obtained, which varies from 94 to 97%, is mentioned here to anticipate any hasty criticism of the details to be given.

Ore Occurrence

The ore occurs in fissure veins in a hard greenish-black diabase, which latter has been much broken by jointing and along the zone of fissuring has attained a slaty cleavage so distinct as to give the name of slate to the country rock as a whole, which, however, is properly diabase.[1] There are two veins on the property, which in places are 6 ft. wide, but which will average about 2 ft., and one of these has ore of commercial value developed by underground works for over 800 ft. on the strike. The ore is a hard quartz, pearly gray in one vein and streaked with red in another, but in both cases hard and tough. The walls are in places well defined, but in others they are frozen to the vein and, either way, much slate is unavoidably broken down while stoping, so that hand sorting has to be resorted to both underground and on top. Of the rock as broken underground, 10% is sorted out by the muckers and sent up as waste. Later on this will be left in the old stopes, but conditions prevent it at present.

The mine cars leave the cage at the landing station, about 8 ft. above the collar of the shaft, and are trammed across a trestle 117 ft. long to the crusher bin and are there dumped on to a flat grizzly with bars set 1½ in. apart. There are four ore pickers here who pick out 16 to 20% more of the coarse slate, which goes into the waste pocket of this crusher bin. This bin was the stamp-mill bin in the former company's old Montgomery mill, and because of its perfect condition was removed and utilized in the new plant, though not exactly what would have been provided if a new one had been built; however, it serves the purpose very well.

Handling the Ore

The ore is drawn from this bin through a standard 24x24-in. single rack-and-pinion steel-plate gate and passes over an inclined grizzly with 1-in. opening to the crusher. The material through the grizzly drops directly to the loading hopper of the conveyor, to which also comes the product from the crusher, which is of the standard Blake type, size 15x9 in., set for 1¾-in. product. The jaw plates are of chrome steel.

This crusher is separately driven by a 7x10-in. Chandler & Taylor medium-speed throttling engine, horizontal type, and the engine and crusher are housed together in a crusher building separate from the mill but connected with it by the conveyor structure.

General View of Uwarra Property

Completed Frame of Mill

From the crusher and last grizzly, all ore is carried by a 14-in. wide trough belt conveyor, 88-ft. centers, traveling on an incline of 20° and at a speed of 250 ft. per min. This conveyor has a capacity much in excess of present needs, but was provided for future expected increase in tonnage from the mine. The belt is a four-ply S. A. special conveyor belt with ⅛-in. rubber cover on the carrying side.

This conveyor is driven from the main mill shafting and discharges the ore into a cylindrical steel ore bin, 12 ft. in diameter by 20 ft. high, which is the only ore bin of this type in the East. This bin is without top or bottom, but is reinforced around both top and bottom with angle irons. The bin is supported on a concrete foundation, which was made duodecagonal in shape, instead of circular, to save the cost of circular concrete forms, and with walls 12 in. thick and 6 ft. 6 in. high. It was intended to reinforce this wall with expanded metal, but a long delay in its arrival made a substitute necessary and heavy hog-wire fencing, secured from a local hardware store, was used in its stead with entire satisfaction. Inside of this duodecagonal foundation was filled with loose rock from the dump and a 2-in. layer of cement grout on top made the bottom of the bin. This bin is just outside of the main mill structure. The ore from this

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[1]Private communication from Joseph Hyde Pratt, State Geologist, Chapel Hill, N. C.

bin is drawn through a standard 18x24-in. rack-and-pinion gate and fed by a 16x6-in. plunger feeder with adjustable eccentrics to the crushing rolls.

Crushing Methods

We think this is the first modern all-sliming cyanide plant to use rolls exclusively for wet crushing between the rock breaker and tube mill. A great deal of study, of course, was given to the selection of these crushing units. I have long been of the opinion that the stamp was out of place for this particular kind of stage crushing, for various reasons. To H. W. Dennison, of the Allis-Chalmers Manufacturing Co., who collaborated with me in the design of this plant, belongs no little of the credit in the choice of these rolls. However, the adjoining mine, the Iola, owned by the Candor Mines Co., has been operating a mill[2] using 1750-lb. stamps, the heaviest in this country. The use of heavy stamps in our mill would have been objectionable also because our only mill site was on the hanging wall of our vein, not far from the shaft; this was one more argument in favor of a rotary crusher. Various types were considered, but rolls were finally adopted, and while at this writing the mill has been in operation but 90 days, our judgment in the installation of rolls seems to have been fully justified.

Two sets of 24x10-in. Allis-Chalmers, style B rolls were installed and operate under real wet-crushing conditions, five tons of solution to one of ore going through the rolls. The roll shells are of low-carbon steel. These rolls are not provided with automatic fleeting devices[3], which were carefully considered but finally omitted.

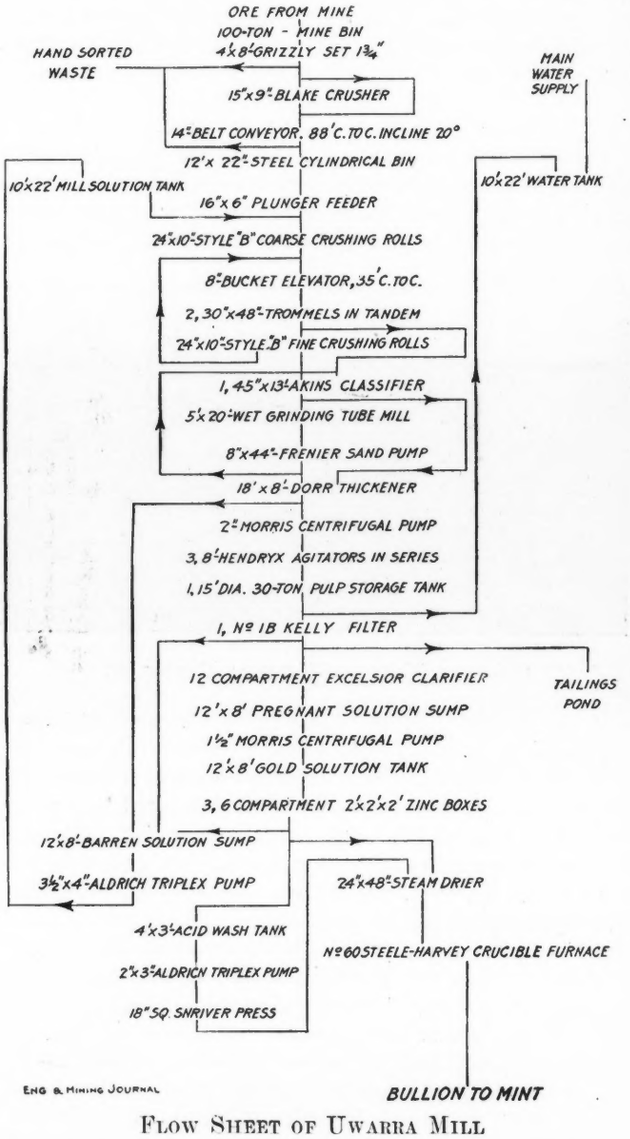
Our first set of coarse rolls getting the product from the Blake crusher set at 1¾ in. naturally gets a very variably sized feed; the slate and slaty ore break into pieces, some of which may be 3 or 4 in. long and 2 or 3 in. wide, although only 1¾ in. thick. It is severe service to feed such material to rolls. However, some of our rock goes to the rolls thus, and we have little or no trouble from them now that the feeders, both mechanical and mortal, have been properly adjusted.

Quoting from Mr. Holthoff's article, "Without abrasion there can be no corrugating. Abrasion is due to two causes, first, if the material fed is coarser than the rolls can nip without slipping; second, if the roll faces are running differential." Some of our feed, on account of the cleavage of our rock, is probably too coarse from the above standpoint, and we expected corrugations, but at the end of 90 days we have only very slight corrugations on our coarse rolls; but on our fine rolls, where the feed is more uniform and none is too coarse, our roll shells are as smooth and straight as can be desired. In this connection it must also be considered that our labor supply is drawn from local circles and we are operating with men who never saw a set of rolls before. Considering this and the tough and abrasive character of our quartz ore, we consider this a satisfactory result and we expect to take these corrugations out by hand adjusting and by regulation of the feed without the necessity of machining the shell. We cannot tell yet what the steel consumption will average per ton of ore, but present indications are that it will be satisfactorily low.

Screening and Classifying

The product from both sets of rolls is elevated by an 8-in. bucket, vertical-belt elevator, 35-ft. centers, which discharges it into a set of two 30 in. diameter by 48 in. long standard trommels set in tandem; the first screen of $\frac{3}{16}$ metal has ½-in. round punched holes and the second of No. 10 steel is perforated with $\frac{3}{16}$ round holes.[4]

All oversize is returned by launder to the coarse rolls. All the screen product goes to the fine rolls and the fine



Flow Sheet of Uwarra Mill

material through the last screen goes to an Akins classifier 45 in. diameter by 13 ft. long. The choice of this classifier was influenced largely by the fact that it had so few bearings to care for, oil and maintain, compared to some others, and as for results accomplished, it has seemed to us that honors were pretty evenly divided. This classifier is giving satisfactory results as to classi-

[2]Iola cyanide mill, by Percy E. Barbour, "Engineering and Mining Journal," Sept. 14, 1912.

[3]Mr. Holthoff, in "Engineering and Mining Journal," Vol. XCV, p. 1302, 1913, argues strongly against any fleeting device. Mr. J. Parke Channing, in "Bull. 31" of the Mining and Metallurgical Society, states that the Miami has finally developed a fleeting device which fleets the roll once in 30 min., and by this slow movement entirely eliminates all the previous troubles had with various devices of this kind.

[4]This screen will be changed for one of woven wire, ¼-in. mesh, in order to get a coarser feed for and put more work on the tube mill.

fication and is giving a tube-mill feed so dry that it is necessary to add solution.

The coarse sands from the classifier discharge directly into the feed box of the tube mill, which is of the gear-driven trunnion type, equipped with spiral feeder and reversed screw discharge. It is lined with Montana Tonopah iron bibbed lining. Danish flint pebbles are used.

The tube-mill product is raised to the Akins classifier by an 8x44-in. standard Frenier pump, thus forming the usual closed circuit at this point in the flow sheet.

The overflow from the classifier goes to a Dorr thickener with steel tank 18 ft. diameter by 8 ft. deep, the overflow solution from which goes to a sump tank 12 ft. diameter by 8 ft. deep on the lowest bench of the mill, and is pumped back to the solution-storage tank 10 ft. diameter by 22 ft. deep, located on the roll bench inside the mill building. For this service a 3½x4-in. Aldrich triplex pump, belt-driven, is used.

The thickened pulp from the Dorr is handled to the agitators by a 2-in. Morris centrifugal pump. We are considering the replacement of this pump by a Frenier because the abrasiveness of this ore is so great as to cause excessive wear on the rapidly revolving centrifugal and the latter cannot be operated satisfactorily on this small tonnage to give continuous flow to the agitators, which is necessary for continuous agitation.

THE AGITATING TANKS

BACK OF THE MILL, SHOWING INCLINE

THE AGITATORS

There are three Hendryx 8-ft. diameter steel-shell agitators, arranged for continuous agitation. This type of agitator was selected after an exhaustive series of tests in small agitators of the Hendryx type. A mechanical agitator was preferred to any other because it was desirable to eliminate the use of compressed air, first on account of certain local conditions and second on account of the cost of compressed air, not only considered *per se*, but also considered as to its compression in a steam-driven straight-line machine versus agitation by mechanical power from the Corliss engine of the mill. These tests, which I hope to publish later, demonstrate the efficacy of this type of agitator for these ores and the actual operation thus far bears out the result of the tests very closely. The agitation period is about eight hours to obtain the extraction as given, varying from 94 to 97%. These agitators have steam coils inside the tank and the pulp is kept heated to about 90°, since our tests showed that this degree of heat was a decided advantage in accelerating extraction. The steam main from the boiler plant to the mill engine is a long one, and is carried in an insulated buried box on a considerable incline. The heating pipe for the agitators is taken off from this steam line in the engine room in such a way as to trap all the water of condensation in the line and we thus save much heat which would otherwise be lost. The power consumption of these three agitators, as shown by indicator cards, is 10.9 hp., which is certainly satisfactorily low.

THE FILTERS

Owing to the fact that the filter works only during the day shift, a pulp-storage tank between it and the agitators is necessary to hold the accumulation of the night-shift mill run. This pulp-storage tank is 17 ft. in diameter by 10 ft. high, with a conical bottom 9 ft. 6 in. high from the inverted apex of which the pulp is drawn to the filter. This pulp-storage tank is provided with an overflow launder and a decantation device, which not only allows for sending a thick pulp to the filter, but also allows the removal immediately of a large amount of the pregnant solution without sending it through the filter.

The filter is a No. 1, type B, Kelly press, and it handles in one 12-hour shift the 50 tons of dry slime ground per day. The operation of this filter and the results have been quite unusual. The solution is expelled from the cake until it contains only 8% moisture and the cake is then discharged as tailings without any washing whatever. The tailings as discharged, including both dissolved and unextracted values, often run as low as 20c. and for the current month will average about 36c. per ton of ore.

The pregnant solution from the filter goes to a 12-ft. diameter by 8-ft. gold sump tank and is then pumped by a 1½-in. Morris centrifugal pump through an 18-in. square-frame Shriver filter press for classifying, from which it goes into a 12-ft. diameter by 8-ft. gold tank, from which it flows by gravity to three 6-compartment zinc boxes, each compartment of which is 24x24x24 in., filled with zinc shavings, which are cut in the mill.

The barren solution flows to the 12x18-ft. sump tank previously mentioned. The precipitate is handled in a 4-ft. diameter by 3-ft. deep clean-up tank, served by a 2x3-in. Aldrich triplex pump and the precipitate is then dried in a steel-plate dry pan 24 in. wide by 40 in. long, heated by steam, and is finally smelted to bullion in a No. 60 Steele-Harvey tilting furnace fired by kerosene.

Every tank in the mill is of steel plate and besides those enumerated there is a water tank on the roll bench 10 ft. diameter by 22 ft. high, a duplicate of the solution tank. The only use for water in the mill is for flushing the cake from the hopper of the filter to the tailing dump down the branch.

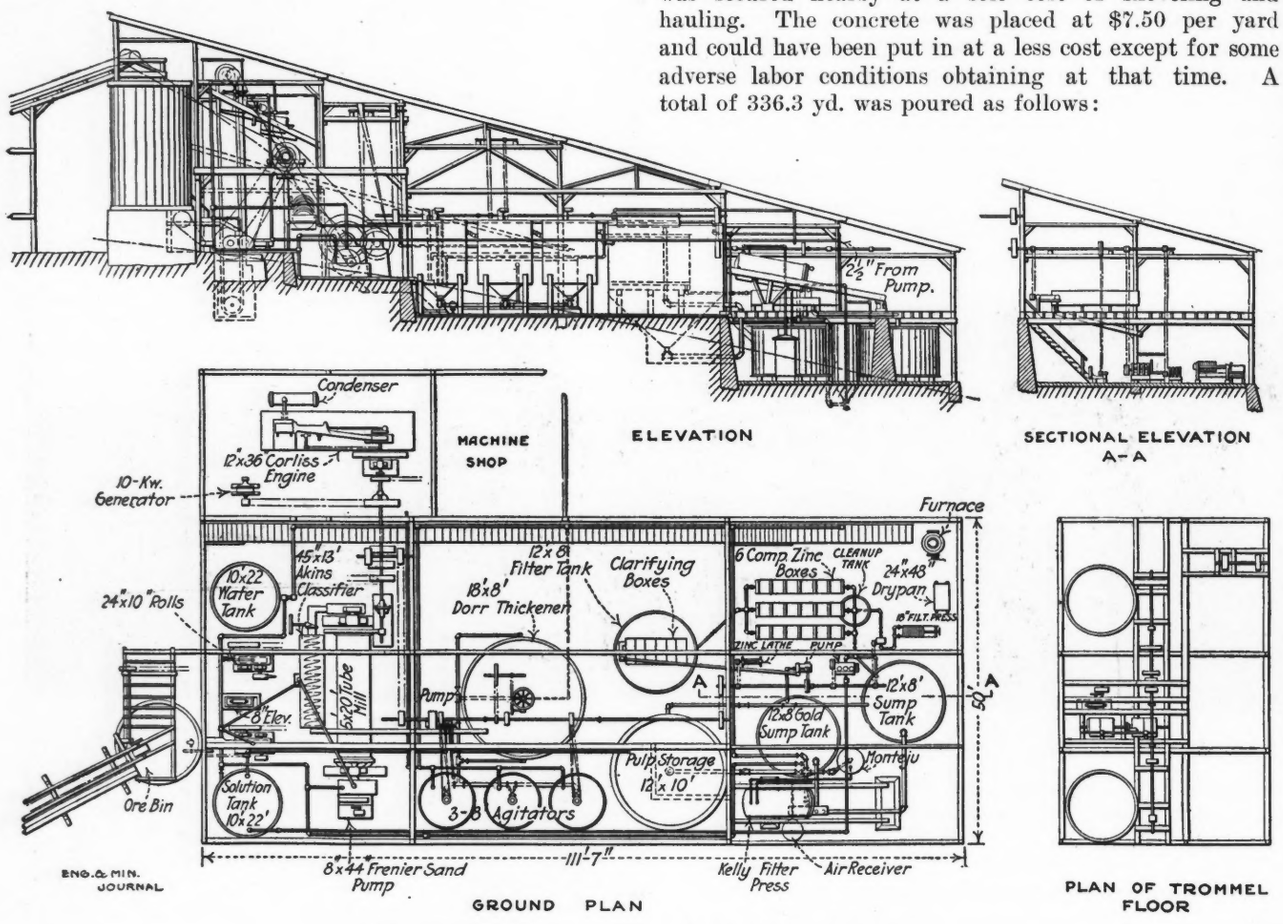
The circulating solution in the mill is 1.2 lb. KCN and the alkalinity about 2 lb. CaO per ton. No lead salts are used.

The mill is driven by its own engine of the Reliance-Corliss type, 12x36-in. stroke, running 150 r.p.m. with steam at 100 lb. at the throttle. A Wheeler 300-sq.ft. surface condenser, with combined air and circulating pump under a grating in the engine-room floor, gives 25 to 27 in. vacuum and the engine with maximum mill load indicated 93.7 hp. The flywheel of this engine is 10 ft. in diameter, has a square cross-section and weighs 7500 lb. In the engine room and driven from the main shaft by a friction-clutch cutoff pulley is a 10-kw., 120-volt, direct-current generator, running at 1150 r.p.m., which furnishes lights for the entire job—mill, surface, houses and underground stations. A model switchboard of black slate, 32x54 in., is furnished with a voltmeter and ammeter, ground detectors, rheostat, main switch and eight current switches.

Details of Construction

The framing of the mill is of oak, not because oak had any special advantage, rather the other way, but because it was the only timber available. This was secured at prices ranging from $12 to $15 per thousand feet at the mills, and the hauling thence to the plant cost from $3 to $5, depending upon the mill from which it was hauled, the weather conditions, etc. The roofing was No. 24 gage galvanized corrugated and the siding was No. 26, and averaged in cost $3.70 per square. This light-weight corrugated is plenty heavy enough for the favorable climatic conditions here.

All retaining walls and machinery foundations and mill floors were of concrete, mixed in the proportion of one of cement, three of sand and six of rock. Cement costs $2 per bbl., f.o.b. Candor. The rock was taken from the mine-waste dump and the sand was secured nearby at a sole cost of shoveling and hauling. The concrete was placed at $7.50 per yard and could have been put in at a less cost except for some adverse labor conditions obtaining at that time. A total of 336.3 yd. was poured as follows:



Arrangement of Uwarra Mill, Candor, N. C.

	Cu.Yd.
Building and retaining walls	126.3
Steel ore bin foundation	11.0
Column pedestals	4.1
Tube mill foundation	13.6
Corliss engine foundation	35.5
Outboard bearing foundation	10.8
Condenser pit walls and floor	9.5
Condenser pier	0.6
Rolls foundation	8.9
Elevator pit walls and floor	7.7
Surface bottom of mill bin	0.2
Crusher foundation	5.1
Conveyor pit, walls and floor	13.6
Crusher engine foundation	2.6
Line shaft pedestals	5.2
Generator foundation	1.2
Wheel pit mould	0.3
Crusher outboard bearing	0.7
Pedestals for storage tank	2.5
Agitator pedestals	7.3
Buckstay footings for new boilers	0.3
Kelly filter foundation	8.1
Thickener pedestals	4.3
Pump foundations	2.5
All floors, 4 in. thick	56.5

Cost of Mill

The total estimated cost of the mill was $45,000, and the mill was built complete for $42,796.48, distributed as follows:

SUMMARY OF COST OF MILL

Concrete walls and foundation	$1962.12
Engineering	2658.85
New boiler house addition	135.33
Foundation bolts and sundries	67.34
Boiler settings	637.92
Mill lumber and timber	1237.07
Mill construction, sundry materials	1627.86
Mill pipe line	1067.51
Mill general expense	875.01
Mill labor	7788.62
Mill excavation supplies	3.30
Freight on machinery	1916.73
Machinery erection, superintendency	340.48
Mill wiring	4.09
	$20,322.23
Machinery contract	22,893.00
Machinery sundries on open account	657.82
	$43,873.05
Credit masons included in both items "Boiler setting" and "Labor"	$144.90
Compressor foundation at $7.50 per yard	76.00
Compressor excavation	4.90
Compressor hauling	26.65
Compressor installing	71.54
	$323.99
	$43,549.06
Total credit from machinery contractor a/c extras	752.58
Final total cost of mill	$42,796.48

The distribution of the labor item in the above summary is given below:

Removing bin at old mill	$ 52.21
Building temporary stable	12.27
Moving dwellings from mill site	37.96
Building garage	20.25
Taking down part of old mill	53.16
Grading millsite	511.02
Grading boiler house site	44.21
Grading crusher house site	22.56
Foundations	974.13
Framing and erecting crusher bin	87.07
Framing and erecting crusher and conveyor plant	327.33
Framing and erecting main mill	1116.68
Hauling lumber	290.32
Hauling corrugated, castings, pebbles, pipe, windows, etc	31.20
Hauling brick for boiler setting	79.27
Hauling fire clay, sand, and lime for boiler setting	51.30
Hauling fixtures and stacks	24.58
Moving small boiler and stack	25.12
Hauling boilers, including unloading and placing	77.50
Connecting and raising stacks	28.47
Laying brick work of boiler settings	222.39
Connecting boilers	4.70
Building boiler house extension	65.02
Hauling mill machinery	298.58
Hauling new compressor	26.65
Installing compressor	71.54
Excavations for compressor	4.90
Repairing and raising dam at cooling pond	49.81
Building launder from condenser discharge to cooling pond, 500 ft	152.33
Building ore trestle, shaft to crusher bin	102.93
Installing mill machinery	727.04
Erecting steel ore bin	32.14
Erecting agitators	101.68
Erecting mill tanks	808.23
Installing pond pump and supply tank	172.11
Main steam line	196.12
Mill piping	121.73
Wiring	9.49
General surface labor and teaming throughout period	612.03
Labor for contractors' account	142.59
Total	$7,788.62

Labor conditions were very unfavorable. In the first place the labor was inexperienced on construction and secondly it was composed more or less of farm hands. Laborers received $1.50 for 10 hours; carpenters, $2 to $3; mechanics, $2 to $2.50. All tank erection and riveting was done by men instructed here, who had never done any of this work before.

On a basis of a 300-day year and 50 tons per day, the mill cost $2.85 per ton of annual capacity.

Victoria Mineral Output 1913

The mineral output of Victoria for 1913, according to the report of the Secretary for Mines, was £2,171,477, of which £1,847,475 was due to 434,932 oz. of gold. Other items, in descending order of value, were: Coal, 593,912 long tons; antimony ore, 6151; tin ore, 57; copper and copper ore, 36; gypsum, 1676 long tons; silver, 16,671 oz.; all else, £3982.

Utah Ozokerite

Special Correspondence

Deposits of ozokerite or mineral wax near Soldier's Summit and Colton in Wasatch and Utah Counties may be worked, on account of advancing prices. The deposits have been opened in a limited way but not commercially exploited as yet. They are practically the only ones available outside of those in Galicia, Austria, from which at present no shipments can be made. Dr. David T. Day and T. Robinson, of the U. S. Geological Survey, have been inspecting the deposits, some of which carry as high as 3% ozokerite. The government is reported anxious to have the deposits opened, and will endeavor to encourage production. The principal properties are the Hobson mine near Tucker, the Soldier's Summit property, the James Peak group near Soldier's Summit, the Utah Ozokerite Co. at Colton, and the P. V. group about two miles from Colton. The district is 14 miles long by three miles wide.

The country rock is sandstone and shale, which trend east and west, and are cut by the ozokerite veins, trending north and south. The veins range in thickness from a few inches up to 12 ft., and consist of fractured zones more or less impregnated with ozokerite. Occasionally there are lenses of pure ozokerite from 1 to 2 ft. thick and 5 or 6 ft. long. Masses of pure material weighing 175 lb. have been obtained. The deposits have been worked only to a depth of 100 to 200 ft. Ozokerite is used in the manufacture of paints, insulation for electrical material, phonograph records, patent leather, and other products. The present price is 40c. per pound. North of Sunnyside in Carbon County there are large deposits of Utah rock asphalt in sandstone, from 400 up to 700 ft. thick. The material carries from 9 to 12% of bitumen, and there is a question whether it also carries ozokerite or other valuable hydro carbons. Material from these deposits has been collected by the U. S. Geological Survey for analyses and tests. Other deposits of hydrocarbons are found in Wasatch, Grand and Uinta Counties.

New Technology-Harvard Joint Professors

In accordance with the agreements for coöperation between the Massachusetts Institute of Technology and Harvard University, 15 of the Harvard professors are to be added to the instructing staff of the Institute this year. The names and departments of those concerned with mining and metallurgy are the following: Henry Lloyd Smyth, A. B., C. E., professor of mining and metallurgy; Edward Dyer Peters, M. D., Gordon McKay professor of metallurgy; Albert Sauveur, S. B., professor of metallurgy and metallography; George Sharpe Raymer, A. B., M. E., assistant professor of mining; Charles Henry White, S. B., A. M., assistant professor of mining and metallurgy; Louis Caryl Graton, S. B., professor of mining geology.

The Production of Natural Asphalt, including also asphaltic sandstone and limestone, in 1913, in the United States, was 92,604 tons.

Men and Machinery of the Comstock --The Barclay and Davey Engines

By G. W. Dickie

SYNOPSIS—The Barclay engine which was to revolutionize pumping in the Comstock was turned over to the Union Iron Works and transformed into a flywheel engine. A single-cylinder flywheel engine which was unable to stand speeding up. The valve gear of the Davey engine gave a constant load at all times and reduced shocks to a minimum. The first compound differential engine used on the Comstock was built by the Risdon Iron Works, and is fully described.

A good deal of speculation as to the final destination of the Barclay pumping engine was indulged in by the engineers of the iron works interested. Finally about the time the engine should arrive it began to be whispered among those who should know that the Barclay engine would be installed at the Virginia mine and that Mr. Fair had bought the engine from Mr. Thompson. Being at Virginia City about this time, I spoke to Mr. Thompson about this rumor and he admitted that, there being no other place offering, he had turned his contract with Barclay over to Mr. Fair at a small profit. "Now we will see," he said, "the superior economy that will result from the use of this type of engine on the Comstock deep mines." We were all very much interested in the final outcome. The engine arrived and was taken to the Union Iron Works whence nothing was heard of it for six months except that they were busy there with something big.

