APPLICATION PROFILE

MILLING FOR EFFICIENCY

A Cat 3406 powers a patented airmill process that saves Gowan Milling approximately $168 an hour.

Start with a theory and plunge into a previously untested application. Forget about pilot projects or lab experiments and roll the application out on a full production scale. Sound risky? This is exactly what Yuma, Ariz.-based Gowan Milling had the courage to attempt. As a result, the company, which airmills insecticides and fungicides for the agricultural market, has reaped impressive cost savings.

It all started with forward thinking management. "A lot of people wouldn't take a chance with something they considered risky," says Wayne Cannell, plant engineer and the person who came up with the initial concept. "They would stay with proven technology." But instead, Gowan milling ventured into uncharted territory, and saved the company money.

Gowing Milling uses airmills to grind insecticides and fungicides for major players in the agricultural chemical market. More than 100 different SKUs are produced at the plant. All airmilled products are the consistency of fine powder (between 4 and 10 microns), which makes safety a primary consideration.

In the presence of oxygen, dust particles become potentially explosive, which requires the airmill to use a closed loop system with an inert gas (nitrogen). The gas takes oxygen out of the equation and allows safe milling of the powder. In a traditional airmill operation, an electric motor turns a compressor. The compressed nitrogen for the closed loop system is supplied through an outside tank. But purchasing nitrogen is an expense.

THE GRAND EXPERIMENT

Cannell came up with an idea that would set the company's airmilling process on an uncharted path. "We knew we had to run a compressor," explains Cannell. "Why not run a compressor with an engine and use its exhaust gas as the source for the nitrogen?" He consulted with outside sources to help put his theory into a working plan.

Theory became reality in 1996. "The biggest challenge resulted because it was completely new," remembers Cannell. The system was based on theory and there was nobody with real-world application experience to answer questions. But the design proved sound. "There are very few changes from the original design," he says.

Here's a simplified description of how the closed loop system works: The airmill requires approximately 880 scfm to operate, which is supplied by a Cat 3406 engine coupled to a compressor. The exhaust gas from the engine is conditioned and run back through the compressor.

First the exhaust gas is run through a catalytic converter and then through a heat exchanger. Next the gas enters an inert gas chamber. From here it travels through a compressor and then another heat exchanger. Next it flows into a receiver and ultimately to an airmill.

After it goes through the airmill, the gas travels through a dust collector to remove particles. It is then sent through hepa filtration and carbon before returning back to the inert gas chamber.

"It works very well, but numerous parameters must be

Pioneering Plant Engineer, Wayne Cannell, right, came up with the idea for the inert gas system. Ron McCulla, account manager from Cat dealer Empire Power Systems, provides support.

controlled to get it right," says Cannell. "There are many things to watch carefully or it will make nitric acid. I've learned a lot about how this engine runs based on watching its fuel ratio controller."

The exhaust byproducts are mainly carbon dioxide and nitrogen and a small amount of oxygen and carbon monoxide. "Once it goes through the scrubbers and other controls, it's virtually just nitrogen," he explains. The resulting gas contains around 3% to 5% oxygen.

"It's not completely inert, but it's at the point where we need to run it," he explains. "Typically, there has to be 12% oxygen to support combustion. We are able to run in the 6% range if we need to."

COST SAVINGS CALCULATED

Gowan Milling's engine-driven system eliminates the need to purchase nitrogen. It also allows the company to use the safe inert gas process to airmill virtually any product. "We can run inert at no additional cost whether we have to be inert or not," explains Cannell.

Another bonus: The system paid for itself in only a few months. Cannell calculates that the system requires a constant 400 scfm to be added to the closed-loop system to maintain an inert operation. This translates to $168 an hour at the current price the company pays for nitrogen. If the mill runs 20 hours a day, this equates to $3,360 a day for nitrogen.

The airmill is shut down twice a month for five days each for cleaning and to switch to another product. Based on Cannell's figures, if the plant operates 20 days a month, the inert system saves about $67,000 a month on nitrogen.

