Technology

Prof aims to revive Ragged Chute technology

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Dean Millar, director, of energy, renewables and carbon management research at MIRARCO – Mining Innovation.

An ingenious but long-forgotten technology for producing compressed air in the Cobalt mining camp could play a role in reducing energy costs in the mining industry today, according to Dean Millar, director, of energy, renewables and carbon management research at MIRARCO – Mining Innovation.

The Ragged Chute compressed air plant was designed by Canadian engineer Charles Havelock Taylor and went into operation in 1910. It produced 40,000 cfm of air at 130 psi, supplied 29 or 30 mines by way of an elaborate distribution network of cast iron pipes and had no moving parts.

As legend has it, Taylor was working on the construction of a dam in Buckingham, Quebec in the winter of 1895 when he noticed that air bubbles entrained in a flow of water over a spillway were carried under the ice at the base of the fall and formed ice domes.

On breaking one of the domes, he realized that the air inside was under pressure.

Taylor thought that if he could replicate the phenomenon, he could produce compressed air for industrial use.

He built a small compressed air plant using this principle in Magog, Quebec, and a second, larger one was built for a mine in British Colombia but never used because the mine failed to go into operation.

When Taylor visited Cobalt in 1905 and discovered the mines were burning coal to power air compressors, he quickly came to the conclusion that he could produce compressed air much more cost efficiently.

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A dam was constructed on the Montreal River and a 9.5-foot shaft was blasted to a depth of 351 feet. Air intake pipes at the top of the shaft introduced air into the water as it plunged down the shaft.

“As the water went down the shaft, it pushed against the air bubbles and pressurized them,” explained Millar. “The deeper it went, the more the air bubbles were compressed.”

At the base of the shaft, the water mixed with air entered a 300-metre long, five by eight metre horizontal cavern at 90 degrees to the shaft.

“It slowed the water down, causing the buoyancy of the bubbles to take over. All the bubbles rose to the top and joined together, creating a large body of compressed air,” said Millar.

The air then entered a 24-inch diameter pipe that carried it to surface, while the water returned through a riser shaft driven by the head between the two reservoirs to rejoin the watercourse.

The plant required no fuel, cost almost nothing to operate and ran continuously for 70 years with two brief maintenance interludes.

According to Millar, an electricity bill today for a plant of that size would be $3 million to $4 million per year.

Millar is convinced the technology is far superior to the electrically-powered air compressors currently used in the mining industry.

“Some of the work that’s done when you compress a gas isn’t used to pressurize it,” he explained. “Some of it ends up as heat, raising the temperature of the gas. That’s not very good. You want all the work that you’re applying to end up as pressure. If you can keep the gas cool somehow when you’re compressing it, you can make that compressor a lot more efficient.

The Ragged Chute system increases the temperature of the gas, but the heat is transferred to the water, making it the most efficient gas compressor possible, concluded Millar.

A modern mine wouldn’t require anywhere near the 40,000 cfm produced by Ragged Chute, nor would it require a river to supply the water.

A simple pipe going down an existing shaft with water from a mine’s water supply would more than suffice to produce the 2,000 cfm of compressed air that a mine would require, said Millar.

As a proven technology, there’s not much point in further research, so Millar’s plan is to start a company and “fast track” straight to commercialization.

The Ragged Chute plant has been converted to a 7 MW hydroelectric power station and is owned by TransAlta.

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