Finally the big thing materialized. Mr. Scott had persuaded Mr. Fair to let him convert it into a flywheel pumping engine. The cylinders were disposed diagonally and worked on a disk of about 14-ft. diameter, keyed to a 22-in. shaft which, by the way, was a spare paddle shaft for the Pacific mail steamer China which Mr. Scott had bought as scrap, the China having been lost; in the middle of this shaft was a flywheel 30 ft. diameter, weighing 100 tons, on the other end of the shaft was a disk 14 ft. diameter, to which the pitman working the pump bob was attached. The arranging of the Barclay cylinders into this design showed great engineering skill on the part of Mr. Scott and his associates for it did not look like a patched job. Fortunately there was not a great deal of water to pump and from five to six revolutions was the regular working speed and this set up no serious stresses in the engine work of the pit work. This ending of the Barclay engine scare was a disappointment to me as I considered this engine well suited to the deep pumping work that was beginning to assume rather serious proportions, especially in the North End mines.

One of the North End mines, the Yellow Jacket, found that the water was beyond the control of their pumping plant and asked proposals for a new plant. I proposed a direct-acting compound condensing Davey differential engine having 30-in. high-pressure cylinder, 60-in. low-pressure cylinder, 120-lb. steam pressure, 10-ft. stroke for the engine, and 8-ft. stroke for the pumps. The pumps were to be a double line balanced as shown on the illustration of the Alta pumping engine taken from my original drawing. My plan, however, was rejected as the cooling pond proposed for the condensing water was considered then impracticable and a plan proposed by Mr. Scott was adopted. This plan showed a single 48-in. cylinder with a stroke of 10 ft. using steam at 120 lb. pressure. The cylinder was set horizontally on a heavy bedplate which carried the slides and the bearings for the flywheel shafts. The pitman extended from the center of the crosshead direct to the pump bob while two side rods, one on each side of the pitman, connected to pins on crank disks on separate shafts projected from each side of the bedplate; the shafts were 20 in. diameter and 10 ft. long with their outer ends carried in pillow blocks supported on solid masonry. The flywheels, of which there were two, running in pits between the bearings, were about 30 ft. diameter and each weighed about 50 tons. This engine ran about six months at 8 strokes per min. and was considered a success. I noticed, however, a suspicious tremble in the rods connected to the crank disks. A slight increase in the quantity of water required that the engine be speeded up to 9½ revolutions and shortly after this change of speed both flywheels burst and a general wreck of the engine was the result. The engine part of this pumping works was rebuilt with a compound condensing engine having differential valve gear and no rotating parts. This experience settled the pumping question in favor of the differential engine, always directly connected to the pit work, the engine compound, and condensing where possible.

During 1875 and 1876, several notable pumping engines were built for the Comstock mines; fortunately, I am able to give one or two illustrations that will show the character of this work. Fig. 1 shows the plan and elevation of a Davey pumping engine designed by me and built in 1875 for the Alta Mining Co. Fig. 2 shows cross-sections of the same engine. This was, I think, the first of the many differential engines built for the mines; it attracted considerable attention among mining men and was the only one built with two lines of pumps, the one line balancing the other. The illustration shows the double right-angle bobs and how they were arranged. This engine was condensing, the air pump being worked by a tail rod from the low-pressure piston. The high-pressure cylinder was 24 in. diameter and the low-pressure 48 in., with a common stroke of 8 ft. The back end of the high-pressure cylinder formed the front end of the low-pressure cylinder as shown in the sections. There were two piston rods to the low-pressure piston which passed through tubes cast on the sides of the high-pressure cylinder as shown in the sections. The two low-pressure rods and that of the high-pressure piston between them were all fixed to one crosshead to which was attached the connecting-rod or pitman for working the pump bobs. The cylinders were bolted down upon a massive bedplate 6 ft. wide and 32 ft. long, the front end of which formed the guides for the crosshead.

The chief peculiarity of the Davey pumping engine was the simple manner in which the engine was made

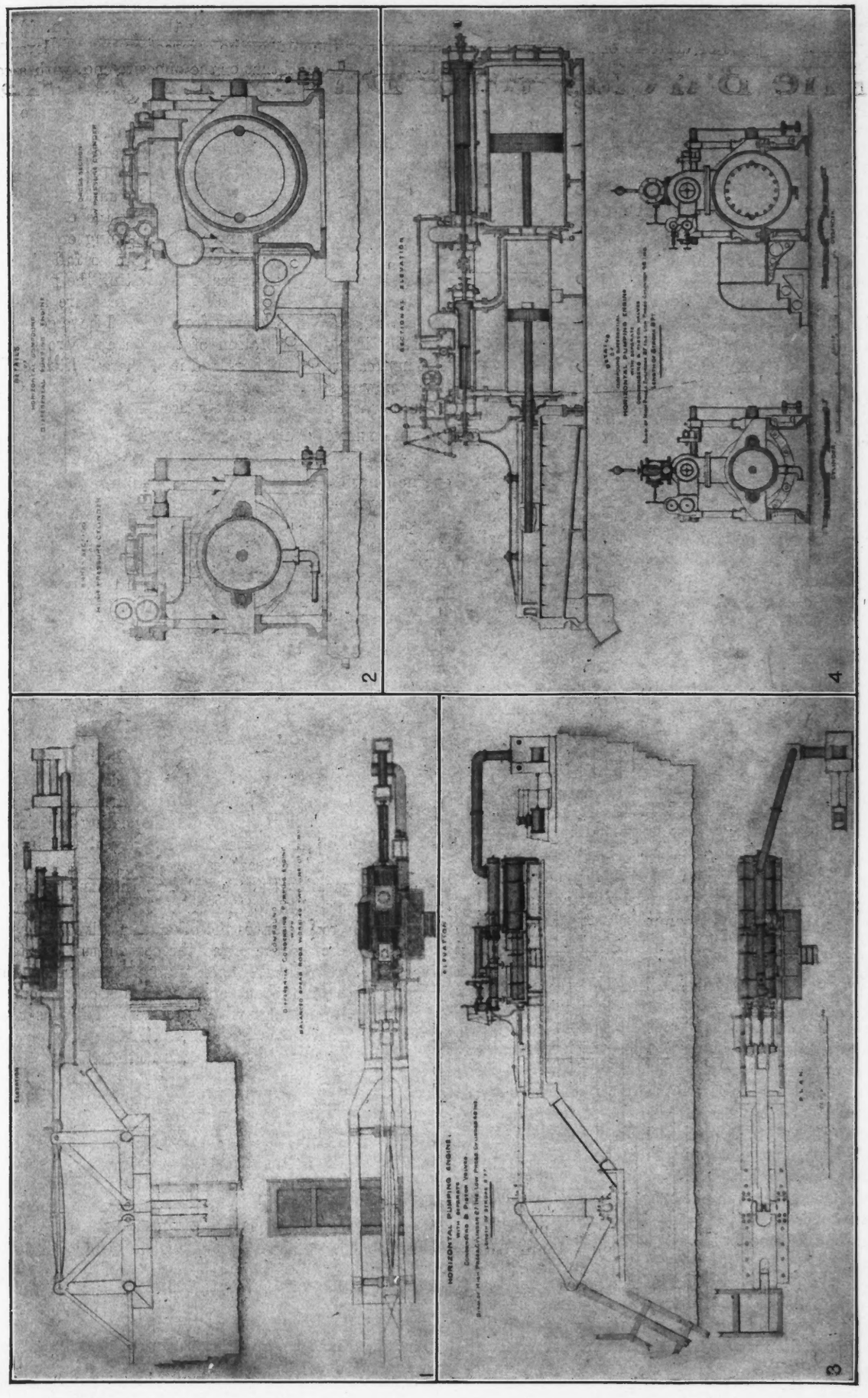


FIG. 1. PLAN AND ELEVATION OF DAVEY ENGINE
FIG. 3. PLAN OF HORIZONTAL PUMPING ENGINE

FIG. 2. CROSS-SECTION OF DAVEY ENGINE
FIG. 4. CROSS-SECTION OF HORIZONTAL ENGINE

perfectly safe in working under all conditions of load, automatically and instantly varying its supply of steam with every minute increase or decrease of resistance; the distribution of steam was such that the pumping was performed without shock even when the resistance varied suddenly and greatly. I think it best to describe the differential valve gear at this point so as to obviate the necessity of doing it again in telling of other engines of this type.

The Differential Valve Gear of the Davey Engine

In this, our first engine of the Davey type, the main steam valves which were balanced D-slides, received their motion from a horizontal lever between the two valve chests to the center of which the valve stems were connected. This lever received two motions; one end derived its motion from the engine crosshead by another lever of the first order which receiving the full motion of the piston at its long end, imparted from its short limb the amount of motion suitable for the correct working of the valves. The other end of the horizontal lever derived its motion from a small subsidiary piston which received its motion from the steam admitted by means of a small slide valve. This motion was controlled by a cataract piston working in a cylinder filled with water or other fluid which escaped from side to side through small openings that could be regulated at will. The motion of the little slide valve of the subsidiary was in its turn governed by the movement of another steam cylinder and cataract which is shown on the cross-section placed above the subsidiary cylinder. The action of this gear upon the motion of the engine will be best understood by an illustration.

Suppose the main engine to be nearing the end of its stroke, the small arm on the left-hand end of the rock shaft, see Fig. 2, will engage with one of the tappets on the small valve rod of the upper or pausing cylinder, the tappet being so placed that the requisite motion will be given to the small valve before the main engine comes to rest; steam being thus admitted on the piston of the pausing cylinder, it will begin its stroke; everything else being at rest, its rate of movement will depend on the amount of opening given to the cataract plug which would be adjusted to the required amount of pause or rest at the end of each stroke. As the pausing cataract nears the end of its stroke, an arm attached to its piston rod engages with one of the tappets on the small valve rod of the subsidiary cylinder and effects the required movement in this valve admitting steam on the piston. Motion would thus be communicated through the main horizontal lever to the valves and the main engine would begin its stroke. As it moves, however, it is giving motion to the other end of the main lever, as already described, in a contrary direction to the motion communicated by the subsidiary piston and cuts off the steam. The main valves, therefore, have a differential motion compounded of the motion derived from the motion of the main engine and an opposite motion from the subsidiary piston. Now the motion of the subsidiary piston is rendered constant by means of the cataract. Seeing then that the cataract end of the lever has a constant motion independent of the engine itself, and that the other end must needs have a varying motion depending on the varying load on the engine, then, the resultant motion of the main valves being taken from the center of the lever and compounded of a varying and a constant motion, must also vary with every variation in the motion of the main piston. At the beginning of the stroke, the cataract end of the lever has a lead in advance of that of the opposite end, with a constant load on the engine this lead will be constant, and the cut-off constant; but the slightest variation in the load causes a corresponding instant variation in the lead and, as a consequence, the cut-off takes place earlier or later as the load is increased or diminished. Thus the engine automatically varies the expansion to suit the varying conditions of resistance. The pause at the end of each stroke is of great importance in a pumping engine as it allows time for the valves of the pump to fall by their own weight alone to their seats, preventing the possibility of shocks from sudden closing under pressure and also preventing a loss of efficiency from slip. I have gone thus carefully into the operation of the Davey valve gear so that my readers will understand it as there is little opportunity now to study this gear in operation except in Great Britain where it is extensively used.

The Arrangement of the Alta Pumping Engine

In the plan and elevation, Fig. 1, of the Alta pumping engine it will be noticed that the pumps are actuated through two right-angle bobs or bell cranks. This was the first and only arrangement of this type. In nearly every other case the engines were built to replace others that had become too small for the work and the existing pit work as far as it went had to be utilized. But in the case of the Alta, I had to design a pumping engine for a new shaft which had to be 1500 ft. deep; all the conditions were known and I had a free hand. Two strong girders, as shown in the plan, cross the shaft in such a way as not to obstruct the shaft opening; these girders were united to the engine bedplate by a heavy east-iron fork piece so that the whole forms one continuation of the engine frame making it one machine with all the stresses within itself. The angle bobs are of cast iron in box form, cast in one piece, the ends of the arms being joined by heavy wrought-iron straps. A connecting-rod ties the vertical arms of the bobs and this, being always in compression was made of cast iron. The bob farthest from the engine was fitted for a balance, the sinking or lift pump being attached to that bob. By this arrangement the one spear rod balances the other thus dispensing with balance bobs in the shaft and the cost of stations to receive them. As the plunger pumps were double discharging both on the out and in strokes of the engine, the pump column did not need to be so large as usual. We had this engine, its condenser, air pump, pump bobs, and connecting girders, weighing in all 134 tons, set up in the shop, the total length was 102 ft. and the height 15 ft., and on a certain day steam was turned on and it was operated for several hours in th presence of a large company of mining superintendents and company directors. To prove to these men how accurately the stroke could be adjusted and depended upon, I put my finger in the clearance of the guides, which at full stroke was one inch, to show that there was no danger of its being crushed. This demonstration had a wonderful effect on the mining men who had been somewhat skeptical about the success of the new pumping engine.

Another Horizontal Differential Engine

There was another type of the horizontal differential pumping engine that should be mentioned in this nar-

rative. This engine was designed by me for the Meadow Valley Mining Co. and was to work a single line of 14-in. plunger pumps, the shaft being a straight incline 62 deg. from the horizontal starting from a depth of 1400 ft. on the incline. Fig. 3 shows an elevation and plan of this engine and Fig. 4 shows a longitudinal section and two cross-sections of the engine alone. The dimensions were: diameter of high-pressure cylinder, 28 in., of low-pressure 56 in., and stroke 8 ft. This engine had piston valves the object being to reduce the friction to place the engine more under the control of the cataract. The angle bob like those of the Alta was of cast iron in box form with heavy wrought-iron straps but having to transmit the push as well as the pull of the engine, it had heavy cast-iron struts fitted and keyed between the straps. The center or rocker shaft of the bob was carried in heavy bearings resting on massive foundation plates which were connected by heavy castings to the main bed of the engine.

By this means one continuous frame was formed that embraced both the engine and pit-head work, thus relieving the foundations of most of the lateral stresses and on this account it was not necessary to make the foundations as massive as when the foundations were the only connection between the various parts. This was a matter of great importance on account of the excessive cost of stone foundations on the Comstock. This engine was also fitted with an independent or separate air pump which was operated by a direct steam cylinder controlled by differential valve gear. This plan enabled the engine to be started with a vacuum. Before this engine left the shop, the Meadow Valley Mining Co. got into financial difficulties and shut down for good. The contract price for the pumping engine and pumps was $90,000, of which $45,000 had been paid. Fortunately for the Risdon Iron Works, a mine in Arizona found water just at the time that the Meadow Valley Mining Co. lost ore. The Arizona mine needed a pumping plant so this pump was sold to them for, if I remember correctly, $80,000; some changes had to be made to suit the requirements of a vertical shaft. I understand that it is still doing good work.

There were other pumping engines of the horizontal, differential type built. At least three large sets, known as Patten designs, although the designing was chiefly by I. M. Scott, were built by the Union Iron Works; there were also several others by the Risdon Iron Works from my designs; those already described had all the features that claim attention at present.

The First Compound Differential Beam Engine

The first compound, differential beam engine built for any of the Comstock mines was that built from my design by the Risdon Iron Works for the Lady Bryan mine. Fig. 5 is a side elevation of this engine and Fig. 6 a plan and end view. The dimensions of this engine were—high-pressure cylinder, 26 in. diameter and 8-ft. stroke; low-pressure cylinder, 42 in. diameter and 10-ft. 7½-in. stroke; the pumps had a stroke of 8 ft. This I considered the finest engine I had designed and both its working and its appearance were much admired by the mining men of that time. The beam was placed below the cylinders, the center and arms being of cast iron trussed with wrought-iron straps as shown, with cast-iron compression members between the straps. The high-pressure cylinder was placed nearest the center of the beam and had the same stroke as the pumps. The longer stroke of the low-pressure cylinder kept down the diameter and preserved the symmetry of the design. All the valves

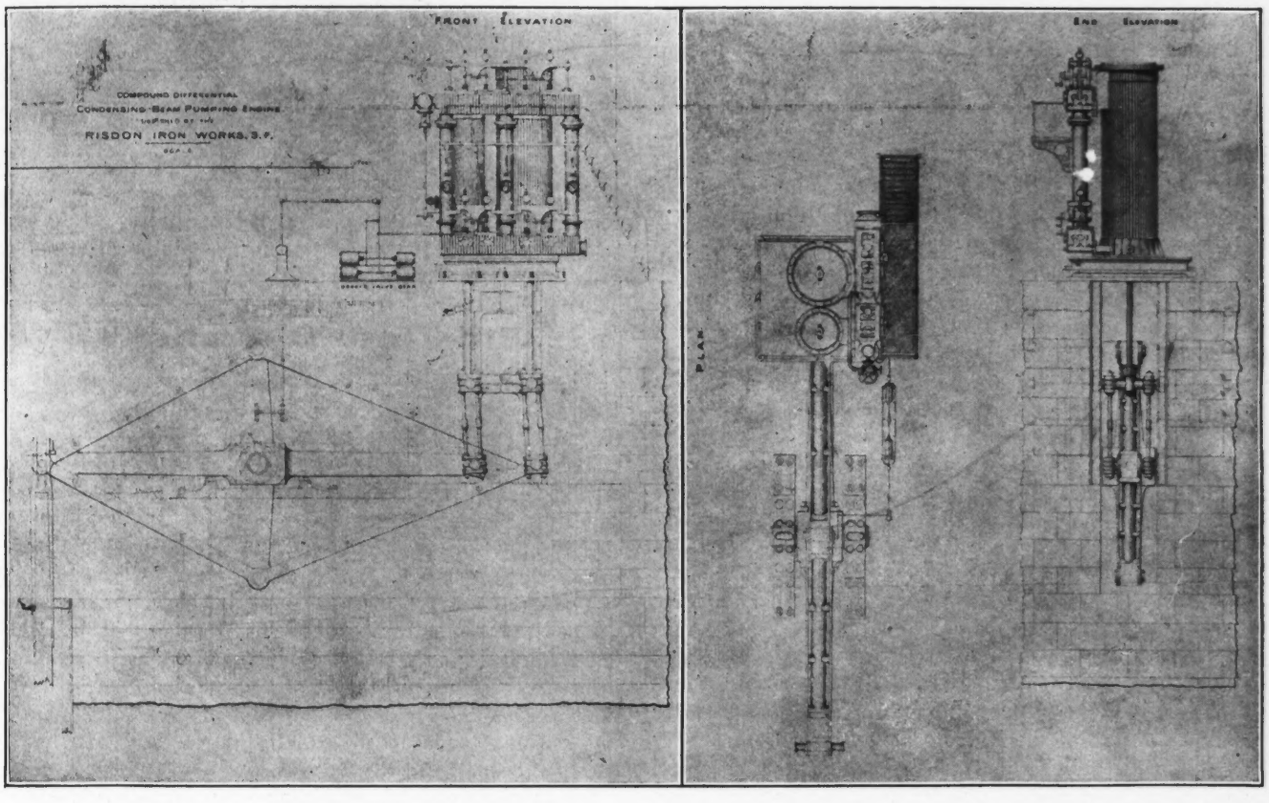


Fig. 5. Elevation—Lady Bryan Pumping Engine—End View Fig. 6.

were of the double-beat Cornish type. The top set for both cylinders was in one valve chest and the bottom set in another. These chests were joined by three columns, the one nearest the beam center being the steam column, the middle one the receiver, and the outside one the exhaust. This arrangement gave the engine a fine appearance and kept all the valve gear on one side in view of the engineer in charge. The condenser and air pump were independent and also served the hoisting engine. This was certainly a fine engine and I am still proud that I designed it for not only did it look and work well, but it was also the most economical engine on the Comstock.

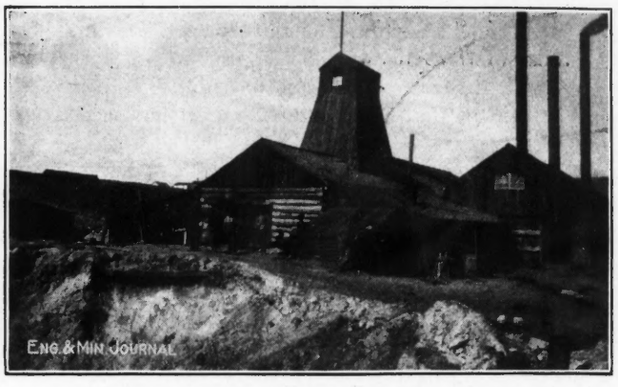
There were three other beam engines built, one by the Risdon Iron Works and two by the Union Iron Works, the valves of which were operated by the differential valve gear. A brass plate on these engines gave the information that they were designed by Mr. Patten, Consulting Engineer, Virginia City. The engines, however, were designed by I. M. Scott, the brass plate only being designed by Patten. They were of larger dimensions and differed somewhat in arrangement from the one described above. The positions of the cylinders were reversed, the low-pressure cylinder being nearest the beam center. Each valve had a separate chest, four valve chests being on one side of the engine and four on the other, the levers and lifters for operating the valves being all on top of the cylinders. The beam was placed under the cylinders and was double, of rather peculiar construction, having no compression to the trusses. My recollection of the dimensions of these engines is that the high-pressure cylinder was 28 in. diameter with a stroke of 11 ft. and that the low-pressure cylinder had a diameter of 60 in. and a stroke of 8 ft. The one at the combination shaft of the Chollar, Norcross and Savage mines worked a double line of 15-in. pumps to the 2600-ft. level discharging into the Sutro tunnel. Fourteen-inch plunger pumps were practically a standard size and often a double line was used, worked by strong cast-iron brackets bolted on each side of the pump rod; for that size of pump the rods, if of wood which they generally were on the Comstock, were 14 in. square in lengths of 50 or 60 ft. The strap plates which held them together were 12 in. wide, 1 in. thick, and 20 ft. long; square bolts usually 1 in. square and 12 in. apart were used, being made square to give a better resistance to pulling apart. Where the pit work was very long, as in the Ophir which had a long incline, the total length of pit work being 4000 ft., experiments were made to determine the extent of the lost motion. In the case of the Ophir, W. R. Eckart, who made the experiments, found that the pumps at the far end of the rod had 2 in. less stroke than those nearest the engine. In the Comstock mines the water was hot, averaging 150 deg. F., which added to the physical obstacles we had to overcome, such as ground slips, but we never let go of any undertaking until we had accomplished more or less successfully what we had begun.

American Manganese Mfg. Co.'s Dunbar Furnace

At the plant of the American Manganese Mfg. Co., Dunbar, Penn., No. 1 stack was put in blast at noon, Oct. 14; the drought, broken on Oct. 13, had caused some delay. The plant will operate on ore from the mines of the company on the Cuyuna range in Minnesota. The coke is made in Semet-Solvay byproduct ovens adjoining the furnace. The products will be high-manganese pig irons of various percentages, spiegeleisen and ferromanganese.

An Old Photograph from Butte

The accompanying photograph is interesting, showing the type of shaft house in use at Butte 30 years ago. The men who are operating the great hoisting engines of



GAGNON SHAFT HOUSE, BUTTE, IN 1885

today would consider this a petty affair. However, "great oaks from little acorns grow," and in Butte the great headframes grew very fast.

Rio Tinto Operations

The short interim report of the directors, usual at this time of year, states that a strike prevented work at the mines during January and part of February. Partial strikes also caused interruption of work in March and April. Excepting, however, as regards some men at the smelting plants, the agitators lost all influence after April and for the following four months operations were on a larger scale than ever before.

The chief markets of the company, however, being on the continent of Europe, the outbreak of war at once cut down the greater part of the company's business, restricting it to the United Kingdom and America. After July, sales and shipments of ore and copper were consequently reduced to comparatively small figures, and are likely to remain small during the war.

In the interests of employees, the company is keeping up the whole of its establishment at three days' work per week. This is more than is required to mine the ore for which there is a demand, but it provides a living wage for the men, and those not actually getting ore are employed on development work in anticipation of future output.

The property is in excellent condition, and as soon as access to markets is restored, a speedy return of prosperity is expected. In view, however, of the great temporary reduction in income, the directors do not consider it desirable to declare an interim dividend on the ordinary shares. They will pay on Nov. 2 the usual half-year's dividend on the 5% preference shares.

Carnotite-Ore Production in 1913 in the United States was 2269 tons of dry ore, according to F. L. Hess of the U. S. Geological Survey, containing about 81,900 lb. of U_3O_8, and calculated to contain about 8.5 grains of recoverable radium. This all came from Colorado and Utah. About 100 lb. of uraninite was also produced in South Carolina as a byproduct of feldspar and mica mining.

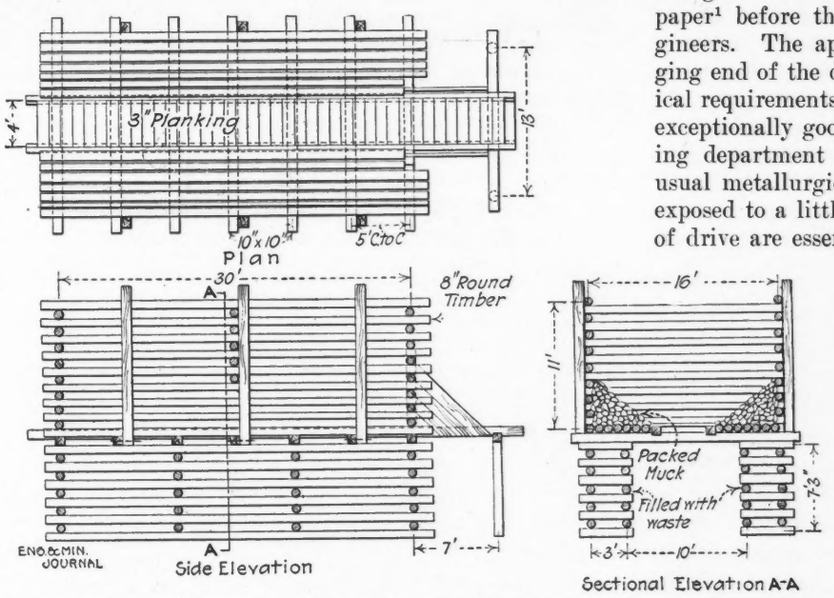
Details of Practical Mining

Round-Timber Bin with Novel Emptying System

By E. S. Shaw*

A bin recently constructed on the dumps of Stratton's Independence, Ltd., is of interest because of its unusual design. It is filled from the top by ore brought in mine cars from the scattered dumps. The ore is then taken to the mill crusher in five-ton cars drawn by a cable attached to an electric hoist.

The bin foundations are two cribs built 10 ft. apart on the surface of the loose rock and filled with waste rock. Waste from the mine is dumped around the sides of the bin to insure greater stability.



Plan and Elevations of Bin, Showing Packing of Ore in Corners

The bin timber is chiefly 8-in. round, with the crevices around the sides filled with 3-in. and 4-in. round pieces. The stringers are of 10-in. square material and the flooring of 3-in. planks.

The method of emptying the bin is its novel feature. The car to be filled is run under the first planks that are covered with ore. The loader stands on the platform outside of the bin so as to be safe from falling rock and loosens the first plank, pulling it ahead with his pick. By doing this with each plank in turn until he reaches the ore, he has a space sufficiently large to allow it gradually to fill his car. The ore will run until the sloping face reaches an angle of about 45°, the angle of repose of loose rock. The loosening of more planks provides a greater quantity of material.

The capacity of the bin is 220 tons. The entire costs of construction were as follows: Labor, $245; material, $269.

The illustrations show the construction of the bin and indicate the method of operating.

This same type of construction ought to be applicable to chutes underground. One man could load for several trammers and keep them moving all of the time. There would be no chance for a boulder to block the opening; the loader could get up above and break it with a hammer, bulldoze it or even blockhole it if necessary, without danger to himself or the chute.

Dredge Digging Motors

The characteristics of electric motors suitable for gold dredges were discussed by Girard B. Rosenblatt in a paper[1] before the American Institute of Electrical Engineers. The application of electric power for the digging end of the dredge is of most interest as the mechanical requirements are severe and the speed control must be exceptionally good. The motor applications in the washing department do not differ much from those of the usual metallurgical plants, except that the equipment is exposed to a little more abuse and that compact methods of drive are essential.