A PROVEN SOLUTION

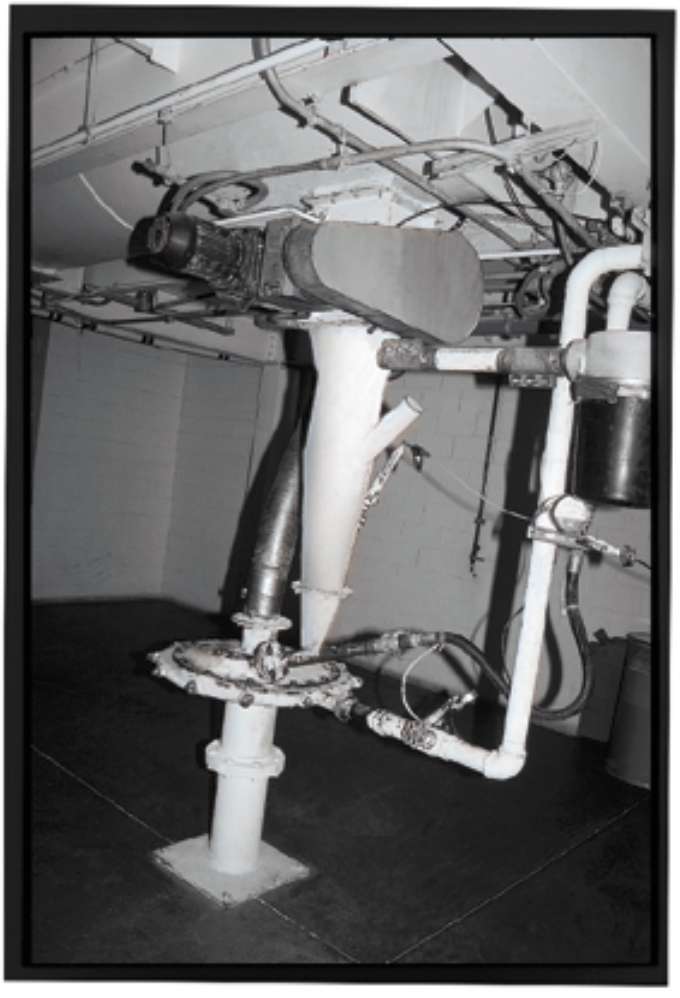
While Gowan Milling was willing to take a calculated risk to develop a more efficient manufacturing process, the company turned to suppliers it could trust with proven products and service to assemble the system. The Caterpillar brand meant a lot to Cannell, who has a mining background. "I wanted something reliable

This Cat 3406 is used to turn a compressor. In addition, the exhaust gas is the source of the inert gas used in the airmilling process.

and proven. Mines use a lot of Caterpillar engines because they are reliable and made well – there is a definite name appreciation with Caterpillar."

Cannell initially worked with the compressor manufacturer to mate the compressor to the Cat 3406. He worked with Cat dealer Empire Power Systems (Phoenix, Ariz.) for the installation. "The most complicated portion of this project is the engine/compressor relationship. I knew Caterpillar had enough experience to handle it," he says.

Cannell has developed a good working relationship with Ron McCulla, Empire Power Systems account manager. "Empire has always bent over backward to help. I've really appreciated that."



This airmill is the workhorse of the system; the speed of air in the airmill can reach near Mach 1. By controlling the air pressure and the feed rate, Gowan Milling is able to control particle size of the product.

The Caterpillar 3406 has also proven its durability in this application. The unit currently has 25,000 hours and just went through its first major overhaul 3,000 hours ago. "It's very reliable," says Cannell.

The only challenge has been premature engine shutdown. "We use a PLC programmed in a first-out indicator," says Cannell. "Now when the engine shuts down, the operator knows why: high water temperature, low water level, high oil temperature or because the stop button was pushed. We can now go directly to the source for corrective action," he adds.

WORK IN PROGRESS

Gowan Milling also has a similar system powered by a Caterpillar G3512. The main difference is that the engine is coupled to a generator. The generator powers an electric motor that turns the compressor. The generator also supplements power to the rest of the manufacturing facility. "We paralleled with APS (the local electric utility) to use the whole plant as a load," explains Cannell.

While this system has also proven itself, it has been more of a challenge. The fluctuations in the power demand at the facility have made it more difficult to control variables that influence the quality of the exhaust gas. "The concept is correct, but unless the system runs at a consistent 400 kW, the gas quality is affected."

Cannell also speaks highly of the fuel ratio controller on the Cat G3512. "It allows me to get online with a laptop and see exactly what the engine is doing," he explains.

On June 29, 1999, Gowan Milling was awarded patent number 5,915,635 for its process of extracting inert gas from natural gas exhaust. The company's future plans include marketing the patent and the technology.

"In applications that don't need pure inert gas, the exhaust can be cleaned up for explosion protection," says Cannell. For questions about this technology, contact Wayne Cannell via e-mail at wcannell@gmilling.com or phone (928) 317-5815.