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Draft Tube Technology Glitters at Nevada Gold Mill

A new 1,000-ton/day Pinson Mining Company open pit gold operation near Winnemucca, Nevada, held its official opening on May 12. More than 400 mining engineers and mine officials from throughout the U.S. and Canada converged on Winnemucca for the occasion, partly to see the first carbon-in-pulp train using draft tube circulators to be put into operation in North America for gold recovery.

At a projected annual output of approximately 47,000 ounces this year, Pinson is expected to account for about 5% of total 1981 U.S. gold production.

Newest U.S. gold mining operation is the Pinson Mining facility outside Winnemucca, Nevada, where innovative draft tube technology in a carbon-in-pulp train facilitates output that is expected to account for about 5 percent of U.S. gold production in 1981.

Orebody Suggests Carbon-In-Pulp

Design of the plant began in earnest late in 1979 at Industrial Design Corporation in Salt Lake City. Continuous Pinson input to the six-month design phase was provided by Bruce Thorndycraft, mill superintendent, with assistance from consultants Gordon Craig and Bruce Brogoitti, and Mixing Equipment Company Senior Application Engineer, Bob McDonough.

The nature of the orebody prompted the interest in carbon-in-pulp technology, a relatively new technique used until now primarily in South African gold mills. The gold at Pinson is extremely fine, predominantly -200 mesh particles, locked intimately in the host limestone. The ore is relatively free of companion substances, such as silver and sulphides, which if present would tend to "load" on the carbon.

Ultimately, the mill operation was set up to process material reduced to -200 mesh by jaw and cone crushers, and by two ball mills.

The reduced ore is piped at 15% solids to a thickener tank 100′ in diameter, and with a capacity of 500,000 gallons. The gold-bearing mix eventually leaves the thickener tank in two streams. Dissolved gold overflows the top of the tank in a clear solution and goes directly to a series of five conventional 4′ x 12′ carbon columns, each holding one ton of granular carbon. The solution flows upward through the tiered columns by gravity. Gold-loaded carbon from the columns is fed to stripping and electrolytic tanks prior to furnacing.

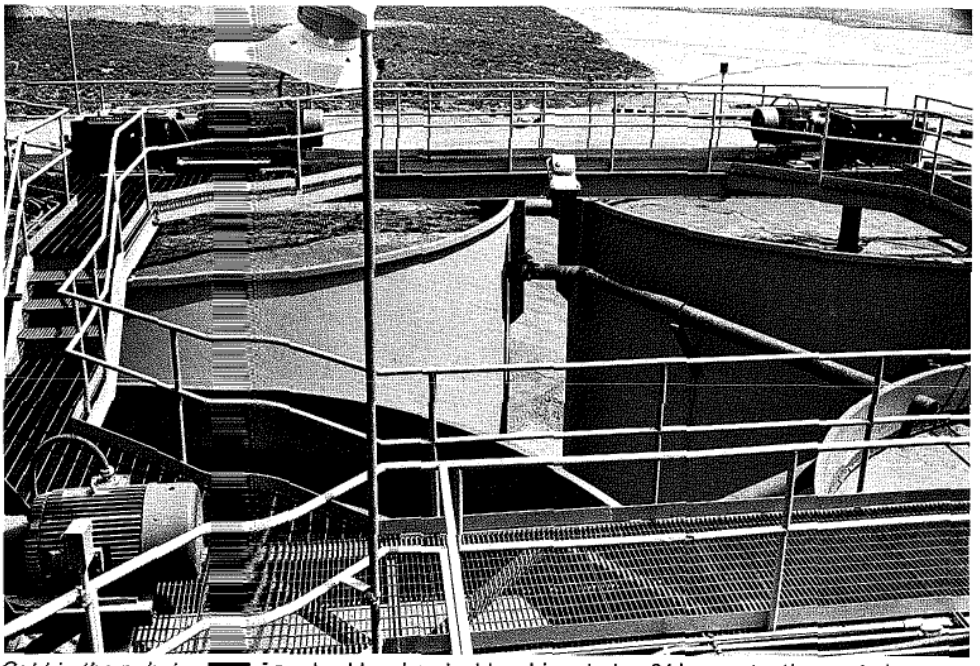
From the conical bottom of the thickener tank, after 6 hours retention time, comes a second stream which has been thickened to 40% solids. This "pulp" is pumped to four large leach tanks, where gold is dissolved by chemical leaching during another 24-hour average retention period. Each of the four leach tanks is equipped with a 60 hp Lightnin agitator.

