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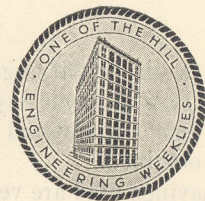
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## The Nevada Wonder Mill

BY ARTHUR C. DAMAN\*

*SYNOPSIS—A ten-stamp cyanide mill that was constructed to handle 75 tons per day has, by some minor changes in solution handling and some small additions to tank capacity, been made to treat 155 tons per day—sometimes more. Power consumption is 27.7 kw.-hr. per ton milled, and 10 tons per day per man is handled.*

The ore of the Nevada Wonder Mining Co., at Wonder, Nev., is milled by the Churchill Milling Co., which is a subsidiary controlled by the same interests.

The crushing of the ore is done with a 10x16-in. Blake crusher, ten 1,400-lb. stamps, one 6-ft. Trent chilean mill and one 5x22-ft. tube mill in closed circuit with a Dorr duplex classifier. The screens used on the batteries have

tute of Mining Engineers, in San Francisco, 1915, some additions have been made to the mill, such as one 28x100-ft. Dorr thickener between the agitator and the stock tank; one clarifying tank, one battery storage tank and two zinc boxes. The pulp, upon leaving the agitators, has a fresh wash of barren solution in each of the four Dorr thickeners before entering the stock tank. By using a fresh barren wash for each thickener instead of the countercurrent-decantation system, the extraction is increased, but the cyanide loss is also increased. From 1,200 to 1,300 tons of solution is precipitated in the 9 zinc boxes each day. The lime is slacked and ground in a small chilean mill and added intermittently to the pulp entering the first Pachuca tank. It was found that only three tanks were needed for agitation, and at present the fourth is used as a settler, the decanted solution being precipitated. To



THE MILL OF THE CHURCHILL MILLING CO., WONDER, NEV.

$\frac{1}{2}$ x1-in. openings, the stamp duty being as high as 16 tons per day, with a yearly average of 15.7 tons. The ore is principally one of silver and averages between \$15 and \$25 per ton. The average tonnage for nine months of 1916 has been 157 tons per day, which is remarkable considering that the mill was designed for but 75 tons and only a few changes have been made in the solution equipment, and at the same time securing a recovery above 90%.

Since the excellent paper on the Churchill Milling Co.'s mill, by E. E. Carpenter, read before the American Insti-

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prevent heavy material from settling on the sides of the Pachuca tank, a cut is made of the heavy sands as they flow over the edge of the funnel and carried to the next in series. Also every day a violent agitation of each Pachuca by high-pressure air is resorted to, so that very little trouble with the Pachuca has been encountered.

The solution strength in the Pachuca tank is kept about  $3\frac{1}{2}$  lb. KCN and 2 lb. CaO. Lowering the strength of cyanide was tried, but a hard, white, crystalline coating formed on the zinc shavings with a resulting steady increase in value of the zinc-box tailings. About 220 lb. of sodium cyanide per day is added to the Pachuca tank



and 150 lb. to the clarifying tanks. By keeping the precipitation heads at about 3½ lb. KCN, no difficulty in precipitation was encountered and tails averaging less than 10c. are obtained.

The zinc shavings used are very coarse, being more than 1/125 in. wide. The efficiency of the zinc was materially increased by clarifying the solution from the Dorr thickeners for precipitation by means of Butters filters. Unclarified, 1 lb. of zinc shavings precipitated 9 oz. of metal, but when the solution was clarified, the same amount of zinc precipitated 15.39 oz. of metal. The average consumption of supplies per ton of ore for the first nine months of 1916 was:

CONSUMPTION OF MATERIALS IN CYANIDING

	Per Ton Milled
Sodium cyanide.....	2.05 lb.*
Lead acetate.....	1.35 lb.
Lime.....	3.69 lb.
Zinc.....	1.45 lb.
Pebbles.....	3.31 lb.
Fuel (heating).....	1.85 gal.
Power (milling only).....	27.7 kw.-hr.
Tonnage per day.....	157
Tons solution precipitated per day.....	1,200-1,300
Tons solution precipitated per ton ore, approximately.....	8

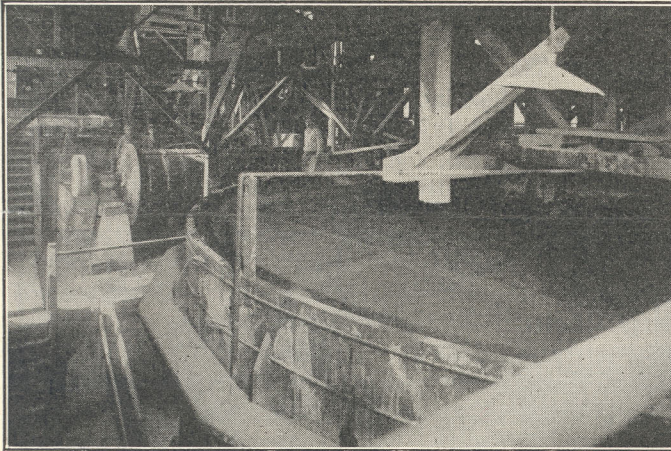
\*1 lb. chemical, 1.05 lb. mechanical.

