

New installation

Tubular drag cable conveyors help company turn green coffee beans into smooth blends

A coffee roaster specifies tubular drag cable conveyors for a new facility's production process to reduce operating costs and improve production efficiency.

Appfels Fine Coffees, Santa Fe Springs, Calif., produces a wide range of custom-blended regular and flavored whole-bean and ground coffees and other coffee ingredients for food stores, private labelers, and food-service establishments. The company imports hand-picked green coffee beans and custom-blends and roasts them to make the whole-bean and ground coffee products that are packaged in 1-ounce to 5-pound valve bags for distribution. In early 2004, the company worked with an engineering firm to design and build a new advanced computer-aided roasting facil-

ity for small-batch and high-volume production runs. When planning the facility, the company needed to install a conveying system that would efficiently and gently move the coffee beans and ground coffee through the production process without diminishing product quality.

Finding better conveyors

In the past, the company used bucket elevators, augers, and pneumatic pressure conveying systems to move the beans and ground coffee through the blending, roasting, grinding, flavoring, and packaging processes. However,



The freshly roasted coffee beans discharge from the roasters into a hopper that directs them to the conveying system that gently moves them to the holding silos.

these conveyors were maintenance- and labor-intensive and required excessive production downtime to clean between product runs to prevent cross-contamination. “This kept our operation costs high and decreased our production efficiency,” says Darryl Blunk, Apffels president. “The conveyors also broke the roasted coffee beans and declassified the coffee grounds because of the way they worked. This was a problem because we want unbroken beans and a consistent grind distribution at the end when we package the final product.”

When the company decided to build the new facility, it worked closely

with Nohbell Corp., Bellevue, Wash., an engineering firm that specializes in designing, developing, and implementing supply-chain operations for coffee, wine, and food processors. During the planning stage, the engineering firm recommended that the company use enclosed tubular drag cable conveyors to move the beans and ground coffee through the production process. Based on the engineering firm’s experience in the coffee industry, these slow-running, dust-free conveyors would carefully convey the friable roasted beans and ground coffee without breaking the beans or stratifying the grounds. And because of how the conveyors move



The roasted beans discharge from the holding silos (right) into a conveying system that moves them vertically and then horizontally above the two grinders (bottom left).

material through the enclosed tubes, they would also reduce maintenance and cleaning requirements and improve production efficiency and product quality.

The company sent samples to a recommended conveyor supplier for testing. The supplier, Cablevey Conveyors, Oskaloosa, Iowa, manufactures custom-designed conveying systems for the food processing, agriculture, wood, and other bulk solids industries. The tests proved successful, and the company's engineers worked with the supplier's engineering team to custom-design eight conveying systems for the new facility.

The tubular drag cable conveyors

In late 2004, the supplier's technicians installed eight Model 4000 Series tubular drag cable conveyors, some of which have multiple discharges, in the company's new roasting facility. Each conveyor consists of two 4-inch-diameter enclosed tube sections (an infeed and a return tube) with a turnaround section at one end and a variable-speed 5-horsepower drive-and-sprocket assembly at the other. The turnaround section connects the infeed and return tubes at the infeed end and includes an automatic cable-tensioning device. The drive-and-sprocket assembly connects the tubes at the discharge end, forming a continuous circuit. If necessary, a strategically placed mechanical corner in the conveying circuit redirects material at a horizontal or vertical right angle. The conveyor is constructed of stainless steel, making it suitable for food-grade applications.

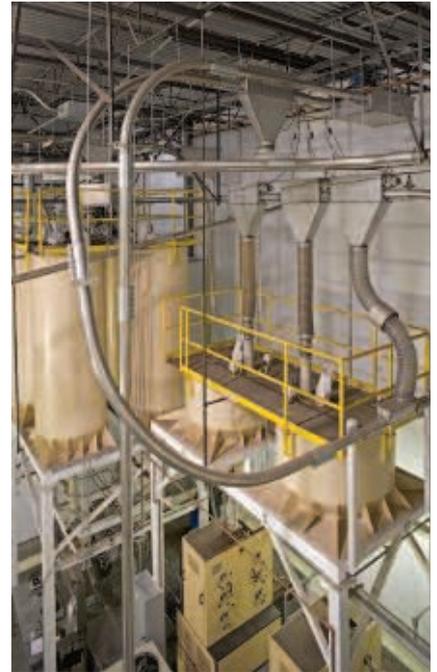
A continuous flexible stainless steel cable is installed inside the enclosed tubes, and solid, food-grade, ultra-high-molecular-weight polyethylene (UHMW-PE) circular discs are mounted on the cable at regular intervals. The discs are shaped to ease material movement and reduce degradation. Since the discs are nearly the same diameter as the tubes, their narrow clearance with the tube walls ensures that the material stays

between them during conveying and minimizes residue on the tube walls. To minimize downtime between product runs, a food-grade clean-out disc mounted on the cable keeps the tubes clean, and a continuously operating air-knife at the outlets blows air across the discs when they pass to dislodge any material from them.