The driving of the bucket chain is the real problem of electrical application on the gold dredge and no system that has yet been devised has proved itself free from all objections. Power requirements are at times excessive and vary through a wide range; accurate control is essential, and good economy is also important on account of the size of the digging motor compared with the rest of the electrical installation, from 35 to 45% of the power used on the dredge being required for driving the bucket line. The greatest difficulty encountered is that of an adequate mechanical connection between the motor itself and the bucket chain. If the bucket line encounters a boulder of larger size than it can handle, the demand on the motor is immediately increased and protective devices must be installed. Also when the buckets run into particularly sticky clay, the load on the digging motor increases. As such a condition is seldom momentary, the continuity of the overload may burn out the motor unless the speed of digging is reduced. In addition to handling such overloads, the motor drive must be capable of revolving the bucket chain slowly at no load for the purpose of repairing the buckets or chain.

The transmission of power from the driving motor to the tumbler has been the subject of much study by dredge designers. The tumbler shaft usually has two pinions, one on each side, which engage two gear wheels carried on a common shaft. This shaft is connected through an adjustable slipping friction to another drive

*Assistant mine superintendent, Stratton's Independence, Ltd., Victor, Colo.

[1]Proc., A. I. E. E., August, 1914.

shaft by means of gearing and the motor drives the last-named shaft. It may be either belted or geared to this shaft.

Belting the motor is, of course, easier on the electrical apparatus, but on the other hand, has some disadvantages. A very large and expensive belt is required on account of the tremendous torques involved; there are sometimes difficulties of maintenance due to the moisture that is often present on board a dredge. A belt may slip just when maximum torque is wanted; occasionally under heavy stress, due to the slipping friction having rusted, a belt will break. A belt transmission suitable for the torques involved takes up considerable space, and space on a drege is valuable.

Gearing, while economical in space and entirely positive in action, has the disadvantage that it imposes very severe service on the electrical equipment, in that every strain and vibration on the bucket chain finds its way back to the revolving part of the motor. Flexible couplings have been tried between the motor and the driving gear, but without success. The large variation in torque met with, sooner or later, ruins any type of flexible coupling that has yet been tried. The gear drive has proved successful where a motor has been secured that will adequately withstand the stress. Both belt and gear drives have their adherents.

From these considerations it will be apparent that the motor for digging service must have the following characteristics:

(a) It must be a varying-speed machine, and if in addition it can be made an adjustable-speed machine, this will be an advantage.

(b) It must be capable of being revolved at light loads and very low speeds.

(c) It must be capable of developing a maximum torque at any speed from zero to approximately full-load speed of several times its normal rated torque.

(d) It must be capable of carrying for prolonged periods of hard digging a torque overload of approximately 25% at a speed reduction of probably 25%.

(e) It must be of substantial mechanical construction, particularly as to shaft and bearings, in order to resist a heavy belt pull when belt drive is used, or repeated shocks of severe gear thrusts when gear drive is used.

(f) It must be reasonably efficient.

It has often been suggested that direct-current motors of the type used in steel mills, with possibly variable-voltage speed control, might prove advantageous for digging service on large gold dredges. Investigation in most cases has developed the fact that the losses in efficiency due to the conversion from alternating current to direct current practically offset the advantages gained by more flexible control under the ordinary cycle of operations, and further that the first cost of such an installation is prohibitive. Accordingly, the only type of motor left available is the moderate-speed, wound-rotor induction type, and for the most successful application the motor should be designed with special reference to the work it has to do. From experience with the troubles of a dozen dredges, Mr. Rosenblatt recommends specifications embodying the following:

(1) The motor should be capable of carrying its rated load continuously with a rise not to exceed 40° in any part.

(2) The motor should be capable of developing a torque 25% in excess of its rated full-load torque at a speed of 75% of its synchronous speed for a period of two hours, with a rise not to exceed 55 degrees.

(3) The motor should have a maximum torque and a starting torque of not less than 2½ times its full-load torque.

(4) The shaft should be of such material and dimensions that strains due to developing of maximum torque will not appreciably affect the dimensions of the air gap on any side of the motor.

(5) The bearings should be designed to resist an upward thrust, and should preferably be of the design known as rolling-mill bearings, furnished with stud bolts and lock nuts, instead of the usual design employing capscrews.

(6) The lubrication of the bearings should be adequate. On motors of 200 hp. and over, at least two oil rings per motor are recommended. On motors of 500 hp. and over, the use of gravity-feed lubrication should be considered.

For small dredges, say employing a digging motor of 100 hp. or less, the ordinary drum-type controller proves adequate. For larger installations a combination of magnet switches, controlled by a master controller, has been used in a large number of installations, but for the larger motors the ideal control seems to be the liquid rheostat.

The digging motors of some of the important American dredges are listed in the accompanying table, together

DATA ON DREDGE DIGGING MOTORS

Place or Owner	Size of Buckets, Cu.Ft.	Buckets per Minute	Motor Rating, Hp.	Average Hp. Input
Oroville	5	18	75	65
Marysville	7	20	150	140
Marysville	7½	19	200	155
Conrey	9	18	150	185
Natomas	14	21	400	285
Folsom	13½	20	300	202
Boston & Idaho	15	..	300	285(?)
Conrey	17	22½	550	460

with the size of the bucket, speed per minute, and average horsepower input; the last, of course, will vary with the kind of ground to be dug.

Chart for Plotting Dips

It frequently becomes necessary in geological and mine mapping to make vertical sections through veins and other inclined orebodies which are not parallel to the dip of the vein, that is, not at right angles to its strike. The

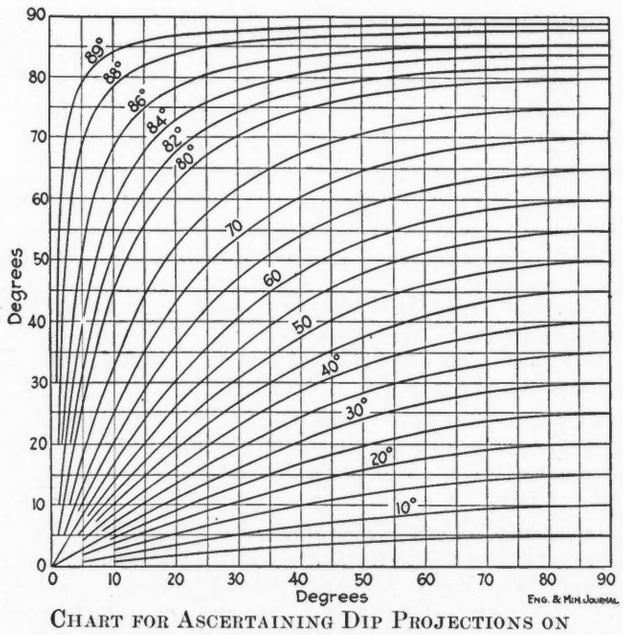


CHART FOR ASCERTAINING DIP PROJECTIONS ON DIAGONAL SECTIONS

calculation involved in plotting the dips of a good many veins thus projected is tedious. The accompanying chart is intended to expedite such calculations.

On the chart, the angles indicated along the bottom are those made by the plane of the section with the strike of the vein. The curves are dips of various de-

grees. The vertical figures represent the apparent dips at which the veins are to be plotted.

Suppose a vein dipping at 86° to be intersected by the vertical projection plane at an angle of 25° with its strike. Find the intersection of the vertical line corresponding to 25° along the bottom of the chart with the curve marked 86°, and follow along the horizontal line from the intersection to a point on the left marked 80½°, which is the apparent dip at which the vein should be plotted on the vertical projection plane.

If the acute intersection angle be termed A, the dip angle B and the desired apparent dip C, then the formula on which the dip is constructed is tan C = sin A tan B.

Lining the Palms Shaft*

The recently sunk Palms shaft of the Newport Mining Co. is vertical, lined with steel and concrete. It is divided into five compartments, as shown in Fig. 1. The skip compartments are 4 ft. 10 in. by 6 ft., and the cage compartment is 6 ft. 2 in. by 10 ft. The outside dimensions of the shaft are 10 ft. 10 in. by 17 ft. 6 in. The 17-ft. 6-in. wall plates, the end pieces and the two dividers, each 10 ft. long, are 5-in. 18.7-lb. H-section steel members. The other two dividers are 4 ft. 10 in. long and consist of 4-in. 13.6-lb. H-sections. The eight studdles are 3x3x¼-in. angle irons. Most of the sets are spaced 8 ft. center to center, but in heavy ground

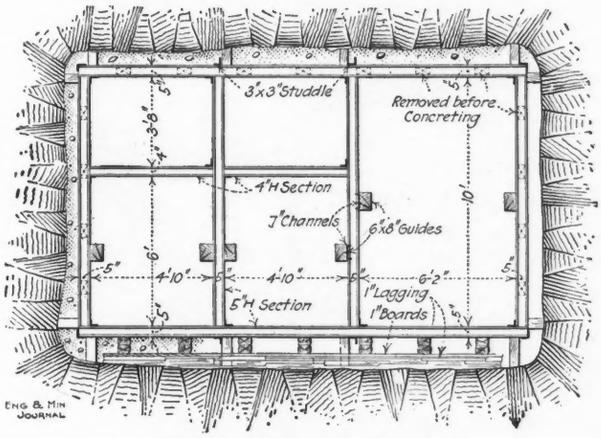


FIG. 1. PLAN OF SHAFT

some sets are spaced 6 ft., and a few of them 4 ft. The wood guides are 5¾ in. by 7¾ in., and two of them, as shown, are strengthened by 7-in. channels.

Hoisting was done with two 26-cu.ft. buckets weighing 900 lb., operated by an electric hoist. Another single-drum electric hoist handled a light cage for timbermen running in the middle compartment of the shaft. The shaft passes through quartzite for part of its distance; the broken quartzite was saved and crushed for concreting purposes.

It was found possible when the rock would stand for 14 ft. below the lowest set, to rivet the steel members together on the surface, lower the set intact and swing it into place. Shoes on the two lower corners guided it to the shaft. Four one-ton duplex chain blocks were used for swinging it into position. To each corner of the set was fastened a ½-in. sling chain about 3 ft. long, with a 5-in. ring on one end and a 3-in. ring on the other, to which the hooks of the chain blocks were attached. When a 14-ft. space could not be maintained, the sets were riveted in parts and bolted together below.

When the rock walls were more than 8 or 9 in. from the sets, 4-in. tie timbers were placed vertically 4 in. outside the sets and about 2 ft. apart. Between the steel sets and these timbers, 4-in. wood blocks 12 in. long were placed. Ouside the verticals, 1-in. rough boards were set horizontally to act as outside forms when it came time to pour the concrete lining. Between the boards and the solid rock, lagging was filled in. When the rock was less than 8 or 9 in. from the sets, 4-in. flat timbers were placed between the flanges of the wall plates and end plates, and lagging was placed behind these up to the rock. This lagging was left in place until concreting time, when it was removed from the shaft.

During the process of sinking, at every 75- to 100-ft. point, two or three adjacent sets were filled in solid to

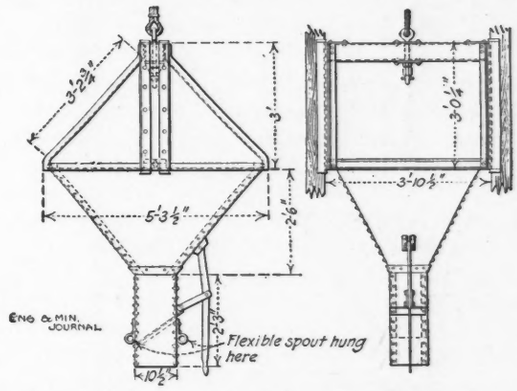


FIG. 2. HOPPER FOR LOWERING CONCRETE

the rock with concrete, eliminating the necessity of bearers set in hitches. This concrete was mixed on the surface and lowered in a hopper, from the bottom of which a flexible spout extended. The hopper is shown in Fig. 2 and the spout in Fig. 3.

When a depth of 1207 ft. was attained, it was thought necessary to complete the concreting, because of the approach of cold weather. This concreting was started at a depth of 1170 ft. The concrete was mixed on the surface in the proportions of 1 : 3 : 5 and carried through a launder to a 4-in. flanged pipe down the shaft, which telescoped into a 5-in. branch, shown in Fig. 3. The branch took the blow of the concrete, and at its bottom it was connected with a reverse bend having its lower end vertical. An 18-ft. flexible spout fitted over this directed the concrete to the proper place behind the form. While the concreting force was filling one set, other men were removing the blocking from the set above, hanging strands of old wire rope vertically 1 ft. apart and horizontally about 3 ft. apart, to be used for reinforcement, and placing the outside forms. For an 8-ft. span, 2-in. hardwood planks were used, and for the 4-ft. and 6-ft. spans, 1⅝-in. hardwood planks. The planks were cut on a bevel at the upper end, so that the concrete came out underneath the steel set to act as a support. At the bottom end, in passing into the outside flange of the H-sections, 2-in. strips of wood about 12 in. long were laid 1 in. apart between the bottom end of

*An abstract from an article presented before the Ishpeming meeting of the Lake Superior Mining Institute, Aug. 31, 1914.

the plank and the inside flange of the section. When these strips were removed, the planks were easily taken out.

The corners were left open for concreting, so that a solid column of concrete was obtained in each corner over the entire depth of shaft. Furthermore, where lagging and timber were left between the concrete and the rock, openings for the concrete were left directly back of the wall plates and end plates to the solid rock, so that in all cases the concrete extended from the steel set to the rock. A 6x8x12-in. block was laid in the concrete midway between the 8-ft. sets, to serve as a support for the two end guides.

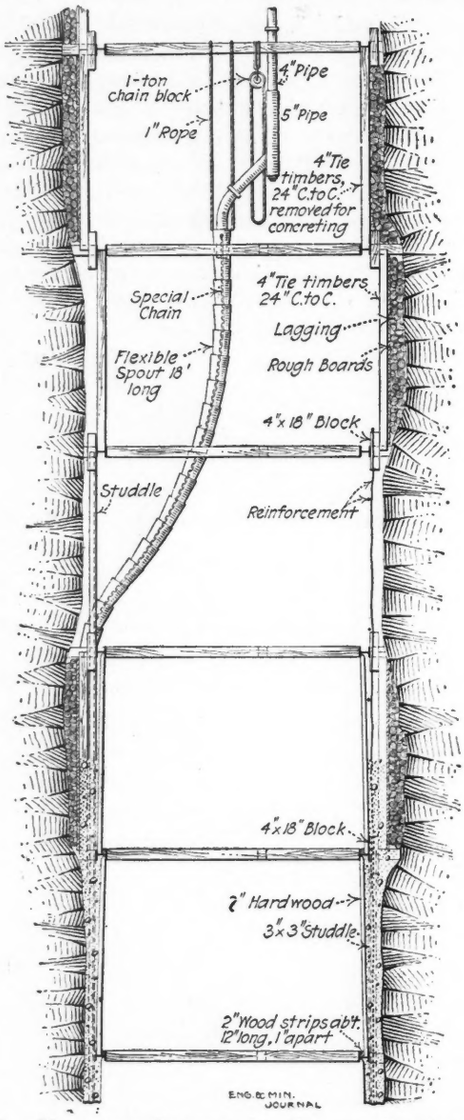


FIG. 3. VERTICAL SECTION OF SHAFT, SHOWING SET AND FORMS AND FLEXIBLE SPOUT

Nine miners and one foreman per shift did the drilling, blasting and mucking and assisted the timbermen in placing the sets, concrete bearers and 12-in. ventilating pipes. Three timbermen per shift, with two foremen for the 24 hr., lagged the sets, put in the guides, extended the air lines, placed the ladders and substituted for absent miners. There were, furthermore, for each 24 hr., four engineers, two toplanders, two men to handle rock, etc., and two blacksmiths.

The concreting required the 10 miners for removing lagging, placing reinforcement and placing plank forms. The four timbermen attended to the distribution of the concrete to the forms. On the surface, three men wheeled rock to the mixer, two men the sand and cement, one poured water and attended to the securing of the proper mixture, one discharged the mixer, one looked after the launder from the mixer to the 4-in. pipe and two men worked the concrete down the 4-in. pipe. All the men worked 8-hr. shifts on the concreting.

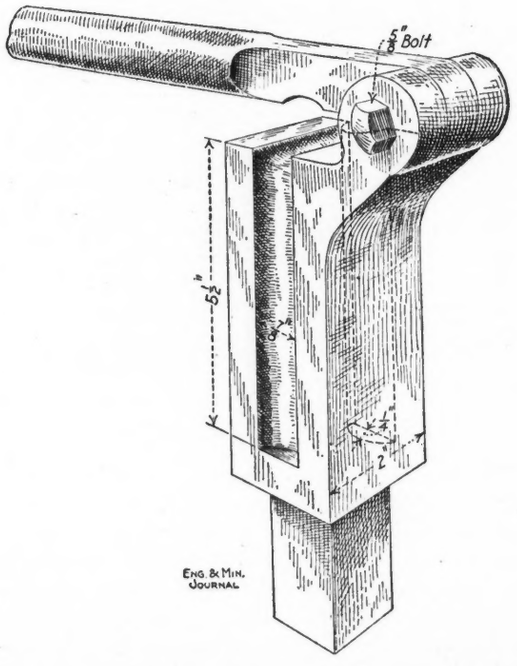
The speed of sinking the shaft, including the placing of steel sets and lagging, occasional concreting, etc., averaged from 4 to 4.56 ft. per day during several months. For the last three weeks in August, 1913, it averaged 5 ft. per day.

The speed of final concreting was from 35 to 48 ft. per day. For the total distance concreted, 78 gondolas of sand and 15,695 sacks, or 21 carloads, of cement were required.

U-Bolt Bending Tool

BY DAN FIELDS*

The accompanying illustration shows a device for bending piston-machine U-bolts without battering the threads. The machine shown is adapted for making bolts for a 3⅛-in. drill, although it can be used for smaller bolts, if they are given one blow on the anvil.



DEVICE FOR USE ON THE ANVIL IN SHAPING MACHINE-DRILL U-BOLTS

To use the machine, the bolt is heated, placed on the center, clamped with the handle and bent down with a wood or rawhide mallet. The square-section projection on the bottom should be of the proper size to fit the anvil hardy-hole. The handle is about 3 ft. long and made of 1-in. round mild steel. It gives sufficient leverage to hold the bolt firmly.

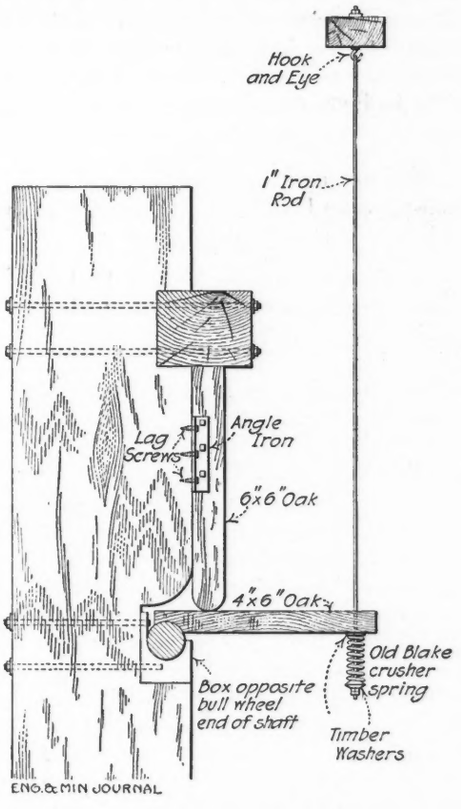
*Eureka, Utah.

Details of Milling and Smelting

Cam-Shaft Damper

By A. B. Parsons*

The accompanying sketch shows a simple contrivance for reducing cam-shaft vibration, which has proved effective in the Iola mill of the Candor Mines Co., at Candor, N. C. There are five 1750-lb. stamps with a 7-in. camshaft, and there has always been a tendency toward excessive vibration. The shaft has broken and been replaced several times, and the unbabbitted box at the end



Cam-Shaft Damper

opposite the bull wheel suffered likewise and has been replaced once. Incidentally not a single stem has been broken in three years of continuous operation.

The installation of this damper has materially lengthened the life of the camshaft, has eliminated most of the wear of the box, and makes a noticeable difference in the smoothness of operation of the entire battery. The sketch needs little explanation. Two short pieces of oak, the iron rod, and any suitable spring is all that is required. The 6x6-in. piece must be fastened in some convenient manner to the front of the battery post, while the other piece is held in place by being fitted to the camshaft. The pressure is easily regulated by the nut at the bottom end of the rod, and by taking off this nut the entire device can be removed and gotten out of the way. A roof-truss member, or some other substantial support, is required for the upper end of the rod.

*Mining engineer, Salt Lake City, Utah.

Concrete Lining for Steel Bunkers

The Minnesota Steel Co., in building its plant at Duluth, Minn., has aimed to make it the best and the most economical steel-making plant in the world.

For supplying coal to its coke plant, there is provided a large circular steel tank. This tank is approximately 55 ft. in diameter, 40 ft. high and holds 2100 tons of coal. For furnishing coal for the gas producers of the openhearth furnaces, 33 parabolic bunkers, approximately 20 ft. wide, 12 ft. deep and 17 ft. long, are provided in a line in the gas-producer building.

In order to protect these steel tanks against the corrosive action of high-sulphur coal, it was decided to line the coke-oven bins with 5 in. of concrete and the producer bins with 2 in. of concrete.

Iron lugs were provided at numerous places on the inside of the tank. To these, vertical rods were securely wired, and to these rods triangular-mesh wire cloth was secured in horizontal bands, the wire mesh being held away from the steel by a distance of approximately ¾ in. Gunite was then applied by means of the cement gun. The first layer is shot through the mesh and serves to hold the wire cloth in place and thoroughly covers and protects the steel plate. The second layer, bringing it to a total thickness of 5 in., is then applied.

When the work is finished, the concrete is monolithic in construction and the surface is smooth and even.

Something should be said about the character of gunite. It consists of a mixture of portland cement and torpedo sand in the proportion of 1 : 3. This is mixed dry. It is then shot through a hose by the cement gun with an air pressure of from 40 to 60 lb. Immediately before emerging from the nozzle, the dry mixture is hydrated, the water coming through a separate and smaller hose. The quantity of water is under the control of the operator. Gunite is therefore simply a 1 : 3 cement and sand that is shot into place under pressure and hydrated immediately before it is deposited into its final resting place.

Several effects are produced. In the first place, the sand contained in the first mixture which strikes a hard surface like a steel plate, rebounds, falling clear of the work to the bottom in the form of clean sand and leaving a coating of neat cement on the surface. As soon as this coating has attained an appreciable thickness, it acts as a matrix, into which subsequent deposits of material imbed themselves. The gunite in immediate contact with the steel plate is clean cement. As a result of this, and of the pressure under which it is applied, the adhesion of the gunite to the flat steel plate, either painted or unpainted, runs as high as 500 lb. per sq.in.

The second effect of the application of concrete by this process is that the material is exceedingly dense. By ac-

tual tests, made by competent engineers, it has been found that its porosity is only one-seventh that of ordinary concrete. It is practically waterproof and airtight. Furthermore, the bond between freshly applied gunite and a surface of gunite that has already set, is perfect, so that there is no possibility of air or moisture penetrating through the layer of gunite and reaching the steel.

The thickness of gunite applied in this case was made 5 in. on account of the large size of the tank and the severe duty to which it would be subjected. In the case of the parabolic bins, which are much smaller and where the drop of the coal against the bottom and sides could never be great, the lining was reduced to 2 inches.

The Iler Crucible Furnace

This type of melting and refining furnace is designed to burn crude oil or gas. It is specially adapted to metallurgical plants, foundries and wherever crucibles are used at high temperatures, as in refining, small smelts, or melting brass, bronze or even steel. It is manufactured by F. M. Iler, 242 W. Florida Ave., Denver, Colorado.

The furnace is cylindrical and in two main parts. The lower part is the combustion chamber; the upper is the

THE ILER CRUCIBLE FURNACE

crucible chamber. A tight seal is formed between the two parts by rings upon the lower edge of the upper chamber that drop down into a bed of sand spread about the circumference of the lower chamber. Both parts have refractory linings in which are embedded coils of iron pipe through which air circulates from a blower to the burner, which is attached near the bottom of the furnace. This air conduit is provided with a slip-joint between the two units.

The combustion chamber contains a stool for the crucible. The lining of this chamber is somewhat barrel-shaped to fit standard makes of crucibles, which may be either clay or graphite. A swinging lid on top of the furnace permits stirring and addition of charges or fluxes. Mounted at the rear of the base are column guides with sheaves for cables to lift and lower the upper chamber by rack-and-pinion mechanism, a counterweight being provided at the back. The furnace is easily opened and the crucible removed by an open-sided shank, as shown in the accompanying photograph.

Air, after traversing the coils, reaches the burner at a comparatively high temperature, thus giving thorough atomization to the fuel (if it be oil) and assuring a most effective mixture of the fuel and air, an essential point in the production of a short flame. As the flame enters the chamber tangentially, it swirls about the stool and crucible, completely filling the space between the crucible and the walls, but not passing out in the flue. In one pyrometer series of tests, the air coming from the coil showed temperatures from 458° to 550°, F., while the temperature of the melt was 2100° F. Much higher temperatures are possible. Mild steel, requiring heats of from 2400° to 2700° F., may be melted. Experiments have been made to determine the increase in efficiency due to the preheating of air. With gas, there was shown to be a saving in fuel of 19.7%, while with oil a greater economy is indicated.

The furnace is portable. The No. 60 size requires a floor space of 3x4 ft., and weighs about 1600 lb. It may be obtained in any size to accommodate a standard crucible of corresponding number. The only auxiliary equipment required is a blower that will deliver 180 to 250 cu.ft. of air per minute at a pressure of 10 to 16 oz. When desired, it is built as a tilting furnace. During the last 15 months, one of these furnaces has been in steady use and has proved efficient, economical in operation and furnishes increased comfort to its operatives.

Separation of Bismuth and Copper

The separation of bismuth and copper as they occur in various metallurgical byproducts, particularly those from electrolytic lead-refining, is covered in a recent patent of William Thum (U. S. pat. 1,098,854). The metals are supposed to have been brought to the state of oxides, as they would occur, for instance, in a cupeling-furnace slag.

This oxide slag crushed to 4-mesh or finer, is mixed with sodium sulphate carrying an amount of sulphur in excess of that required to matte the copper, and carbon in excess of that required to reduce the salt cake to sodium sulphide, and all of the oxides to metal. This mixture is then smelted at a temperature between 2500° and 3000° F., giving three layers, metallic bismuth, copper matte, and a soda slag.

It is obvious that this process would work, using sodium sulphide instead of salt cake and the carbon to reduce it, but sodium sulphide is more expensive than salt cake, and is deliquescent, which constitutes a source of danger if the charge be put in the furnace a little at a time.

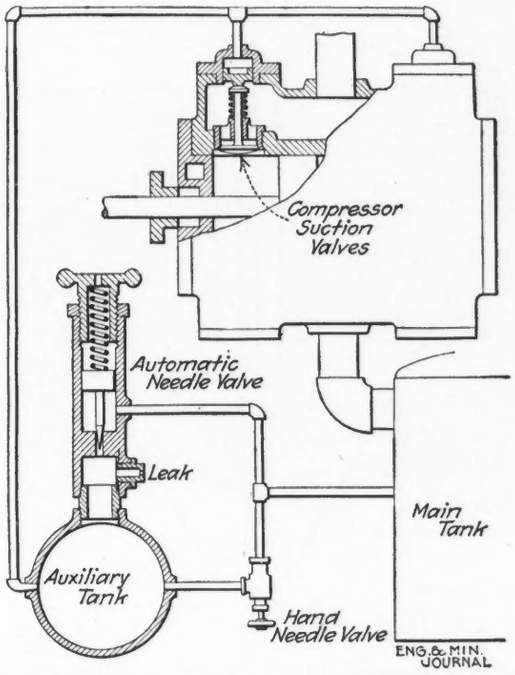
Most of the silver and gold in the oxide slag will go with the bismuth. Most of the arsenic and antimony go with the soda slag, tellurium enters the copper matte, alumina slags as sodium aluminate, silica also, but large amounts of silica are detrimental, while lead enters the slag to the extent of 40%, 10% enters the matte, and 50% goes with the bismuth.