Must Optimize Adsorption and Attrition

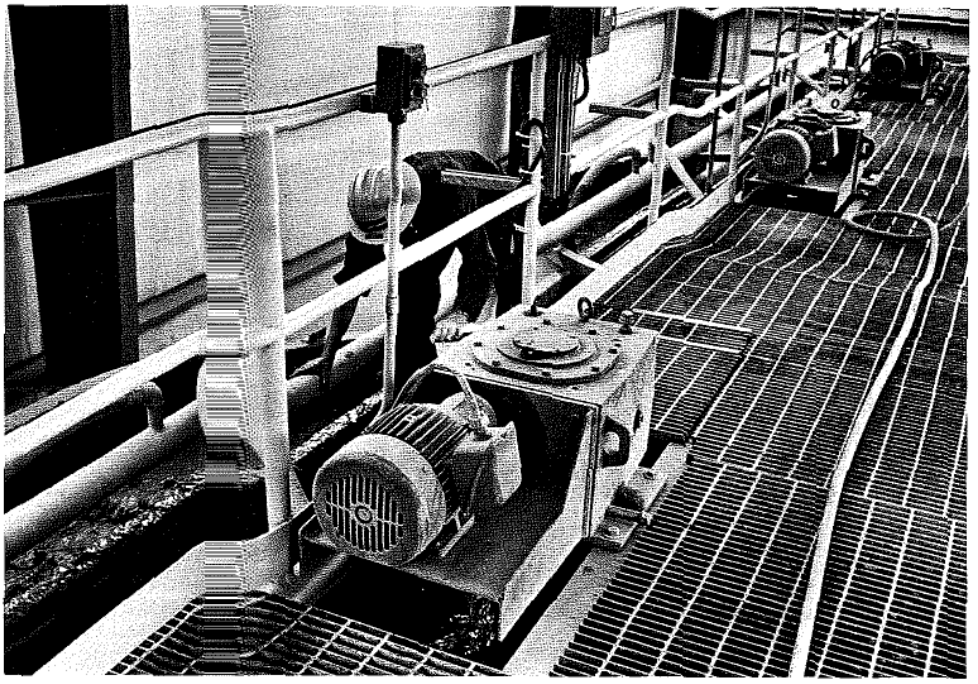
The crucial phase of the carbon-in-pulp train begins when the gold-bearing pulp leaves the leach tanks and enters a series of five carbon tanks. The problem is to propel the pulp into contact with the carbon at a rate that will achieve optimum adsorption of the dissolved gold, but below a force level that would cause breakage and loss of the friable carbon. Abraded carbon, of course, carries adsorbed gold away with it. The challenge of carbon-in-pulp gold recovery is to achieve rapid adsorption of gold while holding carbon loss to an absolute minimum. An attrition rate of .04 pounds of carbon per ton of ore processed, including preconditioning and regeneration losses, is considered commendable.

During the design phase of Pinson Mining Company's carbon-in-pulp train, General Manager Don Duncan and Mill Superintendent Bruce Thorndycraft counseled with various agitator manufacturers.

Ultimately, a proposal developed jointly by J. William Nibley, representative for Mixing Equipment and Mixing Equipment's Robert McDonough, senior application engineer and non-ferrous metals specialist, received



Gold in the pulp is dissolved by chemical leaching during 24-hour retention period. Each of the four leach tanks is equipped with 60 hp Lightnin agitators.



Achieving design output from the carbon-in-pulp train requires a fine balance between contending factors. Rapid adsorption of gold onto the carbon required active contact between carbon and pulp in the draft tube circulators. The force has to be below a level, however, that would cause excessive attrition of the gold-bearing carbon. Each of the five CIP tanks was fitted with a 7½ hp Lightnin draft tube circulator.

approval for incorporation into the Pinson CIP train.

Basic design of the train called for a series of five carbon-in-pulp tanks, each 11'x22' and containing approximately one ton of carbon.

Draft Tube Minimizes Energy Consumption

Propulsion of the gold-laden pulp through the carbon-in-pulp train is achieved in each tank by a 7½ hp draft tube circulator fitted with a hydraulically-efficient axial flow propeller. The advantage of the draft tube circulator is that it achieves the required suspension of solids with minimum consumption of power compared to alternate mixing modes, while minimizing shear rate and carbon attrition.

Carbon is advanced upstream in the train with a recessed-impeller pump to minimize shear rate. Carbon pumped from the final upstream tank has reached an average loading level of 250 oz. per ton.

By mid-May, the Pinson facility was slightly exceeding its 1,000-ton-per-day mill rate. More importantly, gold production had already attained the planned 45,000-oz. annual rate from the open pit operation. A factor in attainment of the planned level of gold production has been Pinson's excellent control of carbon attrition. The yield of potentially recoverable gold at Pinson was reported to be running at 85%.

Yield Rated High

According to Pinson's Bruce Thorndycraft, "We are more than satisfied with our current 85% recovery rate. Our bench tests with exploration samples and our design -200 mesh size indicated that 85% would be the maximum recovery we could expect without much higher capital and energy costs to grind the material finer than -200 mesh. To achieve an 85% yield during the first 6 months of operation meets our highest expectations."

At current recovery costs and production rates, and at gold prices as low as $400 per oz., the Pinson mine was expected to pay back its $18,800,000 capital cost in less than two years. A factor in this success would appear to be the well-designed carbon-in-pulp train, with its highly cost-effective recovery of gold from relatively difficult paydirt.