MILL-POWER DISTRIBUTION

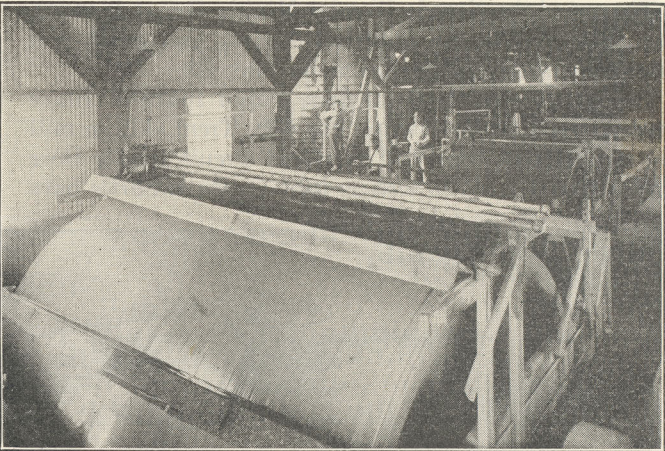
	%	Kw.-Hr. for 1 Ton
Crushing and conveying.....	3.0	0.831
Stamps.....	12.0	3.324
Chilean mill.....	14.0	3.878
Tube mill.....	25.0	6.925
Agitation.....	23.0	6.371
Thickening and washing.....	5.0	1.385
Filtering.....	14.0	3.878
Precipitation.....	1.0	0.277
Refinery.....	0.5	0.1385
Assaying.....	0.5	0.1385
Surface plant.....	2.0	0.554
Total.....	100	27.7

From the mill-power table it will be seen that the crushing uses 54% of the entire power. A total of 300 hp. is represented by the motors in the mill.

The mill has an elaborate system of pipes and pump connections, thus providing for the ready interchange of solutions and pulps without any delay. All the Dorr thickeners have platforms of 2x12-in. plank encircling them, as shown in photograph. These platforms enable the millman to clean his launders or skim off any part of the thickener surface. The regular spray system is not used on the Oliver filters, but water flowing from a perforated 2-in. pipe upon a wooden shelf sprays over the pulp surface. The spray arrangement and the rubber



Tube mill and thickener



The Oliver filters

INTERIOR VIEWS OF THE CHURCHILL MILL, WONDER, NEV.

Squirrel-cage induction motors of 440 volts are used exclusively in the mill. The accompanying table shows the various motors with the load on each:

TABLE SHOWING MOTOR DISTRIBUTION

Motor	Rated Hp. of Motor	R.P.M. of Motor	Hp. to Drive Line Shaft	Hp. to Drive Individual Part	Total Hp. Load on Motor
Crusher and conveyor.....	20	900	6.33	.....	18.75
Dorr thickener No. 5.....	5	1,200	.....	.....	1.17
10 stamps (1,400 lb.).....	30	1,200	4.7	23.46	28.16
Tubemill.....	100	1,200	16.4	.....	106.77
Dorr classifier.....	.....	.....	.....	5.9	.....
Chilean mill.....	.....	.....	.....	36.36	.....
Tubemill.....	.....	.....	.....	48.11	.....
4-in. slime pump (centrifugal).....	20	900	.....	.....	12.9
2½-in. slime pump (centrifugal).....	15	1,200	.....	.....	11.0
Compressor.....	50	1,200	5.63	.....	46.84
Mill compressor.....	.....	.....	.....	34.16	.....
Vacuum pump.....	.....	.....	.....	3.5	.....
Zinc lathe.....	.....	.....	.....	3.55	.....
Thickener.....	20	900	6.0	.....	17.00
4 Dorr thickeners and stock.....	.....	.....	.....	5.00	.....
Triplex and centrifugal pump.....	.....	.....	.....	6.00	.....
Filter.....	30	1,200	3.5	.....	21.12
Vacuum pump.....	.....	.....	.....	1.78	.....
2½-in. centrifugal pump.....	.....	.....	.....	5.86	.....
Vacuum pump.....	.....	.....	.....	8.80	.....
3 Oliver filters.....	.....	.....	.....	1.18	.....
Pump.....	10	1,200	.....	5.39	8.89
Triplex pump.....	.....	.....	.....	3.5	.....

apron used to deflect the excess surface water of the Oliver from entering the filter box are shown clearly in the illustration. By means of the rubber apron the building up of mill solutions is avoided.

The mill crew consists of three batterymen, one crusherman, three solution men, three solution helpers, three refinery men, one utility man, one mechanic and helper and the mill foreman, making a total of 16 men per day, equivalent to 10 tons per man per day.

All mill data—assay values, tonnage, etc.—are posted in the mill so as to give all millmen a knowledge of the mill results. An accurate and up-to-date record is kept of all results obtained and shows very interesting details of milling.

I am indebted to E. E. Carpenter, general superintendent, and H. M. Alley, mill foreman, for the data incorporated in this article.



The Bolivian Mineral and Natural-Products Exhibit, shown at the Panama-Pacific Exposition in San Francisco, has been set up in New York as a permanent exhibit, to be maintained in connection with the new offices of the consul general, Adolfo Ballivian, on the 41st floor of the Woolworth Building.