In the smelting process, after the charge ceases to boil the slag is tapped or skimmed off, and the charge is then allowed to cool from 10 min. to half an hour, the matte is removed, and a calorimetric test made on the bismuth for copper. If the copper is less than 1% and the original material was not too rich in silver and gold, the bismuth can then be cast into anodes. If the copper exceeds 1%, it is best to reoxidize the metal by compressed air blown through the charge by iron pipes inserted in it, and then repeat the original separation.

Mining & Metallurgical Machinery

Hall Volume Regulator for Compressors

The Hall Steam Pump Co., Pittsburgh, Penn., has brought out a new device which can be applied to any kind of air compressors with automatic inlet or outlet valves, or both, and makes it possible to control the amount of intake air so as to: (1) Correspond exactly to the amount of compressed air consumed at any time, thereby keeping the receiver pressure absolutely constant; (2) decrease with increasing receiver pressure, thereby keeping the power required to operate the compressor constant; (3) deliver any desired constant volume within



HALL REGULATOR APPLIED TO POPPET INLET VALVE

the capacity of the compressor, or fill almost any other requirement which the conditions of operation of an air compressor may impose.

The application of this regulator to an ordinary poppet-valve air compressor, acting upon its suction valves so as to keep the receiver pressure constant, is shown in the illustration. The suction valves are provided with springs which tend to close them and with small pistons which are acted upon by the air pressure. The cylinders in which these pistons work are connected to an auxiliary tank. This tank communicates with the atmosphere through a leak and with the main air receiver through an opening closed by means of an automatic pilot needle-valve as soon as the force of the spring above overcomes the receiver pressure acting on the bottom of the valve piston.

A hand needle valve can be arranged so as to obtain a constant leak from the receiver to the auxiliary reservoir, thereby preventing the pressure in the latter from decreasing below a certain value.

When the compressor is working at a constant partial load, the automatic valve will allow some air to enter the auxiliary tank and the same quantity of air will escape through the leak, thereby keeping constant the pressure in the reservoir and the pressure acting upon the suction-valve pistons. The suction valves will close at such a point of the discharge stroke as to compress exactly the quantity of air consumed, the pressure in the receiver remaining constant.

A change in the consumption of air will cause a slight momentary increase or decrease of the pressure in the receiver and the quantity of air entering the auxiliary reservoir through the automatic valve opening will increase or decrease, thereby changing the pressure in the reservoir and the cutoff of the suction valves until new conditions of equal supply and consumption of compressed air are established at exactly the same pressure as before.

For a certain pressure in the auxiliary tank the compressor will work at its maximum capacity, and the object of the hand needle valve is to admit constantly so much air to the auxiliary tank as to produce said pressure. If more air is admitted through the valve, the capacity of the compressor will be reduced and the volume of the intake air will vary with the consumption only as long as the latter remains below the reduced capacity.

The application of the same principle to the regulation of the discharge valves of a piston inlet type of compressor involves only some changes in detail. Applications of electrical control to the operation of the regulator are also possible.

Jackhamer Auger Drill on Mesabi Range

The Ingersoll-Rand Jackhamer Auger drill has recently been introduced on the Mesabi range, and Charles H. Claypool, superintendent of the Cavour Mining Co., at Virginia, Minn., reports some interesting results from its use. No special tests were made with the drill, but a good comparison was possible between results from the air auger and hand auger.

Previous to the introduction of the air auger, the system employed at the Cavour mine was that generally used on the Mesabi. The miners drilled and blasted their own ground, put in their own timber with the help of a timber man, mucked up the ore and trammed it to the pockets. Hand augers were used in drilling, and two miners could drill a round of five 6-ft. holes in about two hours, the Cavour ground being somewhat harder than the usual Mesabi ground. The average drilling speed was about 1 ft. in 8 min. Blasting was done at the noon hour and at the end of the shifts, and occasionally during the shift. In places where the air circulation was

not good, considerable time was lost in waiting for the air to clear up. When working two shifts, five gangs of miners each, the production ran about 3.75 tons per man for every man employed, this low figure being due to the small number of producers compared to the number of nonproducers employed.

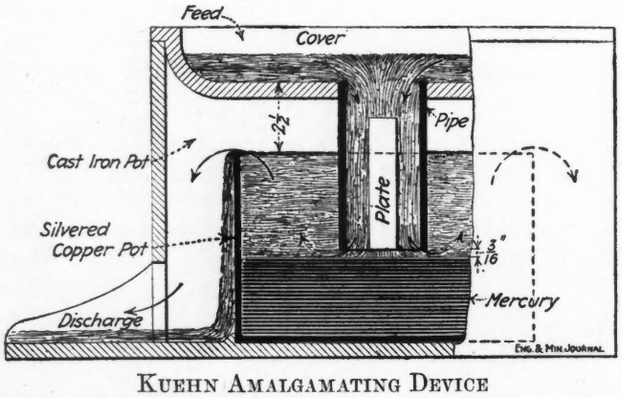
The introduction of the air auger permitted the system to be changed so that muckers were employed instead of miners. Under the new scheme, all the drilling and blasting are done by two men and the timber is all handled and put in by regular timber men. The muckers simply shovel ore and tram it to the pockets. All drilling, blasting, timbering, track work and underground repairs of all kinds are done on the night shift, so that nothing interferes with the tramming and hoisting which is done only on the day shift.

The advantage in this system of working is that there are special men for each kind of work and each man becomes an expert in his particular duty. As a result, it has been found at the Cavour mine that the powder cost has been reduced over 50%, because the drill men become proficient in placing holes and using powder. The cost of timbering has likewise been greatly decreased. Under the new system, the production per man is about 5.25, compared with 3.75 tons per man, with the old system, the total production remaining the same. The drilling speed has increased from 1 ft. in 8 min. to 1 ft. in 1 min. The muckers tram an average of 26 tons per shift per mucker.

The item of labor in drilling has been greatly reduced by the air machines, and while the increase in production per man is probably due largely to the new system of operation, the latter has been made possible only by the use of the air auger.

The Kuehn Amalgamator

A new device which is being offered to mill operators for recovering free gold from pulp or tailings, is known as the Kuehn amalgamator. It consists of a cast-iron pot

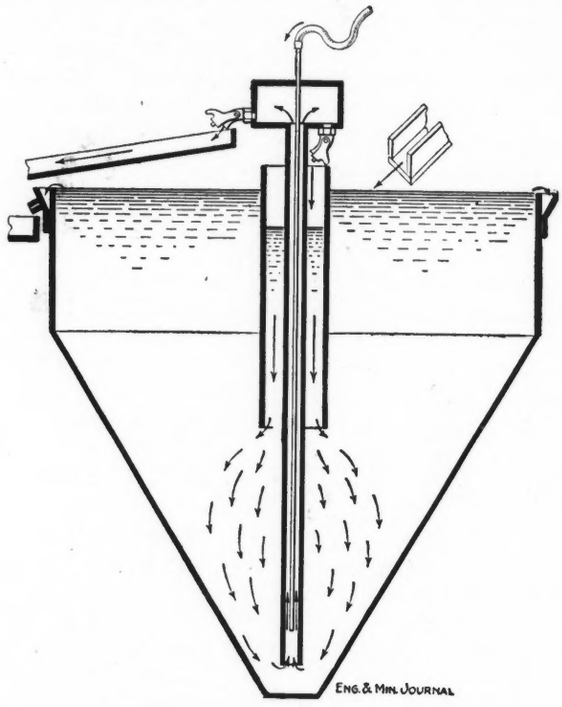


KUEHN AMALGAMATING DEVICE

about 12 in. deep, and the same in diameter. Inside of this there is another pot made of silvered copper plate, which is charged with about 24 lb. of mercury. Covering the inner pot is an iron cover, in the center of which is a short length of 3-in. iron pipe, reaching to within $\frac{3}{16}$ in. of the surface of the quicksilver. The pulp travels vertically down this pipe and impinges upon the surface of the mercury. There is a longitudinal division in the pipe to prevent swirling of the pulp. The pulp does not pass through the mercury but the gold is expected to be thrown against it by its own momentum. There is no special pressure on the column, the head being only about 2½ in. Too much pressure might tend to flour the mercury. The accompanying sketch shows the arrangement of the essentials of the device.

Rothwell Pulp Thickener

A new pulp-thickener device has been designed by John E. Rothwell, of Butte, Mont., and granted U. S. Pat. No. 1,099,396, which has been assigned to the Colorado Iron Works, of Denver. The device is designed after the ordinary cone, but has no opening at the apex. The accompanying drawing shows the features and operation of the machine.



ROTHWELL PULP THICKENER

Pulp is introduced into the cone through the launder, the clear solution overflowing into the peripheral launder, and the solids set toward the apex. Upon reaching that point, the thickened solids are taken by an air lift and elevated into a chamber at the top of the device. Here part of it is taken away through a gate and launder, while part of it can be returned to the central cylinder, thus settling into the bottom of the tank again. By this means, the air lift can be operated at a capacity much greater than the output of thickened slime, the excess going back into the cone again. The operation tends to prevent the accumulation of heavy, hard solids at the bottom of the cone. There appears to be no reason why this device should not work satisfactorily, although its advantages over other thickening devices are not yet perfectly defined.

A New Self Contained Portable Motor-Compressor Set has been put on the market by the Westinghouse Company It runs on either alternating or direct current. There is 15 hp. required, and it blows off at 100 lb. per sq.in. The compressor is furnished by the Sullivan Machinery Co.

Modern American Rock Drills--II

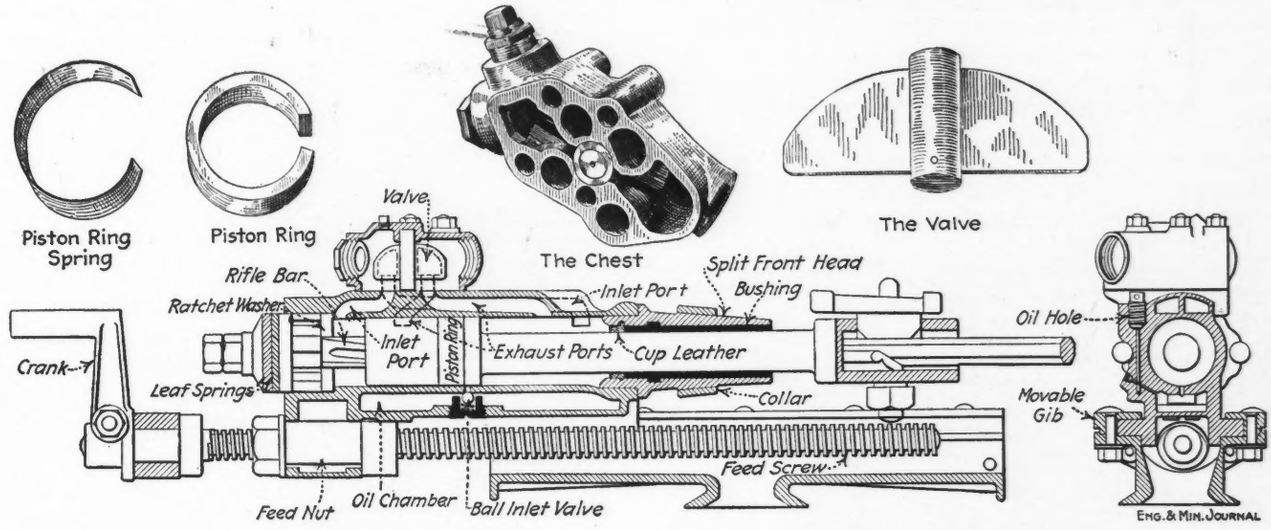
By L. O. Kellogg

SYNOPSIS—Ingersoll-Rand butterfly-valve drill has oscillating valve, short piston, adjustable gibs. Sullivan Liteweight has air-thrown spool valve, may be fitted with hollow piston and hollow steel to carry water to bottom of hole. Sullivan Hy-Speed has auxiliary valve, may also be fitted with water attachment.

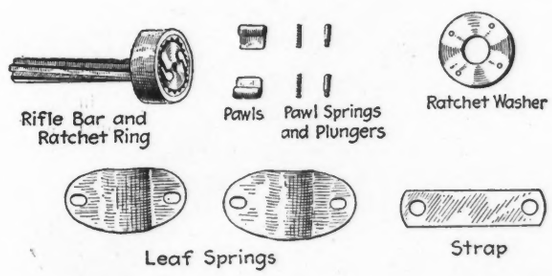
The most modern machine put out by the Ingersoll-Rand Co. is the butterfly-valve, one-man type. Its most interesting feature is the butterfly valve itself. This consists of a trunnion having two wings. The trunnion rests in suitable bearing holes in the chest, and by an extremely slight oscillation moves the wings to open and close air inlet and exhaust ports. Four ports are thus taken care of, an exhaust and an inlet for each end of the cylinder. The valve chest is mounted diagonally on the back of the cylinder and has connections for air inlet and exhaust. This operation is best represented by the diagrams *A*, *B* and *C*. In *A* is shown the beginning of the forward stroke. The butterfly valve is in a position to admit air back of the piston through *S*2 and permit exhaust from in front through *E*1. The other two ports, *S*1 and *E*2, are closed. As the piston moves forward, it uncovers the port *E*2. The only effect of this is to bring the full air pressure on two faces of the valve, so that it is balanced and is held to its original position only by the excess pressure through the impact of the entering air at *S*2.

In diagram *B*, the piston has almost completed its stroke, the exhaust port *E*1 is closed, and the air is now being trapped in front of the cylinder and compressed; pressure is thus exerted against the valve in *S*1 and before long the effect of this pressure in conjunction with that of *E*2 overcomes the pressure of the incoming air and throws the valve over. By this time the piston is at the end of the stroke, as in diagram *C*, and an exactly similar cycle for the back stroke is about to begin. The air passages from the valve ports to the cylinder lie in the thicker portion forming the top cylinder wall.

The front head of the cylinder is unusually long and consists of a sleeve or collar outside, a split head inside with a split bushing bearing on the piston. A cup leather held in the bushing serves as packing against air leakage. The inside of the sleeve and the outside of the halves of the head are tapered so that as the sleeve is drawn back by the side rods or through bolts, the head and bushing halves are forced tightly together. The piston ring is of fiber and is in one piece; it is forced out against the cylder wall by a thin leaf spring bent almost to a complete circle.



Ingersoll-Rand's Butterfly-Valve Piston Drill, Sections and Details



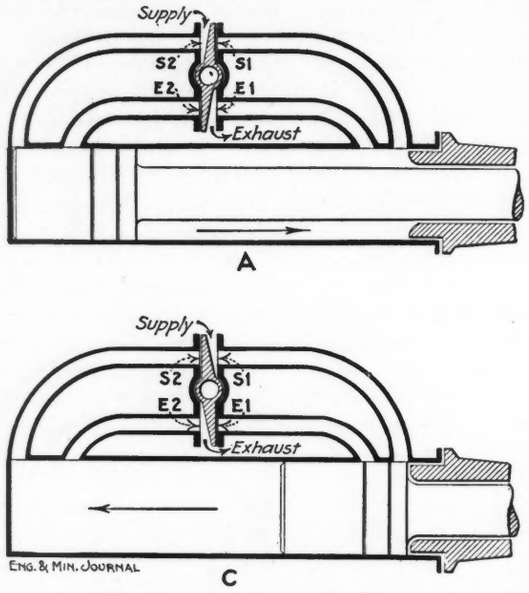
Three styles of chucks are furnished; one consists of the U-bolt loosened and tightened by the nuts on the end; the other consists of the U-bolt with wedge tightening; and in the third style the wedge and the key which bears on the shank of the drill steel are combined in a single piece. The half bushing for the chuck is prevented from turning by lips which engage in slots in the chuck; it is reversible when worn. This type of bushing is designed to take steel of various section and somewhat varying in diameter; octagon or round steel will fit without difficulty.

In the rotation mechanism the rifle bar carries the pawls, and the teeth of the ratchets are cut internally in a ring which remains held by friction between the rotation washer and the back head. The ratchet ring can slip if the torsional stress becomes too great on the rifle bar, and thus the danger of breaking the rifle bar is reduced.

The side rods or through bolts work against two nearly flat, oval leaf springs across the back of the machine,

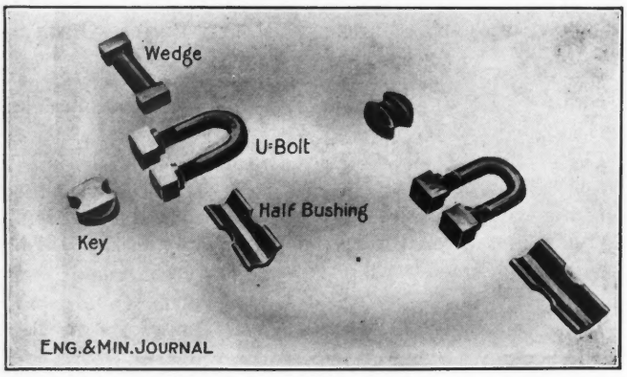
both rods passing through both springs. The effect of this is to equalize the pressure on the two sides, thus preventing either bolt from taking the entire stress of a blow and consequently making breakage less liable.

The shell has adjustable gibs to allow taking up in



ease of wear. The lugs on the cylinder and the guide ways of the shell are right angled. Wear is taken up in either direction by the use of separate shims. The shell rods or studs extend the full length of the shell.

Lubrication is taken care of by a chamber cast in the bottom of the cylinder. An oil hole from the top of the cylinder communicates with this. A port opening upward from the chamber to the cylinder is alternately covered and opened by the piston; it is closed by a spring-actuated ball valve which opens and closes according to whether it is subjected to the full air pressure or to exhaust. A minute quantity of oil is thus sent to the cylinder at each stroke.

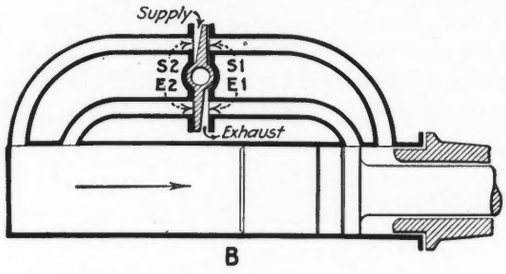


PARTS OF TWO TYPES OF INGERSOLL-RAND CHUCKS

The original butterfly-piston machine has the following dimensions: Cylinder, 2¾ in. in diameter; stroke, 6¼ in.; overall length, 42 in.; weight, 180 lb. Other sizes are now made.

THE SULLIVAN LITEWEIGHT

The Sullivan company makes for mining use two piston drills, the "Liteweight" and the "Hy-Speed," the former equipped with a differential spool valve, the latter with an auxiliary-type spool and tappet valve. Either type can be fitted with hollow piston and hollow steel for cleaning the hole by water and air under pressure. The Liteweight model has a relatively short piston and cylinder.



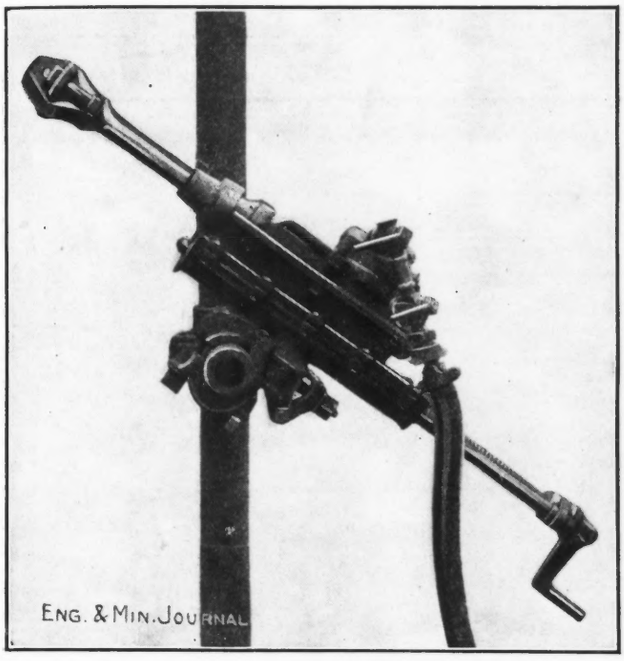
DIAGRAMMATIC REPRESENTATION OF THE BUTTERFLY-VALVE OPERATIONS

The center portion of the piston head is turned smaller and this is always open to exhaust. As the piston reciprocates it alternately covers and uncovers small cross-ports, leading to the ends of the spool valve. These may be thus open to exhaust, open to live air, or closed entirely by the piston head. Differential pressures are thus created which throw the valve. Toward the end of any stroke the piston head opens to live air the cross-ports to the end of the valve chest toward which it is

INGERSOLL-RAND BUTTERFLY-VALVE PISTON MACHINE FRONT HEAD

moving, and opens to exhaust those to the other end. This throws the spool valve in the direction opposite to that in which the piston has been moving and thus opens to exhaust the end of the cylinder formerly receiving live air, and admits live air to the other end, so that the piston reverses its motion. At one point in the stroke, both of the cross-ports may be open to exhaust; this would tend to give an equal pressure in both directions on the spool valve, and a slight excess pressure in the

wrong direction might cause it to leave its seat and flutter. To avoid this the center spool of the three-spool valve is made slightly larger than the end spools, so that there is always a little excess pressure in the right direction, due to the live air passing by. This excess area also tends to delay the throwing of the valve, and the time of reversal is thus controlled by the amount of excess. Furthermore, it compensates for any possible leakage of live air between piston and cylinder into the exhaust area around the center of the piston, which might produce a differential pressure in the wrong direction and throw the valve when not desired. The exhaust from around the central portion of the piston head takes place through a separate opening in the bottom of the cylinder as shown. If it were carried to the same exhaust open-



THE INGERSOLL-RAND BUTTERFLY PISTON MACHINE

ing as that of the cylinder ends, there would be danger that the back pressure might disturb the operation of the valve.

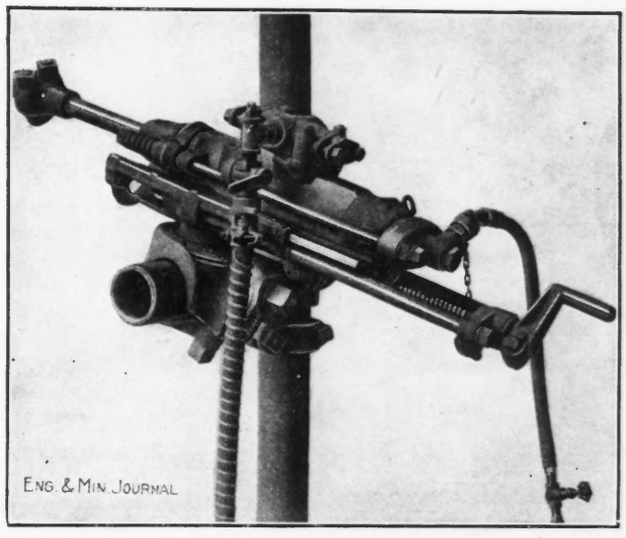
The valve chest is of what is known as the side-rod pattern. Plugs are held in the ends by leaf springs at each end, the springs being kept in action by two small through bolts contained in holes through the chest itself; these holes are lined with seamless steel tubes to prevent air leakage. The shock of the valve striking the end plug and buffers is taken up somewhat by the spring. The buffers are kept tight by bearing against end seats. The valve chest is provided with an exchangeable hardened steel bushing.

The piston rings are in three pieces, held out with circular leaf springs. Annular grooves are cut in the piston head between the piston ring and the smaller central portion, and these are connected with the small section portion by longitudinal grooves. The effect of this is to make the central reduced-section portion actually larger so far as the control of the valve is concerned, but at the same time give sufficient bearing surface on the cylinder wall.

The rifle bar has five flutes; this gives a large amount of bearing surface. The ratchet teeth are cut on the head of the bar and the pawls and springs are carried by the ratchet ring. The bar is extended into a rear bearing in the back head. Between the ratchet head and the cylinder is a collar with the inside corner beveled so that the pressure of blows on the front head transmitted by the side rod to the back head and thus to this collar is given an outward component and does not tend to upset the cylinder inwardly and thus cause the piston to bind.

The ordinary chuck is of the U-bolt type with a key working through a hole in the top of the bushing and a button between the ends of the drill shank and the piston rod. The back end of the bushing is split longitudinally on top to permit the speedy extraction of the chuck. When desired the key or clamp block is made with a flat back and a wedge key is provided to tighten the shank without screwing the bolt nuts. The V-pattern half bushing, which will accommodate almost any style of shank in several sizes, is also furnished, but is not recommended, since it is maintained that the steel, if too large or too small, may be eccentric with the axis of the piston when using this chuck and have a tendency to make the bit bind in the hole.

The front head for air consists of a housing conical inside and out; in this is a bushing split in half and itself containing a bronze lining and a packing ring. The housing is brought back over the end of the cylinder outside with a machined joint which is tight and is designed to decrease the tendency of the cylinder to be cracked



THE SULLIVAN LITEWEIGHT WITH WATER ATTACHMENT

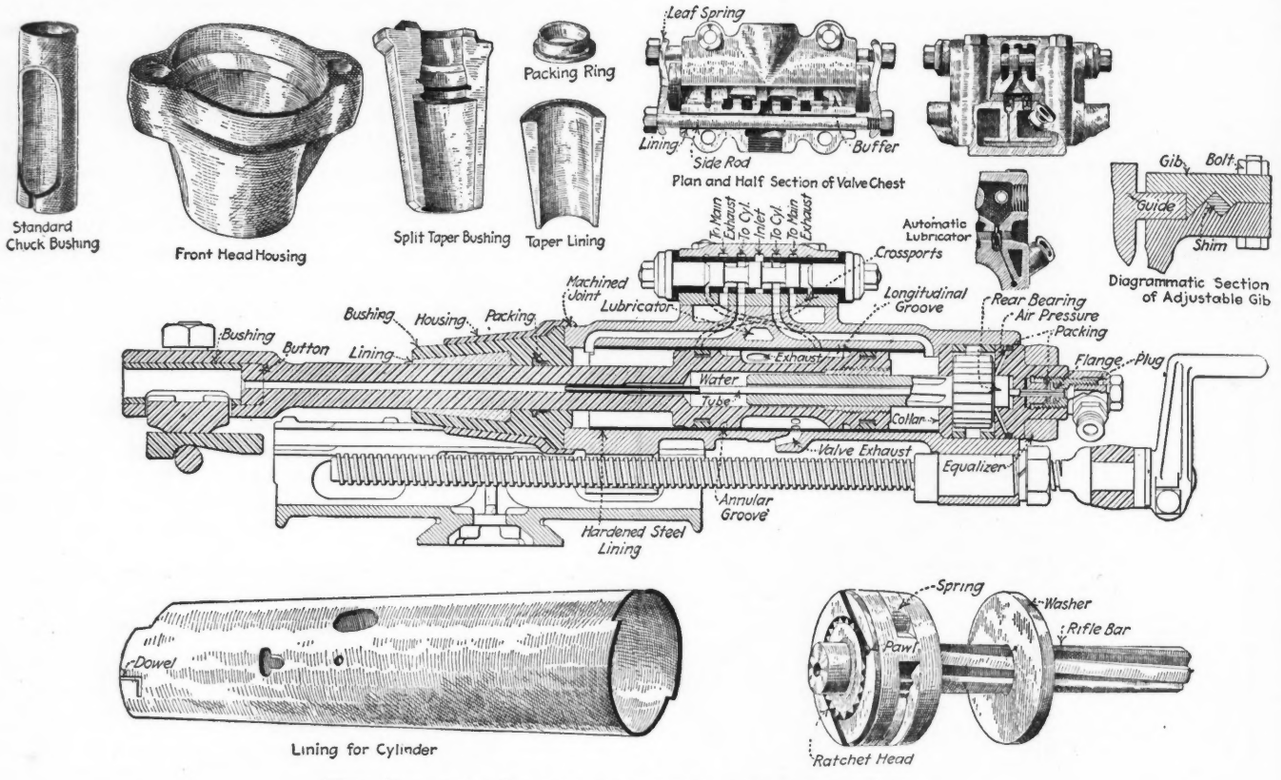
off at this point when the piston rod is subjected to bending. The conical shape of the inside of the bushing and the outside of the bronze lining has the effect of bringing the bushing and lining to a tight fit by the natural vibration of the machine.

