

CYANIDING SILVER ORES AT NIPISSING MINE, COBALT*

By James Johnston.

The cyanide plant is placed in a building apart, but connected to the battery and tube mill building. It is arranged in two floors, the upper one containing all the slime collecting and the cyanide treatment vats and the lower floor containing all the solution vats, slime filters, and pumps.

There are on the upper floor:

Three 34 ft. diameter by 13 ft. deep slime collecting vats,

Seven 34 ft. diameter by 13 ft. deep slime cyanide treatment vats,

Two 34 ft. diameter by 13 ft. deep stock slime pulp vats for charging filters,

One 34 ft. diameter by 13 ft. deep barren solution vat.

These vats are placed in two parallel rows, and, with the exception of the solution vat, they are all fitted with a mechanical stirring apparatus, driven by a line shaft placed over the vats on a wooden bridge or trestle. The paddles in the vats are made of 4 by 6 in. pine on edge and the two longest arms are 27 ft. in diameter and revolve at 8 rev. per minute, giving a speed on the end of 678 ft. per minute; paddles are located at 2 ft. from the bottom of the vat.

These 12 vats are driven by a 125 h.p. motor, and as on an average 8 of them are agitating at one time, the power necessary to drive vats and shafting is 55 kw. Each vat has an average working load of about 140 tons of dry slime plus about 280 tons of solution.

The slime collecting vats are arranged with a circular overflow around the top on the inside, 6 in. wide by 8 in. deep, over which the clear battery solution flows into the launder leading to the lower battery solution vat. The bottoms of the vats are connected to a 7 in. diameter and to a 4 in. diameter centrifugal pump for transferring the thickened pulp, and a 6 in. diameter decanter is fitted to the side of the vat.

The battery pulp is run into one of these vats for about 9 hr., collecting about 92 tons (dry weight) slimes, and during this collecting period the excess solution overflows to the lower battery solution vat, from which it is repumped for circulation in the battery solution circuit. When the necessary charge is collected, the pulp is switched to collect in the next vat and in the meantime the slime is settling, excess solution being decanted until the pulp in the vat represents about 1.5 solution to 1 slime. The pulp is now agitated for about 1 hr., the depth of pulp measured, sampled, and specific gravity determination made for slime tonnage. The specific gravity of dry slimes on this ore is 2.7. The calculation made here, as previously noted, works out at practically the same tonnage as the weighed-in weight of the ore, after due allowance has been made for the addition of lime and tube mill pebbles.

The thickened pulp of 1.5 caustic soda solution at 0.25 per cent. strength and 1 of slime is now pumped to the desulphurizing treatment.

Desulphurizing Process.

The problem of working out a successful all-cyanide treatment for the Cobalt ores, in which there is such a varying amount of complex minerals, led to the discovery, during the period of experimental work, of what is now known as a wet desulphurizing process. The

details of the reactions involved and the necessity for such a treatment will be obtained by referring to J. J. Denny's article. (See page 711, Nov. 15, issue.) Briefly explained, the preliminary desulphurizing treatment breaks up the refractory silver minerals when the slime pulp is brought into contact with aluminum in a caustic soda solution, the silver being left in a spongy metallic state readily amenable to cyanide treatment.

The desulphurizing is accomplished by passing the slime pulp through a revolving tube mill, in which there is a quantity of aluminum, and a further treatment is given in a vat lined with aluminum plates, in which the pulp is slowly agitated.

The practical effects of this preliminary treatment on the ores has resulted in the same and sometimes a better extraction being obtained in 48 hr. cyanide treatment than was otherwise obtained in 120 hr. cyanide treatment with no desulphurizing. In some of the ores which contained a greater proportion of the refractory minerals a better extraction of from 1 to 4 oz. per ton is obtained when desulphurized and cyanided, as compared with a cyanide treatment and no desulphurizing.

A tube mill, 4 ft. in diameter by 25 ft. long, lined with 2 in. thick Silex blocks, is used for the first stage of the desulphurizing treatment. This mill revolves at 10 rev. per minute and carries a load of about 4,000 lb. of aluminum ingots, cut up into cubes about 1.5 to 2 in. The slime pulp is fed through this mill at the rate of 14 tons of dry slimes per hour, diluted with 1.5 caustic soda solution to 1 dry slime. The pulp then gravitates into the 34 ft. diameter by 13 ft. deep alkali stock pulp vat, which is arranged with mechanical agitation and lined around the side with aluminum plates. The pulp is agitated in this vat about 24 to 36 hr. or until it is gradually drawn off in about 40-ton charges to the dewatering filter box. On account of keeping the mill cyanide solution in balance, it is necessary to eliminate as much as possible the crushing caustic soda solution from the slimes before they are transferred into the cyanide vats for treatment, and this is done in a Butters filter plant equipped with 60 leaves, which is capable of dewatering 270 tons of slimes per day, the cake when discharged carrying 26 per cent. alkali solution as moisture.

The slimes after dewatering flow into a 16 ft. by 5 ft. deep pulping vat, where they first come in contact with cyanide solution, being diluted with about 2 of cyanide solution to 1 of slime. A 4 in. diameter centrifugal pump is used for transferring the pulp into the cyanide treatment vats.

Cyanide Department.

There are seven, 34 ft. diameter by 13 ft. deep slime treatment vats, fitted with mechanical stirring arrangement. Each vat has a 6 in. diameter decanter, for draining off the clear settled cyanide solution; they are also fitted with a 6 in. diameter air lift operated by a 0.75 in. diameter pipe with air at 20 lb. pressure.

The slimes are treated in charges of about 130 tons dry slimes in a vat, with a dilution of 2 of solution to 1 of dry slimes in a 0.25 per cent. cyanide solution and 0.20 per cent. alkali, agitation being maintained for 48 to 60 hr. Repeated testing in the mill has demonstrated that equally as good an extraction of the silver values

*Extract from a paper on the Mill and Metallurgical Practice of the Nipissing Mining Co., published in Bulletin of the A.I.M.E., January, 1914.