The production process equipment and conveying systems are fully automated and integrated with a central controller, allowing remote control and monitoring of the entire process from one location. Using the controller interface, an operator creates a recipe for a custom-blended coffee product and pushes the start button. The controller then automatically opens and closes the necessary valves and conveying system discharges to move the beans and ground coffee through the production process, from bag-break station to packager.

To make a custom-blended coffee product, an operator empties the specified bags of green coffee beans into a bag-break station's hopper. The beans discharge from the hopper into a small bucket elevator that moves the beans up and over to a hopper that connects with sizing and screening equipment. This equipment removes off-size beans and any foreign materials, such as sticks or rocks. The beans are weighed and then discharged into the first tubular drag cable conveying system, which moves them to one of six silos. To blend the beans, the controller activates the appropriate silo discharge valves to gravity-discharge the correct combination of beans into a large hopper, which discharges to the second conveying system, which moves the blend to one of two roasters for roasting via the system's two discharges.

The roasted beans discharge into the third conveying system, which moves them to one of 12 holding silos. The controller activates the appropriate holding silo discharge valves to gravity-discharge the beans into the fourth conveying system, which can move the beans to one of three locations via



The central controller can activate the conveying system's first discharge (right) to direct the beans to the flavoring room, the second or third discharge to direct them to one of the grinders, or a fourth discharge to direct them to the packaging room conveying system.

the system's four discharges: the flavoring room, one of two grinders, or the packaging room conveying system. If the beans are directed to a grinder, the ground coffee discharges into the fifth conveying system, which can move it to either one of four degassing silos or to the packaging room conveying system via the system's two discharges. The sixth conveying system moves the ground coffee from the degassing silos to either the flavoring room or the packaging room conveying system via the system's two discharges.

The packaging room conveying system is the seventh system, and it moves both regular and flavored coffee beans and ground coffee to one of four packaging stations via the system's four discharges. The company uses the eighth conveying system to put rework back into the production process. By way of this system's two discharges, material can be moved to either the third conveying system that connects to the holding silos or the

fourth conveying system that connects with the grinders, flavoring room, and packaging room conveying system.

According to Guillermo Contreras, Apffels production manager, the company operates the conveying systems at 85 percent of their maximum 100-foot-per-minute rate and can move 3,000 pounds of ground coffee from a grinder to the degassing silos in about 45 minutes. Overall, the eight conveying systems have a total of 1,970 feet of tubing. To ensure safety during operation, if a cable is tensioned too quickly or breaks or a turn-around-section cover is opened, the system automatically shuts down and sounds an alarm to alert the operators.

Improving the production process

Since installing the tubular drag cable conveyors in the new roasting facility, the clean-out time between product runs and the maintenance and labor requirements have significantly decreased. “The clean-out discs inside the tubes take out just about everything, leaving little to no residue on the tube walls, so it only takes about fifteen to twenty minutes between products,” says Contreras. “We’ve been using them for more than seven years, and I haven’t had to do much to them, other than maintain the gear boxes, turn-arounds, and drives. And if a cable or disc ever breaks, we just have to splice in a new cable section or mount a new disc on the cable and we’re running again. It only takes about an hour, depending on where the break occurs, and I keep plenty of spare parts onsite. We once had to replace a full cable and the system was only down for about half a day, which is much less time than it would take to fix the bucket elevators.”

The conveying systems have also improved the company’s production efficiency and product quality. “The conveyors maintain the grind consistency as they move the ground coffee through the process to packaging,” says Blunk. “We’ve also seen a significant decrease in bean breakage be-

cause the conveyors move the beans so gently. They’ve really helped us improve and maintain the quality of our whole-bean and ground-coffee products.”

According to Blunk, if the company expands the current production process or adds a new one, the supplier will be the first one he calls for conveyors. “Their conveying systems have enabled us to consistently produce top-quality products and easily maintain a dust-free, sanitary operation for more than seven years now, which is critical from a food-safety standpoint,” he says. “They’ve been a good partner and have always been responsive. We definitely challenged them with this installation, but there were things we discovered during the installation process that helped them improve and enhance their conveyors, so I think it’s been a win-win situation for both of us.” **PBE**

Note: Find more information on this topic in articles listed under “Mechanical conveying” in *Powder and Bulk Engineering’s* Article Index in the December 2012 issue and at *PBE’s* website, www.powderbulk.com, and in books available through the website in the *PBE* Bookstore. You can also purchase copies of past *PBE* articles at www.powderbulk.com.

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