An innovation in rock-drill practice is the fact that the cylinder of the Liteweight drill is lined with a hardened-steel shell, which is pressed into the casting and held by slotting the end a short distance in and bending back a small portion as a dowel into a recess of the cylinder casting. This prevents motion of any sort. This lining is said to greatly increase the length and efficiency of service of the cylinder.

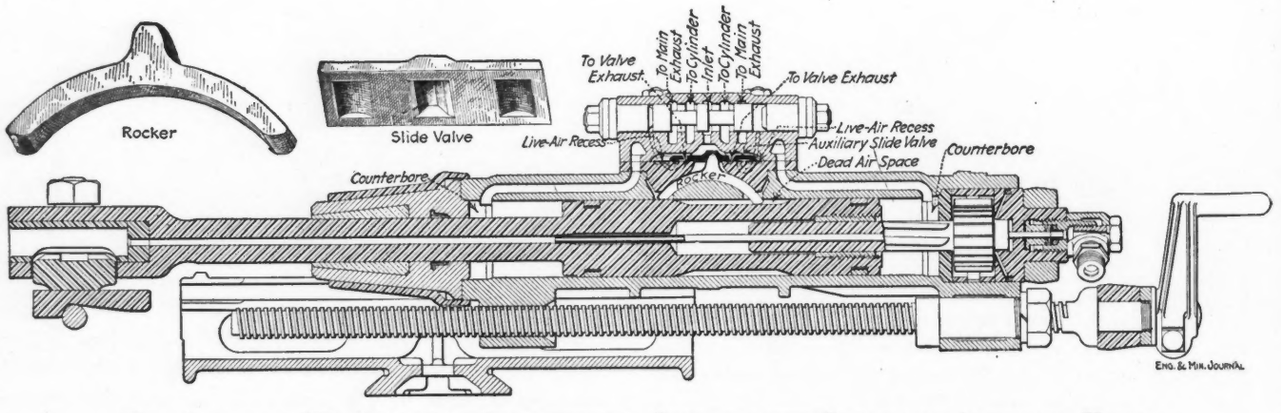
The back head is grooved outside to carry a packing strip in order to prevent leakage; this is held against the cylinder by live air through radial ports. Across the back there is applied an equalizer which consists of a transverse piece having a convex surface bearing on the back head. Its effect is, by rocking somewhat, to take up variations in tension on the two sides. The side-rod springs proper are of the helical type and are applied at the front-head end of the through bolts.

Lubrication is effected automatically by means of a chamber cast in the drill cylinder just below the valve chest and connected thereto. It is constructed as shown in the illustrations. In the oscillations of the spool valve as it passes its middle position, the inlet ports at both sides of the cylinder are shut off for an instant, the pressure in the valve chamber is raised so as to overcome the spring resistance in the right-hand ball valve. This admits a little high-pressure air to the oil chamber. When a cylinder inlet is opened to the valve chamber, pressure falls therein and the left-hand valve opens, allowing a little oil to enter the valve chamber and then be carried to the piston and cylinder.

The shell is regularly of the solid-gib type. A shell with movable gibs is also furnished. These are bolted to the shell body on a bevel joint. By means of various thicknesses of shims introduced as shown, adjustment is obtained along this joint in both lateral and vertical directions.



THE SULLIVAN LITEWEIGHT, ASSEMBLED AND IN DETAIL



THE SULLIVAN "HY-SPEED" IN LONGITUDINAL SECTION WITH DETAILS OF AUXILIARY VALVE

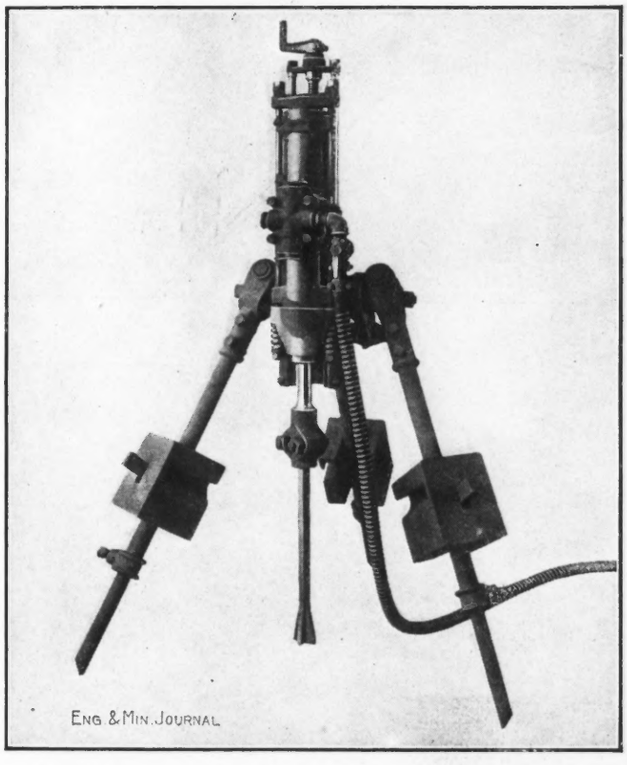
The water attachment is not unlike that used in the familiar Leyner drills. A tube or needle runs through the hollow rotation mechanism and enters the hollow piston rod, so that water is carried to the hollow drill steel. On the back end of the tube a small flange is fastened as shown, and this being set in packing makes a water-tight joint when the plug is screwed down on it.

For down-hole drilling it is found sufficient to clean

the hole with air alone, depending on water poured into the hole outside the drill steel to form a sludge of the cuttings when this is necessary to provide a proper cleaning effect. This is effected by omitting the water connections, but using a hollow piston rod. Live air then passes between the rifle nut and the rifle bar and so gains entrance to the piston rod and hollow steel. This takes place on the down stroke. While live air is thus consumed, it is stated that the additional consumption averages only 10%, being less on long steel than on short. Cylinder diameters are 2⅝, 3¼ and 3⅝ in.; the corresponding strokes are 5¾, 6½ and 7 in., respectively, and the unmounted weights of the three sizes of machine are 162, 295 and 325 pounds.

The Sullivan Hy-Speed

The Sullivan Hy-Speed differs from the Liteweight chiefly in its valve mechanism. A few other points of difference, however, also require attention. The valve



The Sullivan Hy-Speed Mounted on a Tripod

arrangement is of the auxiliary type, the whole mechanism consisting of three moving parts, namely, the rocker, or tappet, the auxiliary slide or "D" valve, and the spool valve proper. The action in general may be described as follows: The bevels or shoulders on the piston, strike and move mechanically the rocker, which in turn moves mechanically the small slide valve; this raises differential air pressures in the spool valve, so that it is thrown and reverses the air feed and exhaust to the ends of the main cylinder. The slide valve is held to its seat by air pressure. The spool valve differs in design from that of the Liteweight, having all three spools of the same diameter. The arc rocker has a central projecting tooth which engages the socket in the bottom of the slide valve as gear teeth engage. The reduced section or spooled diameter of the piston head is a dead air space not open to intake or exhaust, so that there is no leakage taking place past the spool valve; furthermore, the live air from either end of the cylinder, in order to escape, must pass both sets of piston rings, so that leakage from this source is reduced to a minimum, on the principle of the labyrinth passage. Furthermore, the space acts as an accumulator of oil and aids lubrication.

The small slide valve works in a valve chest which is in permanent communication with live air through two recessses at the ends of the seat. Of the four ports in the seat, one in each side leads to exhaust and the other to an end of the spool-valve chest. As shown, live air is entering from the main valve inlet, passing over the right end of the slide valve into the recess, which is put into communication with the port to the right end of the spool valve; this latter is consequently held to the left. The slide valve in this position puts the left end of the spool valve in communication with exhaust. When the right bevel shoulder on the piston strikes the depressed end of the tappet, the slide valve will be thrown to the left, putting the air port to the left end of the spool-valve chest in communication with live air and the other in communication with exhaust air, and thus throwing the spool valve and reversing the direction of motion in the piston. The exhaust of the spool valve is independent of the main cylinder exhaust.

The cylinder of the Hy-Speed is not lined, but it is hardened to a glass-smooth finish. The ends are counterbored, a feature which presents two advantages; in the first place, it permits reboring of cylinders that may become worn out of true, so that it will take a new piston and will fit the old front- and back-head. It also tends to prevent upsetting and binding of the piston, besides providing a means for equalizing the inlet air pressure against the piston rings.

The piston has its ends reduced in section so that it will not strike the head and become upset, binding the rings and sticking in the cylinder. This is also true of the Liteweight piston.

The position of the bevels on the piston head determines the time of reverse and for hard rock a later reverse and a harder blow are made possible by changing the position of these bevels.

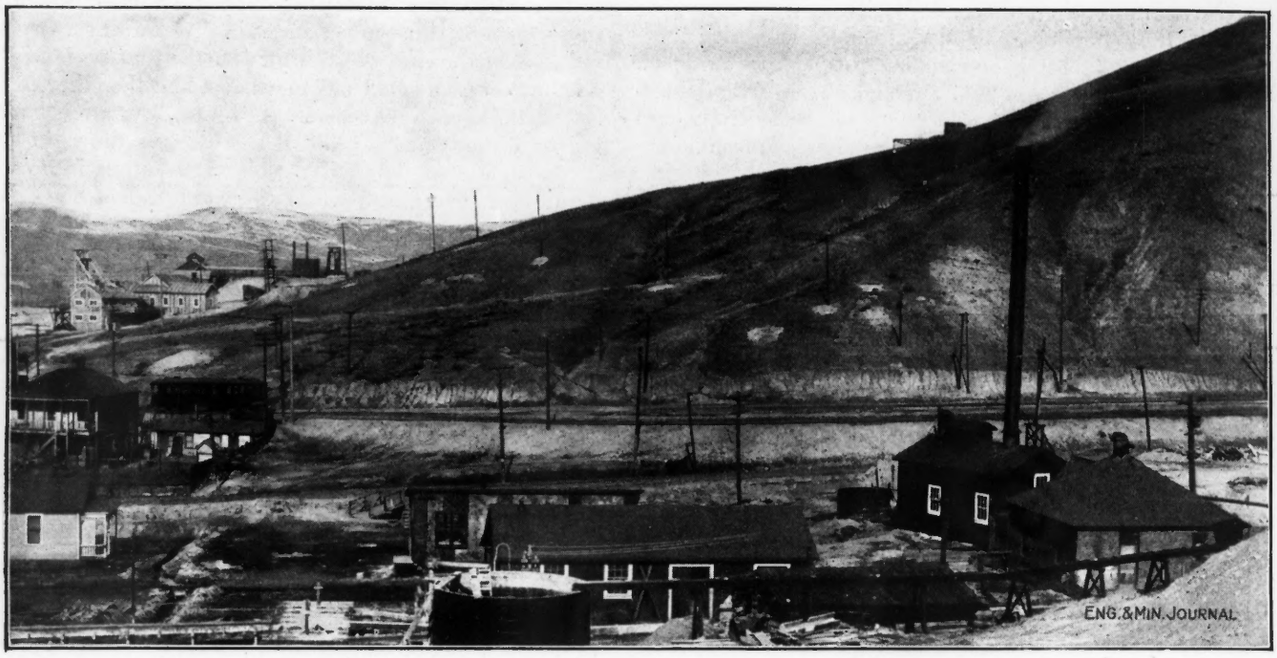
In other respects, the machine is made like the Liteweight. The Hy-Speed is made with cylinder diameters of 2¾, 3, 3¼, 3⅝ and 4¼ in.; the corresponding strokes are 5½, 6, 6½, 7 and 7¾ in.; and the weights unmounted are 250, 275, 330, 380 and 640 pounds.

(*To be continued*)

Argentine Mineral Exports

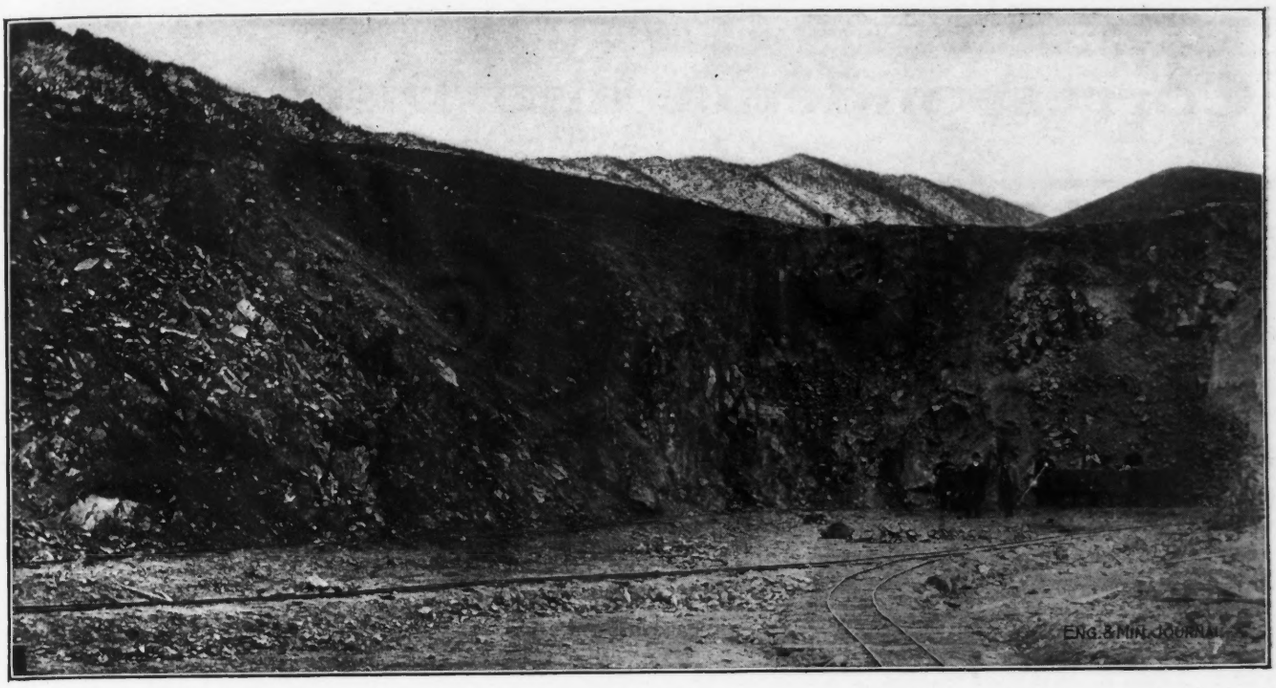
A U. S. consular report from Rosario, Argentina, says that the principal mineral exported from that district at present is wolfram. Exports from Rosario amounted to 637 tons in 1912, and 539 tons in 1913. This is exported by the Hansa Sociedad de Minas, a Germany company, which disposes of its output in Germany. It is not known whether any wolfram will be available for the American market. The subject is being investigated. Rosario also exports small quantities of borate of lime to Germany and Belgium. Exports have been small recently. Considerable quantities of copper ore and ingots were exported formerly, but since the closing of the Famatina mine in the spring of 1913, shipments have ceased.

Photographs from the Field

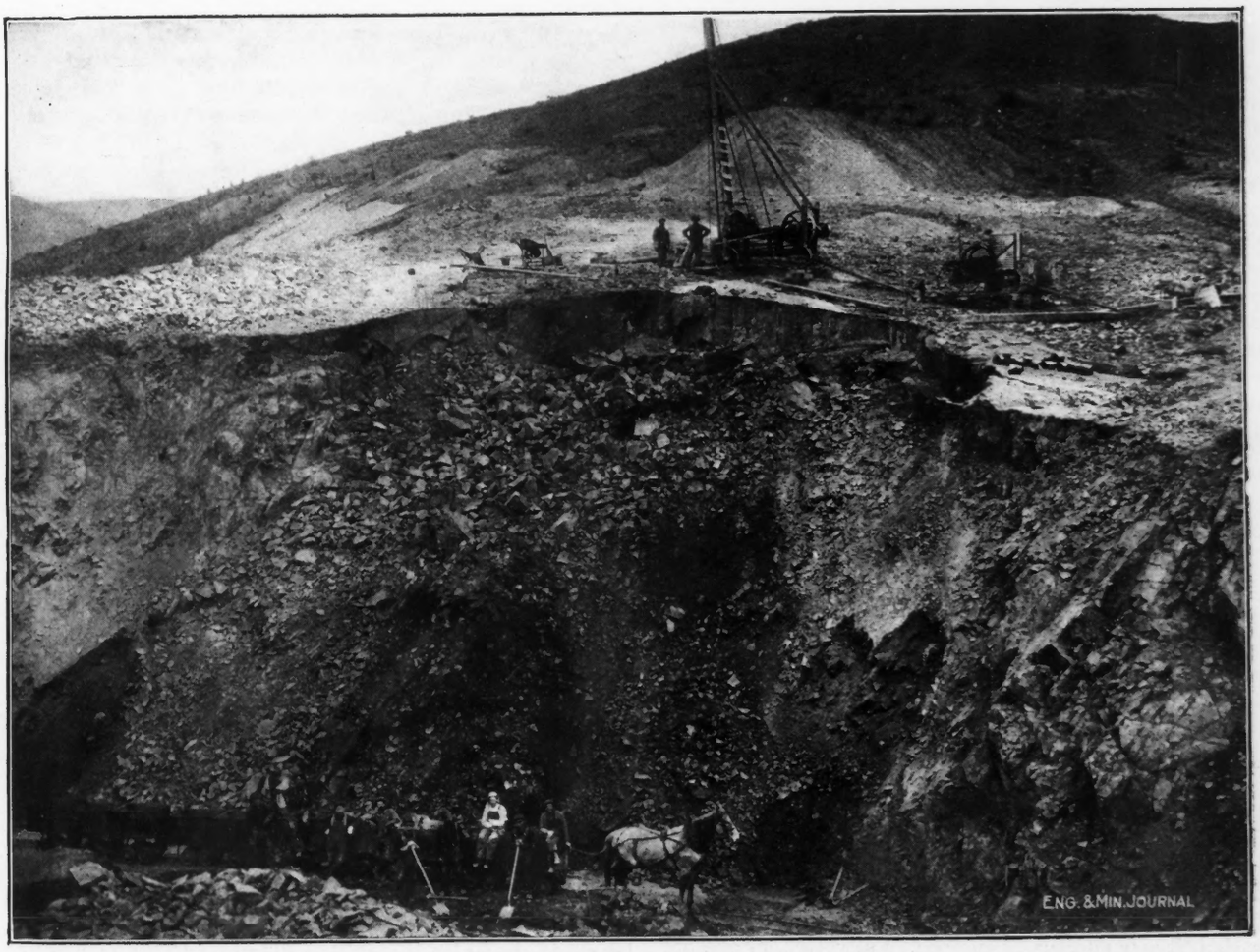


Montgomery shaft and buildings on far side of track.

The plant under construction.
BUTTE DULUTH MINING CO., BUTTE, MONT.



Opencut pit.



Putting down shot holes in opencut pit.

BUTTE DULUTH MINING CO.

Correspondence and Discussion

Ore Treatment at the Argo Mill

In the JOURNAL of Aug. 22, A. H. Roller has seen fit to characterize as incorrect several statements made by me in a previous article. I wish to say that there are no mis-statements or exaggerations in that article. The statistics appearing therein were compiled from the office records, which are still available.

We do not begrudge Mr. Roller any credit due to him "For having taken off the rough edges," but we do sincerely resent the implication that the mill was brought by him to its present state of efficiency just on the eve of change of management.

JACKSON A. PEARCE.

Idaho Springs, Colo., Aug. 29, 1914.

The Burt Revolving Pressure Filter

Referring to our article in the JOURNAL of June 13, I should like to call attention to the following errors:

On the power diagram, Fig. 1, p. 1185, the following footnote was left off: "Discharge of rotary filter, showing peak load portion while six presses and pump are running." Without this note it appears that one filter takes 30 hp., instead of the six filters and one pump. A test on one filter alone showed a consumption of 3.7 hp. when running under normal conditions.

On p. 1189, line 9, an omission occurred. It should read: "Formerly it was the custom to acid-wash the mats while in the filter, and change only those which were worn through. Due to the acid solution falling on the cement floor, which always has a thick coating of lime salts, the acid consumption was high."

Owing to the disturbed conditions in Mexico and being unable to get at my papers, it has been impossible until now to call attention to these errors.

A. B. MYERS.

El Oro, Mexico, Sept. 26, 1914.

The Davey Mine Cave

I have just read an account of the cave-in at the Davey mines of the American Zinc, Lead & Smelting Co., Carterville, Mo., in the JOURNAL of Oct. 10. This article is a trifle sensational. The statement as to the area caved is correct. Owing to the geological formation, however, there was absolutely no danger of large loss of life. In fact, not a man was in a dangerous spot except the tub hookers, who were exposed to 1x12-in. boards falling in the shaft.

The area caved was overlaid by a "soft-ground" formation, which developed a weak spot, causing the caving. Most of the area mined is covered by 200 ft. of unbroken limestone. As soon as the caving ground reached this formation, it was effectually stopped. Fully 15% of the ore is left in pillars under the area in which men were working.

The mine is now operating at full capacity and the total cost of putting it into operating shape after the caving has not exceeded $4000. Anyone likes to make a good story of a bit of news, but we wish to go on record as contradicting the opening sentence of your article. All men were moved from the danger zone three days before the cave-in occurred.

J. H. POLHEMUS, Manager of Mines,
American Zinc, Lead & Smelting Co.

Carterville, Mo., Oct. 13, 1914.

Reversing Rope on Single-Drum Hoist

I note in the JOURNAL of Sept. 5 an article by R. S. Schultz, Jr., giving a method for reversing a rope on a single-drum hoist. I think there is a much easier way than that to change ends with a wire rope that is no longer than 2000 to 4000 ft., provided there is a space about 50 ft. square available outside of the engine house or shaft house. The method consists of starting a coil about 10 or 15 ft. in diameter and continuing coiling, working toward the outside until the rope is all off the drum; it is easy to lay three coils to a foot. With the rope off the drum, all that is necessary is to cut the socket end from the rope, fasten the socket to the other end, which will be at the outside of the coil, fasten the inside end to the drum and wind it up.

JOSEPH HOCKING.

Osceola, Mich., Sept. 28, 1914.

Company Stores

In John T. Fuller's article in the JOURNAL of Sept. 26, 1914, I note in regard to the De Beers compounds, that "no profit is made by the company's stores in the compounds. Everything is sold at cost." I have seen the same thing done in the Southwest, and it was cheaper to pay freight on retail lots of goods from Denver than to buy at the company store. Of course, De Beers may be different, but I wish we could get a Kafir's view on the question.

A. A. NASON.

New York, Oct. 5, 1914.

Clearing Dredge Buckets with a Monitor

Referring to the note under the above heading on p. 491 of the JOURNAL, Sept. 12, 1914, it may interest some of your readers to know that our suggestion to the Natomas company to use high-pressure jets of water for this duty, was based on our successful earlier application of the same principle to the clearing of elevator buckets. A small jet will dislodge the contents of a tightly packed bucket provided the pressure of the water be high enough.

ELMORE & ELMORE.

London, Eng., Oct. 7, 1914.

Imports and Exports of Lead

The exports of pig lead from the United States for the eight months ended Aug. 31 this year reached a total of 92,675,281 lb., an increase over 1913 of 17,613,323 lb., or 23.5%. This year, however, 78.5% of the total exports were of domestic lead; in 1913 and in previous years they were almost entirely of foreign lead imported in ores or base bullion and smelted or refined here. The exports of domestic lead had been almost a negligible quantity and had been confined to a small quantity of manufactures—pipe, sheets, etc.—sent chiefly to adjacent countries. The metal imported in ore and bullion has been chiefly from Mexico.

The exports of domestic lead reported were as follows for the eight months ended Aug. 31, in pounds:

	1913	1914	Changes
Six months to June 30	.....	40,323,662	I. 40,323,662
July	.....	21,787,779	I. 21,787,779
August	.....	10,651,551	I. 10,651,551
Total eight mos.	.....	72,768,992	I. 72,768,992
Add re-exports of foreign	75,061,958	19,906,289	D.55,155,669
Total exports	75,061,958	92,675,281	I. 17,613,323

The exports of domestic lead reported in the first half-year were all made in the four months Mareh-June, inclusive. The destination of the exports is not given in detail, but the general statement is that about one-half were to Germany, one-third to Great Britain and the rest to other European countries.

The imports of lead for the eight months ended Aug. 31 for two years have been as below, in pounds:

Imports of lead:	1913	1914	Changes
In lead ore	12,248,718	20,198,304	I. 7,950,086
In other ore	2,324,676	.....	D. 2,324,676
In base bullion, etc.	80,066,264	10,838,653	D.69,227,611
Pigs, bars, etc.	73,200	232,461	I. 159,261
Total imports	94,712,858	31,269,918	D.63,442,940
Re-exports of foreign lead	75,061,958	19,906,289	D.55,155,669
Net imports	19,650,900	11,363,629	D. 8,287,271

In 1913 the imports had already shown a drop from the previous year, when they were 123,190,379 lb. for the eight months. Of the imports this year 21,343,743 lb. were from Mexico, against 83,151,233 lb. for the eight months in 1913. Of the imports in 1913 there was 79.2% exported, but this year the proportion was only 63.7% of the smaller imports. The decrease in imports was wholly in lead contents of base bullion, lead in ore showing an increase.

St. Joseph Lead Co. Curtails

The St. Joseph Lead Co. issued the following statement on Oct. 19:

The country-wide depression in business, evidenced in the lead industry by a price, since Jan. 1, 1914, lower than in many years, has been further accentuated by the catastrophe of a world war.

In the early weeks of August, it was hoped that the lead industry might escape serious interruption. During the last six weeks however, it has been impossible for the St. Joseph Lead Co. to sell its product, even at the low prices prevailing, so that it has been accumulating a stock of unsold lead. As other companies are in a like position, it becomes evident that the production of lead is now exceeding the country's requirements.

The directors of the St. Joseph Lead Co. and the Doe Run Lead Co., fully realizing the hardship such a course will impose on the district, feel constrained for the present to reduce the company's output 25%. Instead of closing one-quarter of the plant, which for the company would be the easiest and cheapest method of reduction, but which would unevenly distribute the burden on the communities, it has been decided to run five days a week, instead of six, at all mines except No. 9 Doe Run and No. 11 Hunt's, which will be closed entirely.

The Bonne Terre mill will be closed temporarily, the St. Joseph Lead Co. having leased from the Doe Run Lead Co. two sections of its No. 3 mill, to handle the Bonne Terre ore. It will operate these sections by men taken from the Bonne Terre mill. The Rivermines Power Plant will be closed.

So far as possible married men will be given a preferenee in employment.

The New Strike at the Magma

The Magma Copper Co. has made an important strike on the 1000-ft. level of its Magma mine (formerly the Queen mine) at Superior, Ariz. About three years ago the Magma started development of the Queen vein below the 500-ft. level. The old shaft was continued down to the 800-ft. level and crosscuts were run north at the 650-ft. and 800-ft. levels to the vein, developing several rich copper oreshoots. The best showing was on the 800-ft., where a shoot 345 ft. long was found averaging 6.8 ft. in width and running copper 12%, silver 14 oz. The smelter returns on 9614 tons, made largely from development work, netted $468,245, an average of $47.22 per ton. In making these shipments, about 24,000 tons of ore, containing 5% of copper and 5 oz. of silver, was placed on the dump.

A winze was sunk from the 800-ft. level to the 1000-ft., and at the point where it was crosscut the vein was found to be 60 ft. wide and to contain a high-grade copper shoot, a high-grade zinc shoot and a large amount of low-grade copper ore carrying varying amounts of silver and gold. Drifting on the high-grade copper shoot has shown it to be 150 ft. long (with both east and west faces still in high-grade ore), and to contain copper 20%, silver 19.5 oz. and a fair amount of gold for the full width of the drift. Heretofore the best oreshoots have been found in the fissure along the quartzite-limestone contact, but the 1000-ft. shoot is entirely in the diabase which underlies the sedimentary rocks.

A 150-ton concentrating mill has been in operation several months and good recoveries are being made. Electric power for mine and mill is obtained from the Roosevelt dam.

The product is still being hauled 32 miles by team to Florence, a station on the Arizona Eastern R.R., but it is intended to construct in the near future a narrow-gage road from Superior to Webster, and it is expected that this road will reduce haulage costs about $6 per ton of product.

The equipment of a new working shaft is contemplated, as the present development shaft is too small and the equipment too light to handle the tonnage now available.

Boston & Corbin

The report of the Boston & Corbin Mining Co., Butte, Mont., for the year ended July 31, 1914, states that with the available tonnage in sight in the Bertha mine of 10,712 tons, with the knowledge that there is nothing in the working of the mine that might lead one to expect better results as to values or tonnages; with the cost of mining and milling remaining practically the same, there was no use in continuing operations.

The mine has been closed and some negotiations have been carried on for the purchase of adjoining property, but nothing definite has been accomplished. The company now has $51,713 in cash and loans secured by collateral.

Editorials

Coal-Dust Firing in Copper Smelting

The combustion of coal in dust form, instead of in lump form on a grate or in gas form from a preliminary combustion in a producer, has long been a very attractive subject. The combustion of coal gas is so great an improvement over the direct combustion of coal, because of the reduced quantity of air required, the less proportion of unburned carbon, etc., that the advantages of gas firing outweigh the losses experienced in the preliminary combustion in the producer. Now when coal reduced to exceeding fineness is blown into a hot chamber, combustion occurs almost instantaneously and almost completely, the fine coal dust in suspension behaving practically like a gas. Coal-dust firing consequently offers about all of the advantages of gas firing without its disadvantages.

In the cement industry of eastern Pennsylvania, and elsewhere, coal-dust firing has been in successful use for a good many years. In metallurgy, on the other hand, it has been repeatedly tried, but while there has been promise of success, there have been difficulties which have delayed a regular use of the system until lately. In reviewing some work that was going on at the Washoe plant at Anaconda last April, we made the following remarks:

> An interesting experiment is about to be tried in the smelting works, viz., the firing of one of the reverberatory furnaces with coal dust. This is no new idea. Some years ago it was tried by Mr. Sörensen at the Highland Boy works in Utah, and later by Mr. Shelby at Cananea. At neither of those plants was it successful. Mr. Shelby experienced trouble especially from the ash of the coal, which blanketed the slag in the furnace, choked up the throat, etc. Recently, however, coal-dust firing has been applied to a reverberatory furnace by the Canadian Copper Co., at Copper Cliff, Ont., with great success, it is reported, from the standpoint of fuel economy.
>
> There are, therefore, the above precedents for the experiment at Anaconda. As to the fuel economy of this method of combustion there is no question. That has been demonstrated in cement burning in which it has become the standard practice in the Lehigh Valley. In copper-smelting practice the doubt attaches to the accompanying metallurgical effects. Mr. Mathewson and Mr. Laist think that the previous failures were probably due to the imperfect way of doing the thing, especially the failure to pulverize the coal sufficiently fine. Consequently at Anaconda arrangements are being made to grind the coal excessively fine. This seems to be logical. If the coal ash produced in the furnace be so fine that the draft will keep it moving and carry it out of the chimney there ought not to be much trouble from it. Anyway, that is reckoned upon. Not even are the waste-heat boilers to be removed. The coal dust will be blown directly into the firebox end of the furnace. If the expected results are realized the present coal consumption of about 20% may be reduced to something like 15%, basing this upon the Copper Cliff experience.

In this issue of the JOURNAL we present a contribution by Mr. Mathewson, stating the consummation of the experiments that were inaugurated last April. It is quite unnecessary for us to repeat here anything that Mr. Mathewson has said in his article. It is evident that the Anaconda metallurgists have once more achieved a brilliant success, the percentage of coal consumption having been less than 14%, and it is certain that the new path that has been mapped out by David H. Browne at Copper Cliff, Ont., by W. D. Leonard, at Garfield, and by Mr. Mathewson and Mr. Laist at Anaconda, will lead to a further great economy in the metallurgy of copper. Indeed, this is the most important thing that has happened since the successful introduction of the basic converter. It is, perhaps, not too much to expect that the economy of the reverberatory furnace with the new system of firing will finally settle in favor of the reverberatory the old contest between the reverberatory and the blast furnace.

Steel-Trade Conditions

Conditions in the iron and steel trades do not at present seem to improve, though they are hardly as bad as some people try to believe. The base of the industry, the production of pig iron, if followed through the year, shows that the sharp decline at the close of 1913 brought the make down to the rate of about 23,000,000 tons a year. From that it gained gradually until March and April, when a maximum was reached with production at the rate of about 28,500,000 tons. A rather sharp decline from that point was followed by three months of uncertainty, and in September we find that the output was at the rate of 22,800,000 tons yearly, or only a trifle below that of January. The loss in production in the past two months has been rather among the merchant furnaces than the steelworks stacks, so that it is fair to assume that the make of steel is now about where it started at the opening of the year.

Other observation agrees with this indication and there is more dullness in the foundry and other outside trades, than in the finished-steel business. Just at present affairs are not improving, and there are some indications that October and November will show smaller production again—possibly December also; so that the year may show a total not much over 23,000,000 tons; which is still a pretty substantial output. On the analogy of recent years the steel make should be about the same, or a little more than that of pig iron.

The depression of the earlier part of the year has been discussed on various theories, and it is not easy to make a choice of any one of them. The simplest and probably the most nearly correct is that it was largely due to a reaction from overproduction and expansion in the previous two years and a diminution of purchasing power, resulting from moderate crops.

It is no use, however, to get into this discussion now. The present position is plain enough; it is, of course, due to the general financial disorganization caused by the European war. It is useless to urge that our own position is strong, our crops large and other conditions good; as long as our chief foreign customers are stopped from trading with us to a large extent the result must be felt. The effect on sentiment is probably even greater than in reality, but the end is the same. There is no disposition to

risk commitments for the future, and buying is necessarily limited to present needs, or to provision for the immediate future.

At the first outbreak of war we heard on many sides that there was a probability of a great demand for our steel from abroad; but it must be evident that this expectation was exaggerated. It must be remembered that while the demand for steel may be stimulated in certain special lines during a great war, it must be cut off in other and more important lines. And this would be the case even without taking into account the general disorganization of business and the temporary loss of purchasing power of a large part of the people. It was expected, for instance, that England would turn to our mills for most of the billets and other half-finished steel which has been bought from Belgium and Germany. But the demand for this material has been greatly diminished, because no one is buying building or construction material that is not absolutely needed. And there are other such instances. Production is reduced, but consumption is also cut down, even to a greater extent.

As to production, the iron and steel trade of Belgium is absolutely extinguished for the present and that of France seriously crippled. In Germany the industry is practically stopped in Lorraine and Luxemburg, and also in Silesia; in Westphalia and the Rhine districts it must be to some extent crippled by the loss of men and by short supplies of iron ore. In England there is less disturbance, and England also is able to carry on its foreign trade with comparatively little interference, while that of Germany is practically cut off.

The expansion of our foreign trade is dependent, not upon the nations now at war, but upon the other countries which have been buying from those nations. Efforts are now being made to extend business, but the results remain to be seen, and in any event they will be slow. The present revival of the iron trade depends upon the conditions of business and financial readjustment at home. How far that can progress with the larger part of the commercial world in a turmoil, it is not easy to say; we can only hope it will not be too long delayed.

The Manufacture of Zinc Dust

One of our metal industries that has been improved by the war is the manufacture of zinc dust or blue powder, which is used as a precipitant of gold and silver from cyanide solutions, in the process of sherardizing (coating iron and steel with zinc), and in the dye industry. Zinc dust is a byproduct of the zinc smelter, but only two American smelters have heretofore been engaged in producing it in commercial form. They have turned out 400 to 500 tons per annum, while we have been importing from European smelters at the rate of 2300 to 2400 tons per annum.

Before the war zinc dust was worth about 6c. per lb. Now it is about 15c. per lb. It is consequently much more profitable for the zinc smelter to make zinc dust than to make spelter. This has led the New Jersey Zinc Co. to resume the manufacture of zinc dust at Palmerton, and other smelters may do the same thing with the probable result of bringing the price down nearly to where it was in ante-bellum days.

The reason why this business has heretofore been left chiefly to the Belgian and German smelters is that the blue powder which can most easily be put in commercial form is that which is collected in the prolongs. Now, European smelters commonly use prolongs and American smelters do not, labor being relatively cheap in Europe and dear in the United States. Although the increased recovery of zinc by the use of prolongs may be as much as 2.5% of the zinc in the ore smelted, it is considered in this country that there is no gain in dollars and cents with normal conditions.

However, a smelting furnace may be run with such condensers as to produce chiefly blue powder, which we believe is done at Palmerton by means of the Convers & De Saulles apparatus. Also, blue powder may be readily made with an electric furnace, but unless special precautions be taken it will be too low in metallic zinc to be commercial. The chief criterion of blue powder is its percentage of unoxidized, metallic zinc.

Lead and Zinc Declines Halted

Some of the lead producers have at last read the signs of the times. The St. Joseph Lead Co., the largest individual producer, on Oct. 19, announced a curtailment of 25% in its output. This is frankly stated to be on account of the increasing accumulation of its stock of unsold lead. Desloge, another Missouri producer, has also curtailed. The chief producers of the Coeur d'Alene had previously made a curtailment estimated to be equivalent to 3500 tons of lead per month. The Hercules mine of that district has reduced its output 50%, and the Morning is shut down.

There is also to be a curtailment in the production of zinc ore, the Butte & Superior, the largest producer of ore used for spelter, having suspended production on Oct. 17. The reason assigned for this was the necessity of retimbering the shaft. It has been understood for some time back that that work would have to be done. Evidently the management decided, correctly, that the present is an auspicious time. The news of this checking of the production of zinc ore immediately had a favorable effect upon the price for spelter.

The Election in Mexico

We think that the current conferences at Aguascalientes are about the nearest that the Mexicans will come to having a free and fair election. The means whereby the Mexican knows how to express his wishes is not a paper ballot. It is a rifle. The campaigning is not done on the platform. It is done in the field. That is what has been going on in Mexico in recent times. The campaigning having been completed, the captains meet at Aguascalientes on the basis of one vote per thousand rifles. It does not matter what steps are taken to conform to the letter of the Constitution by first electing a provisional president and later a permanent one. The real election is about to take place at Aguascalientes.

Unfortunately, Mexican minorities have not yet learned to bow to defeat and go to work until the time for another election comes around. Consequently, the opposition may be expected to express itself through the operations of many honest bandits who are the captains of hundreds. Except for disorders in outlying regions, however, we are inclined to be optimistic respecting an improvement of conditions in Mexico. The people of that country can hardy indulge in perpetual fighting. They must pause to do some work to feed and clothe themselves.

PERSONALS

Gelasio Caetani sailed for Italy, his native country, last week, and probably will remain there for some time to come.

Ralph W. Deacon and J. H. Polhemus have been elected to membership in the Mining & Metallurgical Society of America.

Guilford D. Scholl, who has completed his engagement with the Electrolytic Refining Co. of Australia, has returned to America.

Hon. W. H. Hearst, minister of Lands, Forests and Mines for Ontario, has been appointed Premier of the Province in place of the late Sir James Whitney.

C. Schnell, of Paterson, N. J., is in Kingston, Ont., in connection with a project for the establishment of a plant for the manufacture of potash from feldspar.

Dr. F. S. Pearson, of London, England, was in Toronto recently in connection with large Mexican enterprises, in which he is associated with Canadian financiers.

Dr. W. H. Ellis has been appointed acting dean of the Faculty of Applied Science, University of Toronto, pending the appointment of a successor to the late Dr. John Galbraith.

J. B. Tyrrell, of Toronto, has returned from an inspection of the Beaver Lake gold area in Saskatchewan, which has satisfied him that gold occurs in sufficient quantities to warrant thorough exploration.

Franklin Joslin, of Fairbanks, Alaska, was injured recently in a railroad wreck near Grand Junction, Colo. He was on his way home from Washington. His injuries are not dangerous, but may detain him in the hospital for a time.

Capt. J. H. Hodgson, superintendent of the Copper Queen mines at Bisbee, Ariz., for Phelps, Dodge & Co., and Chas. A. Mitke, ventilation engineer for the same company, have been looking over the Michigan iron and copper districts for several weeks.

Dr. David T. Day has resigned from the U. S. Geological Survey in order to engage in private practice. Dr. Day has been connected with the Survey for upward of 30 years, being for a long time in charge of its division of mineral statistics. In recent years he has been its expert upon the technology of petroleum, which will be his specialty in private practice.

Edward E. Free has withdrawn from the firm of Gould, Free & Ash, chemical engineers, San Francisco, and will reenter Johns Hopkins University as a student in scientific research. Mr. Free for some time prior to his connection with Gould & Ash was in the service of the Department of Agriculture investigating potash deposits in Nevada. Ralph A. Gould and Charles S. Ash will continue the business under the firm name of Gould & Ash, at 319 Monadnock Building, San Francisco.

OBITUARY

Albert W. Mix died at Boulder, Colo., Oct. 15, aged 58 years. He was born in Indiana, but had lived in Colorado for 35 years. He had owned and operated a number of mines in Boulder and Gilpin Counties. Recently he had been operating two mines near Sunshine. He leaves a widow and one daughter.

Otho E. Youtsey, of Denver, who had just accepted a position as electrical engineer with the Portland Gold Mining Co., died, Oct. 15, of typhoid fever, in Victor, Colo. He received his technical education in the Universities of California and Colorado and was a member of Phi Delta Theta and the Colorado Electric Club.

John Wesley Boileau, geologist and expert in coal lands, died at his home in Pittsburgh, Oct. 7, from a self-inflicted wound. He was injured in an accident some time ago and had since been melancholy. Mr. Boileau came into prominence several years ago when he instituted proceedings before the Interstate Commerce Commission which resulted in a reduction of 10c. per ton in the coal freight rates between the Pittsburgh district and Lake ports. He was joined in the suit by the Pittsburgh Coal Co. and other interests, but he prepared the great mass of data, with original maps and charts. To his efforts was largely due the fact that the testing station of the United States Bureau of Mines was located in Pittsburgh. He made an endeavor to unite all the operators in the Connellsville coke region, which was not successful. He was a member of the Duquesne Club, Oakmont Country Club, Pittsburgh Country Club, Engineers' Society of Western Pennsylvania and other organizations. He leaves a widow and two sons.

SOCIETIES

University of Wisconsin—In memory of the late Frederick E. Woodbury of Milwaukee, general manager of the Newport Mining Co., that Gogebic range corporation has established at the University of Wisconsin a scholarship in geology and mining engineering. The first beneficiary is Arthur Peterson, an Ironwood, Mich., young man who had been connected with the Newport engineering department. Mr. Woodbury was accidentally killed in the Newport mine last winter.

American Institute of Mining Engineers—The Utah branch met, Oct. 10, at the Commercial Club, Salt Lake City, for the election of officers. George W. Riter presided at the meeting, at which 36 members were present. Officers were elected as follows: Robert C. Gemmell, president; C. W. Whitley, vice-president; E. Gayford, secretary and treasurer. These will choose two other members to form with them an executive committee, which will outline the plan of the work for the coming year.

Mining & Metallurgical Society—The New York section met at the Engineers' Club, New York, Oct. 15, about 30 attending. B. F. Tillson, superintendent of the Franklin mine of the New Jersey Zinc Co., read a paper about the prevention of accidents in that mine, which will rank among the most important contributions upon this subject. His paper will appear in the Society's bulletin. Louis Ruhl, of the Roessler & Hasslacher Chemical Co., made some remarks about the cyanide situation. Sidney J. Jennings and W. W. Mein presented papers upon the sampling of mines of low-grade gold ore. Each of these papers led to lively discussion.

Teknik Club—At the regular monthly meeting in Denver, Oct. 13, the members heard an address by Dr. Lucien I. Blake, who founded the club five years ago. He gave a most interesting account of the activities of the Royal Institution, London, whose meetings he has attended regularly during his life in that city. He closed his address with the suggestion that the members of the Teknik Club undertake the individual instruction of young boys who evince scientific tendencies and thus stimulate them to efforts along lines that ordinary technical education does not. The plea was well taken and it will probably bear results. Not being content with this talk, the members of the club prevailed upon Dr. Blake to rise again and to explain the discovery and research that has evolved the system of submarine signaling with which his name is connected.

Colorado Scientific Society—This society has moved its headquarters from the Boston Building to the third floor of the beautiful new State Museum Building on the Capitol grounds, Denver. These quarters were permanently donated by the State to the society through the efforts of Franklin R. Guiterman and Otto Mears. This commodious suite will permit a better arrangement of the library and display of scientific collections than has heretofore been possible. The first monthly meeting in the new rooms was held Oct. 3, and was addressed by Prof Junius Henderson, of the University of Colorado and the State Geological Survey, on "Recent Progress in Colorado Paleontology and Stratigraphy." Prof. George Cannon, veteran geology instructor in the East Denver High School, spoke reminiscently on the discoveries of fossils at Morrison, Colo., years ago, and exhibited a number of specimens.

Colorado Metal Mining Association—The Denver County chapter of the state association recently held two meetings to consider measures that are to be brought before the coming session of the state legislature. The first meeting discussed systems of taxation that might prove more equitable. Since the enactment of the law by the last legislature fixing the valuation of mining properties for assessment purposes at one-half of the gross proceeds plus all the net proceeds, important suits have been won by mining companies at Cripple Creek who protested against taxes thus assessed by the local authority; and similar action is about to be instituted by leading operators of the Breckenridge district. Several plans for assessing mining property were discussed at the meeting, it being the general opinion that differing rates should apply to undeveloped claims, to idle mining properties and to active mines. The second meeting, held Oct. 15, took up the questions of proper width for lode claims, the pollution of streams by placering and mill tails, proposed federal leasing systems, and a more decided financial

support to the state geological survey, state bureau of mines and the school of mines. These topics were discussed primarily to inform the legislative committee as to the desires of their fellow members. Strong opposition was expressed relative to proposed federal legislation aiming to discontinue the outright sale of mineral lands and to substitute sweeping leasing systems. While this proposition has not, as yet, been applied to the metal-bearing lands, it is felt that such application must ultimately occur if the government carries through its policy with regard to the coal and non-metallic lands.

California State Mining Bureau—Recent changes in the State Mining Bureau have been necessitated by the resignation of E. S. Boalich, statistician, and the death of E. B. Preston, determinative mineralogist. Mr. Boalich, who has been with the Bureau for about two years, resigned his position in the middle of September and left San Francisco for Washington, D. C., where he will be engaged in the Bureau of Mines as mine statistician; he was for some time prior to his connection with the Mining Bureau an assistant to Mr. Yale, statistician in the Geological Survey. He is a graduate of Stanford University and has had considerable field experience in California. The position of statistician is being temporarily filled by R. P. McLaughlin, chief of the petroleum department of the bureau. He has completed his field work for the forthcoming general report, and his present engagement in the department of statistics is timely for the reason that a great deal of statistical data essential to the report covers the petroleum industry. Mr. Preston's work has been taken up by F. L. Lowell, who was Mr. Preston's assistant for the past year or so. Mr. Hamilton, state mineralogist, has been very fortunate in securing graduate engineers who have come to the Bureau equipped with considerable field experience. The Mining Bureau is in a better condition as regards its future than it has been for several years. The work that has been put upon the general report should be a guarantee that it will be one of the most complete bulletins of this character that has been issued by the Bureau. If carried out on the plans provided in the initial work it should be of great benefit to prospectors and developers of mining property in California and a guide to investors.

INDUSTRIALS

Hardinge Conical Mill Co. reports that the war in Europe is not seriously interfering with its business in the belligerent countries. The first of September it had no difficulty in shipping machines into France and during the last week of September received orders for two 6-ft. Hardinge ball mills which were shipped on the 24th via Scotland and Archangel into Russia.

The Deister Machine Co. of Ft. Wayne, Ind., reports the following recent orders: Dominion Reduction Co., Cobalt, Ont., five single-deck slimers, two single-deck sand tables; Hollinger Gold Mines, Timmins, Ont., 12 single-deck slimers; Miami Copper Co., Miami, Ariz., 12 double-deck sand tables, 76 cone baffle classifiers; Doe Run Lead Co., Rivermines, Mo., 22 cone baffle classifiers; W. L. Reeder, Johannesburg, South Africa, four sand tables and four slime tables.

TRADE CATALOGS

Goyne Steam Pump Co., Ashland, Penn. Catalog. Goyne Mine Pumps. 60 pp., illus., 9x6¼ inches.

Keystone Driller Co., Beaver Falls, Penn. Keystone Drillers. Instruction Book. 15th Edition. 56 pp., illus., 11½x8¾ inches.

Slag Power Ltd., 638 Salisbury House, London. E. C. Eng. Catalog. Utilization of Heat from Slag. 8 pp., illus., 6x9¾ inches.

The Wm. Powell Co., Cincinnati, Ohio. Booklet. Powell Steam Whistle and Whistle Valves. 14 pp., illus., 6½x3½ inches.

Burd High Compression Ring Co., Rockford, Ill. Booklet. A Few Facts About Piston Rings and Their Relation and Importance. 8 pp., illus., 7½x5 inches.

Sullivan Machinery Co., Chicago, Ill. Catalog No. 111. 68 pp., illus., 9x6 inches. This is a general catalog in the Spanish language and will be found useful to many people in South America.

NEW PATENTS

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

ALKALI-SILICO-ALUMINATE—Method for Making Alkali-Silico-Aluminate Richer in Alkali Than Feldspar. Alfred H. Cowles, Sewaren, N. J., assignor to The Electric Smelting & Aluminum Co., Sewaren, N. J. (U. S. No. 1,111,881; Sept. 29, 1914.)

AMALGAMATOR. Charles R. Dennison, Youngstown, Ohio. (U. S. No. 1,111,251; Sept. 22, 1914.)

BARIUM AND STRONTIUM OXIDES—Process of Producing. Harry G. Akers, Toronto, Ont. (U. S. No. 1,113,178; Oct. 13, 1914.)

BRIQUETTES—Briquette Composition and Process of Making Briquettes. Edward Alfred Paterson, Port Arthur, Ont. (U. S. No. 1,111,919; Sept. 29, 1914.)

CAST IRON—Process of Converting Cast Iron Into Steel or Malleable Iron. John Alexander Hunter, Philadelphia, Penn. (U. S. No. 1,112,909; Oct. 6, 1914.)

CONCENTRATION—Movable Spray for Mineral Washing. Wilton E. Darrow, Sutter Creek, Calif. U. S. No. 1,111,300; Sept. 22, 1914.

COPPER—Process for the Treatment of Copper Ores and the Recovery of Their Values. Charles S. Vadner, Salt Lake City, Utah. (U. S. No. 1,111,874; Sept. 29, 1914.)

COPPER SMELTING—Improvements in and Relating to Metallurgical Furnaces for Use Chiefly in the Metallurgy of Copper. L. Addicks, Perth Amboy, N. J., and C. L. Brower, Chrome, N. J. (Brit. No. 16,307.)

CRUSHER—Gyratory Crusher. Thomas W. Capen, Milwaukee, Wis., assignor by mesne assignments, to Allis-Chalmers Manufacturing Co. (U. S. No. 1,110,887; Sept. 15, 1914.)

CYANIDES—Making of Alkali Cyanogen Compounds. John Collins Clancy, Colorado Springs, Colo., assignor of fifty-one one-hundredths to Portland Gold Mining Co., Colorado Springs, Colo. (U. S. No. 1,112,893; Oct. 6, 1914.)

DRILL—Rock Drill. Daniel S. Waugh, Denver, Colo., assignor to The Denver Rock Drill Manufacturing Co., Denver, Colo. (U. S. No. 1,112,398; Sept. 29, 1914.)

DRILL MOUNTING. Charles C. Hansen, Easton, Penn., assignor to Ingersoll-Rand Co., New York, N. Y. (U. S. No. 1,112,006; Sept. 29, 1914.)

ELECTRIC FURNACE—Apparatus for Reducing Ores. Raymond S. Wile, Pittsburgh, Penn. (U. S. No. 1,111,050; Sept. 22, 1914.)

ELECTRIC FURNACE—Method of Reducing Ores. Raymond S. Wile, Pittsburgh, Penn. (U. S. Nos. 1,111,049, and 1,111,341; Sept. 22, 1914.)

ELECTROSTATIC SEPARATOR. Harry Comstock, Mineville, N. Y. (U. S. No. 1,110,896; Sept. 15, 1914.)

FILTRATION—Apparatus for Making and Filtering Solutions, Applicable in the Extraction of Metals from Ores and for Like Purposes. P. C. C. Isherwood, Bushey Heath, England. (U. S. No. 1,110,790; Sept. 15, 1914.)

FUMES—Process for Arresting Sulphurous Gases and Fumes and Utilizing the Heat and Gases Contained Therein. Charles S. Vadner, Salt Lake City, Utah. (U. S. No. 1,110,660; Sept. 15, 1914.)

ORE-CONCENTRATING TABLE. Howard D. McLeod, Cleveland Heights, Ohio. (U. S. No. 1,110,070; Sept. 8, 1914.)

PIG-BREAKING MACHINE. James B. Ladd, Ardmore, and David Baker, Haverford, Penn. (U. S. No. 1,112,146; Sept. 29, 1914.)

REFRACTORY ORES—Process of Treating Complex Refractory Ores of Silver and Gold. Court C. Titus, Helena, Mont., assignor to Montana Metallurgical Co., Helena, Mont. (U. S. No. 1,111,976; Sept. 29, 1914.)

RETORT PRESS. Charles Albert Wettengel, St. Louis, Mo. (U. S. No. 1,112,103; Sept. 29, 1914.)

ROASTING—Improvements in Rabble Shafts for Roasting Furnaces. E. J. Fowler, San Francisco, Calif. (Brit. No. 7471 of 1914.)

SCREEN OR SEPARATOR. Thomas Joseph Sturtevant, Wellesley, Mass., assignor to Sturtevant Mill Co. (U. S. No. 1,111,044; Sept. 22, 1914.)

SINTERING APPARATUS. John E. Greenawalt, Denver, Colo. (U. S. No. 1,110,623; Sept. 15, 1914.)

STIRRER OR CONVEYOR. David J. Nevill, Denver, Colo., assignor to The Stearns-Roger Manufacturing Co., Denver, Colo. (U. S. No. 1,111,084; Sept. 22, 1914.)

WASTE LIQUOR—Recovery of Values from the Leach-Water of Copper Extraction. Clarence A. Hall, Mount Airy, Penn., assignor to Pennsylvania Salt Manufacturing Co., Philadelphia, Penn. (U. S. No. 1,112,608; Oct. 6, 1914.)

ZINC—Electric Zinc Furnace With Integral Condenser. Charles Victor Thierry, Paris, France. (U. S. No. 1,110,359; Sept. 15, 1914.)

ZINC—Improvements in Muffle Furnaces for the Production of Zinc. H. Koppers, Essen-Ruhr, and N. Lengersdorf, Bunzlau, Silesia, Germany. (Brit. No. 6349 of 1914.)

ZINC—Process of Extracting Zinc from Its Ores or Compounds. Ernest Estram Watts, Kingston, Ont. (U. S. No. 1,111,201; Sept. 22, 1914.)

ZINC OXIDE—Manufacture of Zinc Oxide. James Arthur Singmaster, Palmerton, Penn., assignor to New Jersey Zinc Co., New York, N. Y., a Corporation of New Jersey. (U. S. Nos. 1,112,853, and 1,112,854; Oct. 6, 1914.)

ZINC RESIDUES—Treatment of Zinc Residues. Archibald Jones, Bartlesville, Okla., assignor to Bartlesville Zinc Co., New York, N. Y. (U. S. No. 1,112,010; Sept. 29, 1914.)

Editorial Correspondence

SAN FRANCISCO—Oct. 14

Relief of the Potash Situation may be under consideration by the Department of the Interior but the report that the government may advance money to the American Trona Corporation is untrue. The corporation is amply able to take care of its own affairs, and has asked no assistance from the Government. In addition to the Searles Lake deposit, which has been proved by exploration and development, there are other good prospects in California, the owners of which would probably be glad to receive financial aid. But this is likely to come from the incorporation of operating companies and the sale of stock. Besides the production of potash through mining operations, its manufacture from kelp is attracting the attention of San Francisco men, who are making a thorough, scientific and practical investigation to discover whether or not the kelp contains sufficient quantities of potash to make its handling a profitable commercial venture. The potassium content of sorted kelp has been demonstrated by Government experts to be high. But manufacturing on a commercial scale must depend upon whether or not the content of large quantities will average sufficiently high. There is no question but that the potash can be recovered from the kelp. That matter has been thoroughly investigated and the result was wholly satisfactory.

DENVER—Oct. 15

The Western Chemical Co., of Denver, has just erected a $30,000 fireproof steel building for the manufacture of nitric acid. Improvements to the extent of $10,000 have been made in the hydrochloric-acid plant. These works have been visited by disastrous fires in the past. Frank Ashley is president of the company.

Contracts for Pumping Equipment to be installed in the Penrose shaft at Leadville were finally let Oct. 10. This means that the Downtown Mines Pumping Co. will probably be in operation this winter, since delivery of the machinery has been guaranteed within 12 weeks. The Providence Engineering Works, Providence, R. I., secured the order for the centrifugal pumps while the General Electric Co. will provide the motors and other electrical apparatus. The success of this project means much to the Leadville district, since it will permit the operation of a centrally situated mineral area that has heretofore defied exploitation on account of its heavy flow of water. Former Governor Jesse McDonald has worked two years securing suitable contracts from the many owners of properties that will share in the proposed benefits. Pending arrival of the machinery, necessary surface alterations will be affected.

In Granting a Lease for Excavating and Retreating a Slag Dump at the defunct Boston & Colorado smelting plant, there was no intention to give publicity to certain shortcomings in Denver's earlier metallurgical practices. But the matter has reached litigation and some figures will inevitably be revealed. From the pending district-court suit, it appears that Crawford Hill, part owner and trustee of the Hill estate, including the old smelting site, entered into a lease contract with one Morris Prigel whereby the latter proceeded to ship slag to the Globe plant of the American Smelting & Refining Co., expecting to receive 70% of the settlement returns. After the resmelting of 5200 tons of this, Prigel has sued Hill for $1280 which is alleged to be only a part of his share in the profits that have been unlawfully withheld. More particulars, whereby analysis of former smelting efficiencies may be possible, will probably crop out when this suit is tried.

BUTTE—Oct. 15

Labor Situation—Interest during the week centered in the suspension of the military courts as described in the "Journal," Oct. 17. While the decision left no room for misinterpretation, speculation immediately became rife as to the consequences of illegal procedure by the military authorities, covering a period of over six weeks, during which a great number of persons were tried, convicted and sentenced. All of them will have to be retried in the civil courts with the benefit of a jury. As to restoration of fines imposed and paid and stocks of liquors destroyed in the case where the saloon closing regulations were disregarded, that is a question which has not yet been answered. It looks as if the undoings may prove as interesting as the doings. Up to date a number of damage suits, aggregating $30,000, have been filed against Governor Stewart, Major Donohue, Major Roote and Provost Marshal Conley for illegal arrest and imprisonment. More are expected to make their appearance.

In announcing the suspension of the military courts, Major Donohue stated in no uncertain terms that there would be no relaxation of military authority so far as maintenance of peace and order in Butte was concerned. He pointed out that under the decision, the military forces might arrest disturbers and trouble makers as a matter of military necessity and might detain them, and he stated that this would be done.

Duncan and Driscoll will take their ouster cases into the supreme court as soon as transcripts can be made of the testimony. Since the decision causing suspension of the military courts, the press censorship has come in for adverse criticism on the part of the "Butte Socialist." Upon being advised that this paper intended to defy the censorship ordinance, Major Donohue notified the editor that if he published any matter calculated to incite the people and stir up trouble, he would have to suffer the consequences. The "Socialist" then decided not to resist the military censorship but intimated that a test case would be made of its legality by some outside paper.

Plans have been made to reduce further the force of men under arms in Butte, from 400 to about 200. This step is being taken in order that the civil authorities may begin the active resumption of their duties.

The first battalion of the 14th U. S. Infantry, which some time ago was brought to Fort Harrison, near Helena, from Fort Wright, Spokane, presumably to await developments in the Butte situation, was transferred to Fort Missoula on Oct. 12. No information is available as to the reasons for keeping the soldiers in Montana, but it seems evident that the Butte situation and other conditions in Montana, especially the I. W. W. movement, are the determining factors.

Latest reports are that the marauding band of men calling themselves I. W. W., decided to keep away from Butte.

The committees of the Western Federation of Miners and the United Mine Workers of America were in session in Butte, Oct. 12 and 13, to consider plans of uniting the two bodies under a proper working system. Many suggestions were made but the meeting adjourned without adopting definite measures, awaiting the results of discussions at the Denver meeting of the Western Federation to be held in the near future. The new Butte Mine Workers' Union had positively refused to merge with the United Mine Workers, if this had to be accomplished by first coming back into the Western Federation.

The Helena Mining Bureau, organized by Helena citizens, has succeeded in enlisting the interest and support of local as well as outside business men in the development of meritorious mining claims in and about the capital. From among a large number of properties, listed with the bureau, two have been selected by expert engineers as warranting the expenditure of energy and money for development. The Wayside group of claims, located six miles from Helena, is being developed under the supervision of the bureau and with local capital. Assays of the ore, extracted during the work have run well in gold and from present indications the prospects of opening a large body of pay ore are promising. The other property being thus developed is the Hawkeye, an old gold, silver and lead mine, situated close to the heart of the city. Modern machinery has been installed at both properties and the force of men will be increased as work progresses. The bureau is listing all properties near Helena and in tributary camps with a view to attracting outside capital. Inquiries have already been received from American and European firms, and mining men from various parts of the country are constantly inspecting the properties listed.

Outside of the activities of the bureau, many private enterprises are reported in the camps adjacent to Helena. Colonel Cruse is operating successfully his Franklin lead mine, six miles from Helena. The York Mining Co. is operating a gold property 26 miles northeast of Helena and has blocked out enough ore to keep its 50-ton mill and cyanide plant in operation for three years. At Rimini, 12 miles west

of Helena, James Breen is putting in a 20-stamp mill to treat the product of the Porphyry Dike which carries gold values varying from $8 to $20 per ton. At Marysville, Colonel Cruse is exploiting, successfully as usual, his Bald Mountain mine, while the Piegan-Gloster recently acquired by the Barnes King is expected to enter the list of producers by the end of the year.

SALT LAKE CITY—Oct. 15

At the Snake Creek Tunnel, the September report, by Guy McKay, engineer in charge, shows that 350 ft. progress in hard rock was made, working two shifts. The face is in 9436 ft. The first igneous rock, a dark-colored basic rock of granular texture, probably gabbro or granodiorite, was cut early in the month. Several belts of similar igneous rock were passed through, the limestone in the contact zones being more or less silicified or altered. A good deal of the material is mineralized with pyrite, and occasionally with small seams of lead. This is not in known mineral-bearing ground. The tunnel is being driven northwesterly, and is approaching the known mineral-bearing zone of the camp on the southwest. It will crosscut the formation, both beds and fissures. Drifting will be done to the northeast to connect up with the Daly-Judge workings, at a depth of about 2000 ft. The tunnel will have a depth of 3500 ft. from the surface in places. Several large fissures and open water-courses were cut. The average flow in September was about 4767 gal. per min.

SEATTLE—Oct. 14

In the Portage Bay District, tributary to Cordova, this season saw a good deal of activity. Extensive prospecting and development work went on all summer and at least two new quartz gold discoveries apparently of some value were made. One of these was made near Picket Bay by Patrick Hogan, an old-time prospector of the Port Wells district, and the other in the same region by Hamilton, another well known prospector. Both discoveries gave exceedingly high assays, but enough development work has not been done yet to indicate the size and extent of the veins. The Golden Eagle mine where a five-stamp mill was put into operation for the first time this season, is said to have had a most successful run. The Granite mine also had a good season.

Prospectors Returning from the Knik District tell of large low-grade gold deposits near the head of the Indian River. This territory, opened last year under the name of the Broad Pass district, has never been extensively prospected before. The land was considered valueless for mining, but since the railroad will probably pass through the district the low-grade ore, which is known to be there, should become valuable, with cheap transportation. Men who entered the Broad Pass country this year report favorably on its prospects and hundreds of operators have announced their intention of going into the new territory next season.

No important new strikes have been made in the Knik district this season, the claims already in operation, however, have greatly increased their yield over that of last year. The Bullion mine, one of the largest in the district, yielded $140,000, while $115,000 was taken from the Alaska Gold Quartz holdings.

The Speel River Project is being pushed by its managers, who have established headquarters in Juneau. Messrs. Kennedy, Lass and Rascovich, recently of the Treadwell group, are in active command. The Speel River is a fair-sized stream dropping down off the mountains a few miles south of Juneau into a natural, deep-water, all-year-round harbor. A group of lakes connected with the river constitute a natural reservoir. The power can be developed at relatively low cost and it is estimated that 100,000 hp. can be had throughout the year. Since topographic and climatic conditions prevent the transmission of this power for any great distance and since at Juneau the demand is not at present very large, the project includes the formation of a manufacturing company to use the power. It is intended to make calcium carbide, ferroalloys, etc. The manufacture of wood pulp is also a possibility. The Treadwell engineers have had large experience in the installation and operation of hydro-electric plants in this vicinity and as consulting electro-chemical engineer they have engaged J. W. Beckman.

At Nome, a Departure in Freight Transportation, where practically no wagon roads exist, will be tried by the Kougarok Dredging Co. next season. The company has several hundred acres of dredging and hydraulic ground about 60 miles from Nome. The cost of transportation on the Seward Peninsula has been figured at about $125 per ton over country of similar character for the same distance as that on which the company has to figure. It is planned to use a large caterpillar engine and either wagons or especially designed cars and thus reduce the cost to about $25 per ton. The company has announced that it will carry freight to other properties also, which should help toward a speedy opening of the section. The engine will be of 70 hp., capable of hauling 40 tons over the rugged country, making its own trail as it goes. If this engine proves a success it will help to solve the difficulties of installation of dredges and heavy machinery in Alaska. The company will install a 2000-yd. dredge of the endless-chain type. It is claimed that the dredge is 40% lighter than other machines of similar design, strength and capacity. It is to be operated by two engines of 50 and 75 hp. Gasoline will be used as a fuel.

SILVER CITY—Oct. 15

A Profit Sharing Plan for all employees of Phelps-Dodge in service three months or over at Bisbee, Douglas and Morenci, Ariz., was inaugurated Oct. 1. The plan also includes the employees of the Burro Mountain Copper Co., at Tyrone, N. M. The following is an outline of the plan:

The company will share with its employees who have been in its continuous employ for three months or more, the net profit accruing from sales of merchandise to them. The employees will participate to the extent of 5% on their purchases of merchandise, not including wines and liquors. The year will be divided into quarterly periods. Bank drafts will be mailed on the first day of May, August, November and February to all employees entitled to participate.

ISHPEMING—Oct. 17

Notwithstanding a General Installation of Safety Devices and the adoption by the operating companies of other measures to protect human life, the mortality rate at the mines of the Marquette iron region for the year ended Sept. 30, according to the report of county inspector Quine, was exceptionally high. Including a force of about 50 men employed in quarries, there were engaged in the mining industry a total of 4969 workers; 22 men were killed, of whom 19 met death beneath the surface. The mortality rate underground was 5.23 per 1000 employees; on the surface it was 1.8; the combined rate was 4.43. Of the 22 men killed, seven lost their lives by falls of ground, four by objects falling down shafts, two by blows from skip or cage, one by breaking of cable, one by falling into shaft, one by an inrush of water and sand; two died in mine fires, one from a cause unknown and three as a result of railroad mishaps above ground. At least two accidents could, it is believed, have been avoided had the victims heeded orders. The largest number of fatalities at any one property took place at the American mine, Diorite, where four men were killed. Aside from the men killed, 200 suffered injuries involving the loss of 20 days of work or more and 345 were incapacitated for from one to 20 days.

That Independent Steel-Makers Are Not Apprehensive over the matter of future ore supplies is the deduction drawn from the action of Jones & Laughlin in relinquishing its option to the Feigh lands on the Cuyuna range. As previously described in the "Journal," the lands comprise 160 acres in Section 10, 46-29, and adjoin Tod, Stambaugh & Co.'s open-pit Pennington mine on the west and southwest. The tract is owned in fee by Thomas Feigh, of Duluth. It was leased to the C. M. Hill Lumber Co., on the basis of a royalty of 35c. per ton, was explored by that concern, and ore was found. Subsequently the Hill company transferred its rights to the Northern Pacific for a reported consideration of $250,000, and the latter, in turn, granted to the Jones & Laughlin company an option specifying an increased royalty, the amount of which was not divulged, and specifying also that the ore be shipped over the Northern Pacific R.R. It was stated at the time that drilling had revealed the existence of 3,500,000 tons of ore, a large part of which can be won by the steam-shovel method, and it is understood that the check drilling conducted by Jones & Laughlin has added materially to the known dimensions of the deposit. On account of the business demoralization due to the European war the company has retrenched in all directions, as have other Lake Superior operators. It is believed, however, that had the company felt there would be any difficulty in procuring ore supplies in the future a deposit so large as that in the Cuyuna tract would not have been abandoned.

TORONTO—Oct. 17

The Revival in the Sudbury District has been the most interesting feature of Ontario mining during the last two weeks. International Nickel, which has been running at about one-third capacity, started up two more furnaces and is now operating at about 75% of its old rate. The New Jersey refinery was started about two weeks ago, and there is now a satisfactory demand for nickel. The Mond company is working steadily and, since most of its output is sold in England, it has been affected to only a slight extent. The only change of importance has been a reduction in the amount of development work, most of the drills being now kept on ore production.

The Mining News

ALASKA

COPPER RIVER & N. W. R.R.—Offer to sell or lease road to government made by J. P. Morgan to Secretary Lane in Washington. Secretary replied would have to await report by board of engineers.

ALASKA COAL LANDS LEASING BILL passed by Senate and House as returned by conference committee and signed by President Oct. 20, becoming law. President presented with pen and inkwell made of Alaskan gold and mastodon ivory bought with subscriptions of Fairbanks citizens.

ARIZONA

Mohave County

PITTSBURG (Oatman) — Air compressor and steam pump installed; sinking to begin at once.

GOLD REED (Oatman)—Good ore found in shaft at 212 ft. at which depth sinking was discontinued. Station being cut at 200-ft. level from which drifting will soon be in progress.

HARQUA HALA (Parker)—Rich strike made on 200-ft. level, in prospecting for lost orebody. Vein 12 ft. wide, is good milling ore. Mill being put in shape and bins filled preparatory to starting 20-stamp mill.

PIONEER (Oatman)—Work suspended temporarily. Shaft sunk on Pioneer claim from 200 ft. to 450 and about 200 ft. of drifting done. Property controlled by Carl S. Shaller, Santa Monica, Calif.; under development contract to Rochester, N. Y., syndicate; C. T. Van Winkle, in charge.

UNITED EASTERN MINING COMPANY (Oatman)—Organized to explore Tom Reed Extension group of claims for the Tom Reed vein or branch. It was supposed Olla Oatman vein was extension of Tom Reed vein and Tom Reed company held this vein and explored it on this idea. Promoters of new company assume Tom Reed vein proper branches at north end of Tom Reed claim or that it continues on in same course instead of swerving to west to take course of Olla Oatman vein. Proposed to sink shaft to 500 ft. to cut vein. Work on shaft commenced. George W. Long president of company; J. L. McIver, secretary.

CALIFORNIA

Butte County

NUGGET (Stirling City)—Electricity installed for operating machinery.

BUTTE STAR GOLD MINING CO. (Nimshew)—Reported company has resumed operations. E. C. Wilson, principal owner.

MAMMOTH CHANNEL GOLD MINING CO. (Magalia)—Judgment for $20,000 secured by widow for killing of William Crabbe while in company's employ, confirmed by state supreme court.

Kern County

AMALIE DISTRICT near Caliente attracting attention through recent discoveries of good ore. Ferris property installing new tube mill with capacity of 70 tons per day Over 200 tons of new machinery installed at Parlow mine. Other mines being developed: Zenda, Cowboy and Antarosa. District easily accessible by stage from Caliente on Southern Pacific and Santa Fe railroads.

Mariposa County

MOUNTAIN KING (Mountain King)—New hydro-electric plant to be installed, will develop 400 hp. Twenty stamps will be added to present 10-stamp mill. Force to be largely increased. Alexander Hamilton, superintendent.

Modoc County

MODOC MINES CO. (Fairport)—Active development work in progress. N. E. Guyot reports mill will be erected.

Nevada County

UNION HILL (Grass Valley)—Shaft being sunk from 600-ft. point to 900 without drifting. Drifting on 300-ft. level in progress to tap Georgia vein, formerly producer.

Riverside County

IRON CHIEF MINING CO. (Riverside)—As soon as properly proved up, company will be allowed to retain properties containing iron deposits, in litigation with General Land Office.

Santa Clara County

AMERICAN MAGNESITE MINES (Livermore)—Road being constructed to connect property with Livermore for shipping purposes. Ore will be hauled by motor trucks. J. J. Cummins, manager.

Shasta County

UNCLE SAM (Kennett)—Milling operations to be resumed. One hundred tons high-grade ore shipped to Selby for treatment. Fred Dakin, Jr., manager.

Sierra County

SOUTH FORK CO. (Downieville)—Los Angeles company operating gravel properties has begun development of several quartz veins; drifts being run; indications good. Fred Kuhfield in charge.

WISCONSIN NORTH FORK (Forest)—After hard fight against swelling rock in mine and adverse financial conditions, good strike made in this gravel property being developed by San Francisco company with D. E. Hayden at head.

MOTT (Downieville)—This gravel property leased to Gilbreath & Hughes, of Downieville, who will repair the 1200-ft. tunnel and lay track preparatory to working the ground. Channel known as "black lead," gravel being dark and badly cemented to bedrock; nevertheless, yielded well when worked several years ago. Mott & Morrison, of Forest, and Harlan, of San Jose, owners.

Siskiyou County

ASH CREEK MINING CO. (Hornbrook)—Five-stamp mill being erected.

Summit County

NIAGARA—Purchase of this gold mine controlled by W. M. Johnson Co., of Chicago under consideration by new company proposing extensive development.

Trinity County

TRINITY CONSOLIDATED MINING CO. (Douglas City)—Reported operations on large scale will be conducted as soon as rainy season starts. Company also operates Union Hill hydraulic mine.

GOLD-PLATINUM MINING CO. (Burntranch)—Litigation over possession of claims on New River, settled out of court and operations will begin with shipping in of supplies. W. H. Holcomb, superintendent.

Tuolumne County

QUARTZ VEIN running under municipal buildings in Sonora may be leased to E. H. McMahon, who will conduct extensive operations if conditions warrant.

PEORIA FLAT (Sonora)—Robert Lewis and Dennis Scott, who hold bond, will run open trench through gravel beds for draining water and exposing gravel. Installation of mill for washing gravel contemplated.

COLORADO

Boulder County

PRUSSIAN (Rowena)—Samuel L. Newhouse has decided to equip and operate this property, which he has owned many years. Under various leases, mine made reasonably large production, but through lack of sufficient capital and of business capacity, past operators failed. Mr. Newhouse will equip with modern plant.

Gilpin County

PENNSYLVANIA (Central City)—This Pine Creek property being provided with small stamp-mill and buildings so that work may continue through winter.

Lake County

NORTH SIDE (Leadville)—Sinking resumed; was necessarily suspended during installation of pump following tapping of strong water-course a few weeks ago.

BENGAL TIGER-GORDON (Twin Lakes)—After 17 years of idleness, mining about to be resumed by company organized by George W. Boyce, who has taken lease and bond and is now making systematic investigation of ore reserves; estimated in various reports that between 43,000 and 66,000 tons is blocked out.

BIG FIVE OPERATING CO. (Leadville)—Thomas M. Raney has contract for sinking Big Four shaft 350 ft. and will begin work soon. This will develop that portion of the district to about 1100 ft., much deeper than any neighboring workings. Steady small production of 10- to 15-oz. gold ore maintained. Richardson Gibson manager.

San Juan County

IOWA-TIGER (Silverton)—Lessees Kafka & Gaisi rebuilt jigback tram and will ship lead-silver ore. Melville Leasing Co. sinking winze for 100-ft. lift. Delsant & Co., in new winze, have opened streak of rich gray copper in same vein that produced heavily years ago.

KITTIMAC (Middleton)—Aërial tramline, of which several towers were last winter destroyed by snowslides, repaired. Good stopes of low-grade sulphide ore opened during summer in Kittimac vein proper while, in Little Joe vein, shoot of gold-silver ore disclosed and found adapted to cyanide treatment. New addition to mill, together with complete remodeling of equipment, almost completed.

San Miguel County

JUNTA (Telluride)—While starting up machinery, short time ago, motor of tube-mill burned out. Repairs proving rather uncertain, cyanide department of plant temporarily retired and the mill's work will be solely stamping and amalgamation. Ore from Orion mine keeping 30 stamps busy.

Teller County

JERRY JOHNSON (Cripple Creek)—On Oct. 7, ore house at main shaft totally destroyed by fire. New ore house will be built at once.

JOE DANDY LEASING CO. (Raven Hill)—Operations temporarily discontinued to permit necessary repairs near shaft collar. Upper 40 ft. of shaft being concreted to make it solid through dump.

BEACON GOLD LEASING CO. (Victor)—This company, now operating through Mable M. shaft of Gold Dollar, will sink winze from 13th level to water level, then crosscut 80 ft. to point under shaft, and raise to connect with shaft. Development will be performed on company account under supervision of Manager A. J. Campbell.

IDAHO

Coeur d'Alenes

PARAGON CONSOLIDATED (Wallace)—Company recently started mill, after shutdown on account of water shortage for month or more.

MONTANA-IDAHO COPPER CO. (Adair)—Work started on 7500-ft. tunnel from Adair, under shaft of Monitor Mining Co.; proposed to develop and operate number of promising properties in Adair district, according to Otis Hill, general manager of company. Buildings erected and preliminary operations started. First unit of water-power plant being installed and by Nov. 1 power drills will be in use for driving. Tunnel will be of double-track size, eventually to be equipped with electric haulage.

MICHIGAN

Copper

WHITE PINE (Ontonagon)—Thousand-ton stamp mill will be ready May 1, 1915, if operations continue at present rate of speed.

WYANDOT (Winona)—All operations suspended, treasury being so low it was considered wise to retain the funds for necessary expenses, such as taxes, during prolonged period of idleness.

Iron

JUDSON (Alpha)—Loading machine described in "Journal," Sept. 19, invented by J. H. Hodgson and Nels Floding, now being given trial at this property. Operating in one of main underground drifts and reported to be doing good work. Believed by some it has not enough power, but this will be easy to remedy. Machine manufactured by Lake Shore Engine Works, Marquette, Mich.

PORTER (Amasa)—Tract in Sect. 22, 44-33, to be developed by Longyear interests; explored with drills some months ago. Deposit reported to contain 1,000,000 tons; ore of excellent grade, much within bessemer limit. Formation is continuation of that of Hemlock mine several miles to northwest. Machinery formerly in service on Mesabi range being installed. Sinking will continue through winter and mine should produce next summer.

MINNESOTA

Cuyuna Range

CROFT (Crosby)—Installation of 150,000-gal. water tank completed.

CUYUNA-SULTANA (Ironton) — Second exploration shaft now going down on property. Deposit adjoins Cuyuna-Mille Lacs; is a manganiferous iron ore, estimated at several million tons.

WILCOX (Brainerd)—New Vulcan hoist, received. Surface plant now complete and operators expect to ship this season. Thus far only 200 gal. water per min. encountered, unusually small volume for Cuyuna property.

Mesabi Range

LEONARD (Chisholm)—Tracks of Great Northern and Duluth, Missabe & Northern being removed from property to facilitate stripping operations recently inaugurated.

MILLER (Aurora) — After sending 300,000 tons to Two Harbors dock this season, shipments suspended. As soon as possible new level will be started, when operations will be resumed for winter.

MISSOURI-KANSAS-OKLAHOMA

JOSEPH POWELL and others, of Galena, Kan., opened up good zinc prospect on their lease on Illinois Lead & Zinc Co. land west of Galena.

LESLIE PATRICK & CO. (Galena, Kan.)—Rich strike of silicate on lease at Happy Hollow; ore lies in loose formation of ground or water course. Company experienced great difficulty in holding ground, but now believes timbers recently placed will hold.

COMMERCE MINING CO. (Baxter Springs, Kan.)—Several drill rigs at work. Most of ore encountered at 200 ft. or more, some of it going as low as 300 ft. Almost exclusively milling undertaking, requiring large amount of capital.

GUM SPRINGS MINING CO. (Cave Springs, Kan.)—Ground drained and being let out to miners; several good prospects already struck and mill running steady on custom dirt taken from mines on ground. Land idle after mill was burned about a year ago, but with advancing price of spelter was reopened.

MONTANA

Lincoln County

LIBBY PLACERS (Libby)—P. J. Brophy, of Butte, secretary-treasurer of company, just returned from inspection, reports more than $100,000 in gold taken out since present company took possession. Holdings comprise 1100 acres, most of it suitable for dredging or steam-shovel. Company contemplates introducing shovel next season to permit operating without interruption throughout year.

Silver Bow County

BUTTE & SUPERIOR (Butte)—Mine closed down night of Oct. 17 to repair shaft.

ANACONDA (Butte)—Extensive tests under supervision of safety-first department with "Sabulite" so satisfactory that it is probable company may use it in its mines in future and that factory will be established in Butte for manufacture and distribution in United States.

BULLWHACKER (Butte)—Plans for reorganization as follows: Sell and dispose of all assets to Clark Bros. & Klein, total purchase price to be total indebtedness of the company. Clark Bros. & Klein will then transfer all of property to Butte-Bullwhacker Mining Co. and receive all capital stock of said company, consisting of 1,000,000 shares; will then sell to each stockholder of Bullwhacker Copper Co. same number of shares in new company as are owned by each stockholder in old company at 15c. per share, payable in six monthly installments of 2½c. per share. When entire issue of new stock is subscribed and paid for, Clark Bros. & Klein will place in treasury cash equal to difference between total indebtedness of the old company and $150,000. This will leave $20,000 cash in the treasury.

NEVADA

Elko County

LEACHING EXPERIMENTS ON COPPER ORES AT CONTACT made with success. Samples high in lime and thought to offer insurmountable difficulties were successfully treated in Butte & Duluth plant, Butte, Montana.

Humboldt County

NEW CAMP OF SILVER MOON established between Queen Cañon and Sacramento. Several sales of claims reported. Number of small veins containing shoots of high-grade gold-silver ore discovered.

DAVEY GOLD MINING CO. (Davitown)—Five-stamp mill operating; average grade of ore said to be $40 in gold. Deep shaft will be sunk this winter, and if satisfactory tonnage of milling-grade ore is opened, a 50-ton mill and cyanide plant will be built.

Lander County

FOREST SHAFT (Austin)—Lightning set fire to timbers of this shaft on Lander Hill, Oct. 2. Lower tunnel bulkheaded and timbers saved, but all fire-fighting means useless for shafts, which finally caved in. Estimated loss, $10,000.

Lincoln County

NEVADA-DESMOINES (Pioche)—Stated company will resume work. Shaft, now 327 ft. deep, will be sunk another 100 ft. Larger pump will be installed.

Lyon County

NEVADA-DOUGLAS (Ludwig) — Second consignment of two cars of machinery for new leaching plant received.

MASON VALLEY MINES CO. (Thompson)—Operations closed down Oct. 17.

Nye County

TONOPAH MERGER (Tonopah) — Station being cut on 1235-ft. level preliminary to crosscutting.

LITIGATION HILL MERGER (Manhattan)—Milling of 50 tons completed by lessees in Associated mill, heads said to run $48 per ton.

GOLDEN ARROW MINING CO. (Golden Arrow)—Timber and machinery being packed in. Expected mill will be in operation by January, 1915.

CONSOLIDATED LEASING CO. (Manhattan)—Lessees of the Manhattan Consolidated have just started 1000-ton milling in Associated mill of ores developed when lease was in operation over year ago. Grade of ore said to average about $12.

TONOPAH JIM BUTLER vs. WEST END CONSOLIDATED (Tonopah)—Attachment for $1,500,000 served to cover value of 25,000 tons of ore alleged taken from West End-MacNamara vein in Eureka and Curtis claims, valued at $500,000; exemplary damages allowed under statutes.

WHITE CAPS (Manhattan)—Company will take over immediately cyanide part of Manhattan Milling & Ore Co. ten-stamp mill, now under lease to Mushett & Wittenberg, operators on Big Pine. White Caps will use stamps and tube mill for one shift each day. Base ore will thus not be run over plates, but go direct from stamps to tube mill and then into cyanide department. Fifty-ton ore bin now being built near White Caps shaft, and milling will soon be started. Oxidized ores proved amenable to cyanide.

White Pine County

DISCOVERY OF ANTIMONY ORE reported at old camp of Taylor, near Ely.

RUBY HILL (Ely) — Lease and bond on group of five claims taken. Work will begin soon. Considerable work done in past.

NEVADA CON. (Ely)—Adjustment to new conditions gradually being brought about. Mining and smelting forces greatly reduced; wherever possible, married employees retained, so district has more prosperous appearance than might be expected. At McGill, one reverberatory out of three in operation, and at Steptoe, four of eight sections operated for period of four to five days, then other half of plant for equal period; this to prevent deterioration of drive belts, vanner belts, launders, etc., which would rapidly dry up and become useless. As result of the half-time operation and consequent shifting of workmen from one part of mill to another, there is decided decrease in efficiency. Believed no further reduction in output will be made for present, at least, and that a complete shutdown will not occur unless imperative. Experiments in oil flotation at Steptoe being continued with satisfactory results. Large consignment of new equipment received recently. Experimental plant operated in connection with section of concentrating plant, so that ore is treated in commercial quantities. In addition to effecting greater saving of copper content, thought flotation will permit dispensing with part of concentrating process now followed.

NEW MEXICO

Grant County

CHINO COPPER (Santa Rita)—One steam shovel and two locomotives now working on night shift; more expected to be added soon. Mines worked on six-day shift; mill at Hurley running 5½ days.

AMERICAN MEERSCHAUM & PIPE CORPORATION (Hanover)—Mines and mill in hands of receiver. Equipment being sold. J. W. Bible appointed receiver. Close-down said to be no fault of mine or mill. Ore in sight and mine management excellent.

C. & O. MINING & MILLING CO. (Pinos Altos)—Several cars of ore high in gold shipped to Douglas. Mining continues on high-grade oreshoot. Incline shaft used; equipment at mine excellent. Four arrests made for alleged "high-grading." Cases come before grand jury at Silver City in February.

San Miguel County

ROMERO MOLYBDENITE MINES (Las Vegas)—Shipment of one ton of molybdenite will be made in few weeks. Mineral in demand at Philadelphia. Mill now producing 85% product.

Sierra County

BIMETALLIC MINING & MILLING CO. (Sierra Blanca)—Distillate engine, air compressor and drills purchased. Machinery will be moved to works soon.

Taos County

SILVER QUEEN (Red River)—Pending litigation over fraction crossed by quartz vein now settled. First shipment made to local mill Oct. 1. Tables being installed in concentrator.

UTAH

Juab County

CHIEF CONSOLIDATED (Eureka)—Side track or spur, three-quarters of mile long, from the D. & R. G. completed to mine. Experimental mill for treatment of ore from Chief Consolidated being built by separate company, known as Utah Minerals Concentrating Co. Work will start with ore from mine dump; if successful, may lead to building of larger custom mill in Tintic. Plant now in process of construction will have capacity of 100 tons. Foundations, ore bins, etc., built, and some of crushing machinery being installed.

WASHINGTON

Pend Oreille County

BEAD LAKE GOLD-COPPER MINING CO. (Newport)—Company developing group of 20 claims for 10 years, has opened vein about 12 ft. wide in lower tunnel, according to W. E. Allen, secretary. Strike made at 300 ft. depth. Shoot about 180 ft. long, of good milling grade. Company preparing to begin shipping immediately, but contemplates constructing mill soon to handle low-grade product. Other Spokane men interested are Dr. C. O. Linder, G. C. Reisler, Joseph Roslow and Edward Tragger.

Stevens County

GWIN (Kettle Falls)—Mine will resume operations after shutdown due to low water. Mine has been equipped with a 50-ton concentrator and electric-light plant. Power secured from Hall Creek. Peter Proff, manager.

CANADA

British Columbia

CONSOLIDATED MINING & SMELTING (Trail)—To date, over 290,000 tons of ore treated for year from Kootenai and Boundary districts and prospects are for a total of 350,000 tons. Biggest shippers are: Center Star, 130,000 tons; Le Roi, 61,000 tons; Sullivan, 23,000 tons; Le Roi No. 2, 2600 tons; and Ben Hur, 10,000 tons.

VOIGT (Princeton)—Active operations will start soon on this property, just taken over by lately organized Similkameen Consolidated Copper Co., located at Copper Mountain. W. S. Ayres, of Hazelton, Penn., president and chief consulting engineer. Expected large tonnage will be blocked out by next summer. With this company launched and British Columbia Copper Co. operating in Princess camp, future for Princeton district looking better than for some time.

Ontario

PEARL LAKE (Schumacher)—Plant will be sold at auction by sheriff, Oct. 22.

DOME LAKE (South Porcupine)—New 100-ton stamp mill in operation. Main shaft down 400 ft., where station has been completed. No. 3 vein opened up for 100 ft. on 300-ft. level. Believed by some that cyanide addition will be necessary for treating ore.

TEMISKAMING (Cobalt)—Main shaft down 750 ft., at which level high-grade vein several inches wide was encountered. Pockets of good ore on the 575- and 650-ft. levels.

VIPOND (Schumacher)—New Hardinge mill in successful operation. Third cleanup realized 550 oz., valued at about $11,000. Several new veins discovered on surface. Ore reserves above 300-ft. level sufficient to keep mill going 20 months.

DOME (South Porcupine)—Report for September shows steady increase in tonnage treated, which partially compensates for lower grade of ore. During month, 21,940 tons milled, producing $99,301. About 50,000 ft. of surface and underground diamond-drilling contracted for.

CANADIAN COPPER CO. (Copper Cliff)—Four of six furnaces at Copper Cliff closed on outbreak of war. Two of them started again and mining activity being resumed. Only Creighton mine being operated, but understood that No. 2 mine will shortly be reopened.

McINTYRE (Schumacher)—Contact vein which faulted on 500-ft. level picked up and attempt being made to reach orebody on 600-ft. level through Pearl Lake shaft. Arrangements made with the Schumacher to prove up ground underlying Pearl Lake from one of Schumacher shafts. Mill treating 300 tons daily; ore reserves given at 15 months' supply.

CANADIAN EXPLORATION CO. (Long Lake)—At this mine, in Sudbury district, mill now treating 150 tons daily. Ore contains about 13% sulphide, refractory, rendering cyanide treatment necessary. Extraction of 86.6% being obtained. Bullion shipped to Ottawa mint, consignments last month amounting to $20,000. Four drills working on orebody which is being stoped from 180-ft. level.

TOUGH OAKES (Kirkland Lake)—Production from first of year to date, $100,000. Good progress being made with construction of 100-ton mill; company expects to resume underground work in December. New mill will crush in 20x12-in. Buchanan crusher, pass through trommel and crush oversize in 10x16-in. Buchanan; grind in 6-ft. by 16-in. Hardinge ball mill; send to simplex and duplex Dorr classifiers; grind in 5x20-ft. tube mill; pass over amalgamating plates in tube-mill circuit; agitate; thicken; precipitate by Merrill apparatus. All tanks fitted with Dorr mechanism. Scheme of treatment involves counter-current decantation.

Saskatchewan

BEAVER LAKE—This company, organized at Prince Albert to operate in Beaver Lake gold area, has shaft down 67 ft. and is putting up camp buildings. Plant contracted for and will be brought in during winter.

MEXICO

MEXICAN ABSTRACT & CHARTER CO. reports that by decree of supreme chief of Constitutionalist army, in charge of executive power, such matters as have been handled and decided upon since Feb. 19, 1913, by Department of Fomento, and later by so called Department of Agriculture and Colonization since date of its creation, are declared void. Those affected by this decree are at liberty to call upon Department of Fomento to request reconsideration of their matters, and, should there be justice in so doing, new documents will be issued.

EL ORO MINING & RY. CO. informs stockholders that, owing to disturbed conditions prevailing, no accounts have been received from mine since end of April, and for same reason Mr. Main has been unable to furnish directors with usual annual report. In consequence, annual general meeting of company, usually held about end of September, will have to be deferred until manager's report and accounts to June 30 are received. Meeting will be held quickly as possible after these documents arrive. Management was compelled to suspend all milling and other surface operations on April 28. After that date, development of mine continued, and general surface equipment, as well as workings underground, maintained. So far as directors are advised, company's property has not suffered physical damage or disturbance.

Under date of Aug. 22, Mr. Main wrote that forces of Constitutionalist party entered El Oro on Aug. 7, after evacuation of town by Federal troops, but except for levy on various companies operating, under which this company was assessed 20,000 pesos, peace of camp was not disturbed. Under date Sept. 9, Mr. Main cabled that, owing to difficulty in exporting and disposing of bullion, and general unsettled financial condition in Mexico City, did not see way to recommend resumption of milling.

On Sept. 22, Mr. Main cabled that in view of recent changes in situation, and peculiar local conditions, he believed it advisable partially to resume milling operations about first week in October. Directors now hear through New York that milling operations on small scale were resumed on Oct. 1, and that this course was believed necessary for protection of company's plant and interests. In view of terms of Mr. Main's cable of Sept. 9, directors cannot divest themselves of conviction that pressure was brought to bear on Mr. Main which left him no alternative but to adopt this course. On Sept. 30, directors were informed by foreign office in London that information received from chargé d'Affaires in Mexico City stated bullion, estimated at 1,500,000 pesos, had been seized by military authorities there on Sept. 29, of which 72,000 pesos was property of El Oro Mining & Ry. Foreign office informed directors that urgent representations with regard to matter had been made to Mexican authorities.

ASSESSMENTS

Company	Delinq.	Sale	Amt.
Annie Laurie, Utah	Nov. 9	Nov. 28	$0.004
Black Bear, Ida. (post)	Oct. 30	Nov. 28	0.01
Blaine & Emmett, Ida	Oct. 26	Nov. 14	0.005
Bullion, Ida	Oct. 21	Nov. 23	0.005
Bullwhacker, Mont	.....	.....	0.15
Cardiff, Utah	Oct. 19	Nov. 9	0.01
Challenge Con., Nev	Oct. 27	Nov. 17	0.05
Coeur d'Alene Investment, Ida	Oct. 10	Nov. 14	0.002
Comet, Ida	Oct. 20	Nov. 20	0.0005
Comstock Copper, Ida	Oct. 5	Nov. 5	0.001
Confidence, Nev	Nov. 11	Dec. 2	0.10
Continental, Ida	Oct. 6	Nov. 5	0.016
Copper Chief, Ida	Oct. 21	Nov. 23	0.005
Copper Crown, Ida	Oct. 10	Nov. 14	0.002
Copper King, Ida	Oct. 1	Nov. 1	0.01
Copper Plate, Ida	Aug. 29	Nov. 29	0.002
Custer Peak, S.D.	.....	.....	0.02
Dalmatia, Ida	Oct. 1	Nov. 2	0.001
Davis-Daly, Mont	Oct. 15	.....	0.25
Diamondfield Black Butte, Nev. (post.)	Oct. 15	Nov. 21	0.01
East Hercules, Ida. (post.)	Nov. 1	Dec. 1	0.001
Eastern Star, Ida	Oct. 20	Nov. 20	0.002
Ely Con, Nev	Oct. 15	Dec. 2	0.03
Emerald, Utah, (three installments)	.....	June 9, '15	0.01
Excelsior Iron, Utah	Oct. 25	Nov. 15	0.115
Greenhorn, Utah	Oct. 26	Nov. 30	0.005
Hilarity, Ida	Oct. 12	Nov. 23	0.003
Hypotheek, Ida	Oct. 26	Nov. 16	0.01
Idaho-Montana, Ida	Nov. 2	Nov. 21	0.001
Idaho-Nevada, Ida	Nov. 7	Dec. 1	0.001
Lead King, Ida	Nov. 1	Nov. 16	0.0005
Lewis & Clark, Ida	Sept. 15	Nov. 13	0.001
Little North Fork, Ida	Oct. 12	Nov. 12	0.001
Lucky Deposit, Utah	Oct. 12	Nov. 15	0.005
Lucky Swede, Ida. (post.)	Oct. 19	Nov. 19	0.001
Nabob, Ida	Oct. 1	Nov. 2	0.005
National Copper, Ida	Oct. 5	Nov. 5	0.03
North Bunker Hill, Ida. (post.)	.....	Oct. 31	0.002
North Scranton, Utah	Nov. 3	Dec. 3	0.002
Overman, Nev	Oct. 8	Oct. 29	0.05
Peerless, Utah	Oct. 30	Nov. 16	0.001
Phoenix, Ida	Oct. 26	Nov. 26	0.005
Robbers Roost, Calif	Oct. 15	Nov. 9	0.01
Santaquin, Utah	Oct. 7	Nov. 21	0.005
Silver Pick, Nev. (post.)	Sept. 30	Nov. 2	0.01
Sunset, Ida	Nov. 7	Nov. 30	0.003
Tarbox, Ida. (post.)	Oct. 26	Nov. 27	0.0025
Triumph, Utah	Nov. 2	Nov. 23	0.01
Tuscumbia, Ida	Oct. 20	Nov. 20	0.002
Union Con, Nev	Oct. 15	Nov. 5	0.05
United Copper, Wash	.....	.....	0.005
United Tintic, Utah	Nov. 7	Nov. 23	0.01
Valentine, Ida. (post.)	Oct. 12	Nov. 12	0.001
Yellow Jacket, Nev	Nov. 5	Nov. 25	0.05

The Market Report

METAL MARKETS

NEW YORK—Oct. 21

The chief features of the week have been a further softening in the prices for copper and silver, a sharp advance in the spelter market, a slump and recovery in tin and a distinctly firmer tone for lead.

The steamship "Dwinsk" sailed from New York for Archangel, Russia, on Oct. 15, with a cargo comprising 1600 tons of lead, 400 of spelter, 200 of nickel, and 172 of antimony.

A London dispatch of Oct. 20 says that the committee of the London Metal Exchange has decided that its members must pay all sums due at the end of October by Nov. 5, on the following basis per ton: Copper, £49; tin, £120; iron, 49s. Members who are unable to pay the full amount due must notify the committee by Oct. 22, and the committee will thereupon appoint an accountant to investigate such members' financial standing or position. Members who are unable to pay will be suspended from dealing and must pay interest at 1% above the bank rate, with a minimum of 6%. Members must also take up and deliver metals due and close their defaulting clients' accounts. The committee is yet undecided about reopening the Exchange on Nov. 5, but the scheme paves the way for the resumption of daily settlements.

Copper, Tin, Lead and Zinc

Copper—Only a small business is reported. Sales have been made at 11⅜@11¼c., regular terms, to domestic consumers, corresponding with about 11¼@11⅜c., cash, New York, but sales for export are said to have been made at prices netting only 11c., cash, New York. Producers are apparently feeling more free in their efforts to make sales and the market is becoming less one-sided than it was, which no doubt has had something to do with the declining tendency. However, an accumulation of unsold stocks is still going on.

Base price of copper sheets is now 17c. per lb. for hot rolled and 18c. for cold rolled. Full extras are charged and higher prices for small lots. Copper wire is quoted at 13@13¼c. per lb. for carload lots at mill.

The American Smelting & Refining Co. has authorized its works managers to settle at 12.02c. per lb. for copper purchased in September.

The Australian copper mines are reported to be producing at about 80% of their ordinary capacity. The government has been making advances (of 80% on a valuation in August) to them in order to keep the mines going in the interest of the laboring men. Wallaroo & Moonta has notified the government that it will have to recede from this arrangement unless 20% reduction in wages be permitted.

The Rio Tinto is understood to be operating only three days per week and to have suspended its shipments of pyrites.

L. Vogelstein & Co. has issued a circular letter to its clients, saying that the firm proposes to account for all material received during trade interruption at the actual price realized when the respective quantities of copper are ready and marketable as refined copper. In the event of this proposition not meeting with approval, copper will be sold on order of the consignor, subject to a commission of 1%, or will be returned to the consignor, the commission having been deducted, for sale by the consignor.

The price reported in the newspapers as having been paid by England for the copper seized in the Holland-America ships was incorrect.

Tin—The market was heavy under liquidation during the first half of the week. Its tone changed completely as soon as the liquidation was over. Domestic consumers became more interested and were buyers of futures, which, however, they found hard to obtain at the ruling prices. The market closes firm.

Lead—The curtailment of production by the principal producers of Idaho and Missouri has given a distinctly better tone to this market. As yet, consumers have not become interested in taking very large quantities, although it is commonly recognized that the price is probably at bottom. Some sales of lead for export have been made.

The St. Joseph and Doe Run have curtailed production 25%; Desloge, 20%; no advices respecting the Federal have been received. Among the Cœur d'Alene producers, Hercules has curtailed 50%; Hecla has curtailed; Morning is closed. Total curtailment in the Cœur d'Alene is estimated to be equivalent to about 3500 tons of lead per month compared with the production at the midyear.

Spelter—This market advanced right from the beginning of the week, first under the influence of support by important producing interests who became buyers last week, next because of an increased inquiry from Europe, and finally because of the suspension of production at the Butte & Superior mine. Some sales for export have been made and some domestic sales, but the volume of business has not been large, the market having advanced by producers progressively raising their prices after doing small business. There has been a distinct improvement among them and some have not yet been induced to offer quantities any larger than necessary to feel the market. At the close some sellers were asking 5c., but there were sellers at lower prices.

DAILY PRICES OF METALS

NEW YORK

			Copper	Tin	Lead		Zinc	
Oct.	Sterling Exchange	Silver, Cts. per Oz.	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.
15	4.9700	51⅜	*	28¼	3.50	3.32½ @3.35	4.70 @4.75	4.55 @4.60
16	4.9725	50⅞	*	28½	3.50	3.35	4.70 @4.80	4.55 @4.65
17	4.9700	50⅞	*	28½	3.50	3.35	4.75 @4.80	4.60 @4.65
19	4.9675	50½	*	28¾	3.50	3.35	4.80 @4.90	4.65 @4.75
20	4.9625	50⅜	*	29	3.50	3.35	4.90 @4.95	4.75 @4.80
21	4.9500	50	*	29½	3.50	3.35	5.00 @5.10	4.85 @4.95

*No quotations.

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 for this metal remains quiet, but there has been some increase in inquiries. Quotations are 18@19c. per lb. for No. 1 ingots, New York.

Antimony—The market has been stronger, chiefly on account of a demand for export. Ordinary brands, Chinese, Hungarian, etc., are selling at 11@12c. per lb. Cookson's sold early in the week at 14c., but is now held at 15c. per lb., New York.

Quicksilver—Demand here is fair, but the market has settled a little. The current quotation is $50 per flask of 75 lb.; it is possible that this might be shaded on a good order. In London, the price has been advanced to £9 5s. per flask.

Silver—Owing to the sharp decline in foreign exchange and the apathy in the silver market, the price has reached the lowest point—50c.—yet touched in the decline.

The London official prices for the week were: Oct. 15, 23⅜d. per oz. standard; Oct. 16, 23⅛d.; Oct. 17, 23⅛ d.; Oct. 19, 23d.; Oct. 20, 22 1/16d.; Oct. 21, 22⅛ pence.

Platinum—The market is rather uncertain and business is slow. The demand from jewelers, usually good at this season, has been slow. Prices are quoted at $48@50 per oz. for refined platinum and $55@58 for hard metal; but these are subject to negotiation. Abroad the market is entirely nominal.

Zinc and Lead Ore Markets

JOPLIN, MO.—Oct. 17

Blende showed a high price of $42; assay base, $36@40; metal base, $34@36 per ton of 60% zinc. Calamine base, $18@20 per ton of 40% zinc. Average all grades of zinc, $38.16 per ton. Lead was steady at $40 per ton of 80% metal content. Average all grades of lead, $39.84 per ton.

Purchases Friday were at prices $2 to $3 per ton higher than Thursday, and the week-end brought a ray of hope to the producers of zinc ore. The lead shipment this week is 300 tons short of last week, and buyers are expecting a further decline in output on account of the low price level.

SHIPMENTS WEEK ENDED OCT. 17

	Blende	Calamine	Lead	Value
Totals this week	9,565,320	343,600	1,462,530	$219,170
Totals this year.	418,366,280	31,033,660	72,395,670	10,366,730

Blende value, the week, $185,680; 42 weeks, $8,299,320.

Calamine value, the week, $4360; 42 weeks, $362,660.

Lead value, the week, $29,130; 42 weeks, $1,704,750.

PLATTEVILLE, WIS.—Oct. 17

The base price paid this week for 60% zinc ore was $38@39 per ton. The base price paid for 80% lead ore was $40 per ton. Shipments were light owing to the rains and bad condition of roads.

SHIPMENTS WEEK ENDED OCT. 17

	Zinc Ore, lb.	Lead Ore, lb.	Sulphur Ore, lb.
Week	2,313,460	110,000	290,940
Year	127,175,460	4,230,700	27,776,510

Shipped during week to separating plans, 2,052,800 lb. zinc ore.

IRON TRADE REVIEW

NEW YORK—Oct. 21

The iron and steel trades continue dull, and new business is scarce still. Even on contracts, specifications are rather slow in coming to mill.

Prices are weak, as might be expected under the circumstances. Sellers are holding for higher quotations for next year's business, but not much has been reported as yet.

A little inquiry for pig iron is reported, but few sales, and business has been slow. Some small sales of Southern iron are reported for shipment to Italy and Japan.

Arguments in the suit to dissolve the United States Steel Corporation were begun in the U. S. Circuit Court at Philadelphia on Oct. 20. The hearing will occupy several days.

PITTSBURGH—Oct. 20

The iron and steel market as a whole has lost a little more ground in the past week, specifications on old contracts being filed in lesser volume, while new orders are still lighter. An exception is the pipe industry, which has had heavier bookings. The lightness of steel buying is attributed to the financial situation, whereby banking accommodations are largely withheld.

Steel mill operations this week are at an average rate of about 45% of capacity, against a 50% rate a week or two ago. The tin-plate mills are showing the best operation, the wire mills being a close second. At the bottom of the list stand the plate, structural and rail mills. Export business is running at a slightly lesser rate than just before the war, when it was abnormally quiet. South America is a particularly poor market, but Canada is doing better. England has shown good demand for barb wire, nails and wire rods.

Pig Iron—No transactions in bessemer iron have been reported for some time. There have been a few small sales of basic iron, generally at slight concessions from $13, Valley, which has been the regular asking price. Foundry iron is moving only in a very small way, and some sellers are making concessions, it being possible to buy a fair sized lot at $12.75, furnace. We quote prices unchanged, except for foundry iron: Bessemer, $14; basic, $13; No. 2 foundry, $12.75@13.25; malleable, $13; gray forge, $12.50@12.75, at Valley furnaces, 90c. higher delivered Pittsburgh.

Ferromanganese—The market is very soft, generally speaking. There has been no contract buying at the reduced price of $68, Baltimore, lately quoted by the English producers. There is considerable resale material available from the United States, and there are even offerings from foreign consumers who find themselves overbought. Prompt lots can be picked up at about $65 per ton.

IRON ORE

Imports and Exports of Iron Ore in the United States eight months ended Aug. 31, in long tons:

	1913	1914	Changes
Imports	1,621,309	986,576	D. 634,733
Exports	505,841	518,597	I. 12,756

The larger imports this year were 565,543 tons from Cuba and 240,967 tons from Sweden. The exports were chiefly to Canada.

Imports of manganese ore were 238,475 tons in 1913, and 183,929 tons in 1914; decrease, 54,546 tons.

Iron-ore shipments from the Lake Superior region in September were 5,431,307 long tons, a decrease of 1,828,555 tons from September, 1913. For the season to Oct. 1 the total shipments were as follows, by ports, in long tons:

Port	1913	1914	Changes
Escanaba	4,297,223	3,019,651	D. 1,277,572
Marquette	2,573,604	1,385,718	D. 1,187,886
Ashland	3,558,802	2,741,917	D. 816,885
Superior	10,818,324	9,478,253	D. 1,340,071
Duluth	9,830,726	5,278,899	D. 4,551,827
Two Harbors	8,194,738	4,804,975	D. 3,389,763
Total	39,273,417	26,709,413	D. 12,564,004

Of the 5,341,307 tons of iron ore shipped from Lake Superior ports in September, 4,260,529 tons, or 79.8%, were delivered to Lake Erie ports.

Imports at Baltimore for the week included 13,530 tons manganese ore from Brazil; also 1182 tons ferromanganese from Liverpool.

COKE

There is tentative inquiry for a little furnace coke for November delivery, also for a moderate sized tonnage over the balance of the year. A recent forced sale of about 4000 tons of spot furnace coke was at $1.50, generally regarded as under the regular market. There is a fair demand for prompt lots of foundry coke, but scarcely any for contract. Prices are quotably slightly lower: Prompt furnace, $1.60; contract furnace, $1.65@1.75; prompt foundry to consumers, $2.10@2.25; contract foundry, best grades, $2.35 to jobbers, $2.50 to consumers, per net ton at ovens, Connellsville region.

CHEMICALS

NEW YORK—Oct. 21

The general markets are quiet, even inclined to be rather dull.

Arsenic—There is a little more activity and sales have been larger than for some weeks. Prices have weakened, nowever, and current quotations are $3.75 per 100 lb. for both spot and futures.

Copper Sulphate—The market is not specially active, but is steady. Quotations are unchanged at $4.50 per 100 lb. for carload lots, and $4.75 per 100 lb. for smaller parcels.

Nitrate of Soda—Business has been quiet, with only moderate sales. Quotations continue 1.87½c. per lb. for spot and November-December; 1.90@1.92½c. for 1915 deliveries.

Imports and Exports of Raw Material for chemical manufacture, eight months ended Aug. 31, long tons:

	Imports		Exports	
	1913	1914	1913	1914
Sulphur	4,841	14,583	52,684	95,174
Pyrites	614,288	667,066	.....	.....
Chrome ore	45,779	48,081	.....	.....
Magnesite	112,010	89,690	723	1.196

Exports include reëxports of foreign material. Exports of calcium carbide were 21,448,762 lb. in 1913, and 23,174,699 lb. this year.

PETROLEUM

Total oil production in California for the eight months ended Aug. 31 is reported at 70,608,830 bbl.; deliveries, 67,278,-167 bbl.; surplus added to stocks 3,330,663 bbl. The production showed an increase of 6,005,905 bbl. over last year.

Production of petroleum in Ontario in the half-year ended June 30 was 109,884 bbl. in 1913, and 104,641 bbl. in 1914; a decrease of 5243 bbl. The total amount of bounty paid was $54,936 this year.

Exports of mineral oils from the United States in September were 520,333,573 gal. For the nine months ended Sept. 30, the total exports were 1,504,868,564 gal. in 1913, and 1,695,583,269 gal. in 1914; an increase of 190,714,705 gal., or 12.7%, this year.