Case history

Conveyor removes knots from pretzel enrobing operation

A snack food company installs two horizontal-motion conveyors in its pretzel enrobing operation to improve production and reduce labor costs.

For more than 50 years, Georgia Nut Co., Skokie, Ill., has been developing and manufacturing snack foods and confections, including hard candies, roasted and salted nuts, and an assortment of coated or sugar-shelled nuts, fruits, and pretzels. One popular item is enrobed pretzels, which are available with various chocolate or yogurt coatings. To produce the pretzels, the company uses an enrobing process in which the pretzels are arranged in several single-file rows on a belt conveyor that moves them through a chocolate or yogurt enrobing machine and cooling tunnel. In the past, vibratory conveyors were used in each of the three enrobing lines to arrange the pretzels into rows and feed them from a hopper to a belt conveyor. However, the conveyors' vibratory motion caused production problems, so the company decided to find a better way to align and feed the pretzels to the enrobing equipment.

Coating pretzels with chocolate or yogurt

When running the pretzel enrobing lines at full capacity, the company operates two 10-hour shifts a day, 7 days week, with each line producing 550 pounds of chocolate- or yogurt-enrobed pretzels per hour. To make enrobed pretzels, an operator manually dumps pre-salted pretzels into a large feed hopper at the front end of an enrobing line. The hopper has a vibratory feeder pan and a slide gate, allowing the operator to control the pretzel discharge rate by either changing the pan's vibratory amplitude or the gate's opening.

After discharging from the vibratory feeder pan, the pretzels move through a layering section designed to create a single layer and then across a sifting screen at the infeed of a conveyor. The sifting screen removes broken pretzel pieces and loose salt from the material stream so that only whole pretzels go through the enrober. And the conveyor, which has vertical lane-divider fins installed in its conveying trough, arranges the pretzels into single-file rows.

The conveyor transfers the pretzel rows onto a belt conveyor that moves them through the enrober, where a

During operation, the horizontal-motion conveyor's slow-forward, quick-return conveying action transfers the pretzels from a hopper to an enrobing line at 10 fpm.

continuously streaming chocolate or yogurt waterfall fully coats the pretzels. After exiting the enrober, the coated pretzels move through a cooling tunnel that sets the chocolate or yogurt and then to a collection hopper that services the packaging operation.

Problems aligning and transferring pretzels

When originally building the three enrobing lines, the company constructed and installed two conveyors for aligning and feeding the pretzels to the enrobing equipment. (Both conveyors were movable, and one was used on two lines.) However, the company eventually became dissatisfied with the conveyors' performance and contacted a vibratory conveyor manufacturer for replacement conveyors. The company noticed an improvement in production rates but was still experiencing production problems.

"The vibratory conveyors, what we call pretzel feeders, weren't able to effectively create a single layer of pretzels at high production rates, so the pretzels were still shingling — going through the enrober on top of each other, creating doubles in the final product," says John Bocskay, Georgia Nut Co.'s plant engineering manager. "Since the final product must have a doubles percentage below our maximum allowable doubles specification, we had to have one or two operators deshingling the pretzels on the vibratory conveyor before they got to the enrober, which added to the enrobing process labor costs. We could have slowed down the pretzel feeder to decrease the doubles and reduce labor requirements. But then we wouldn't have been able to maintain daily production goals. So we had to constantly find a balance between labor and the process rate to maintain optimal production."

Additionally, the vertical amplitude of the conveyor's vibratory motion knocked salt off the pretzels during conveyance, which caused problems in the enrobers and diminished the final product's quality. And because each vibratory conveyor required a heavy support structure for its electromagnetic drive to properly vibrate the conveying trough, the conveyors were very heavy and difficult to move around, sometimes requiring three or more operators to move a conveyor to a different enrobing line.

The conveyor trough's vertical lane-divider fins align the pretzels into single-file rows, which are transferred onto the enrobing line's belt conveyor.

"We wanted to reduce labor costs and increase production rates to get more pounds per hour," says Bocskay, "so we decided to look for a better feeding method for the enrobing lines."

Finding a better method

In spring 2001, Bocskay and other Georgia Nut Co. engineers traveled to the Powder Show in Chicago to look for a feeding solution. While there, they stopped at a conveyor supplier's booth and saw a demonstration conveyor transferring a fragile material horizontally from a feed hopper to a collection bin at a high conveying rate without using vibration. The supplier, Triple/S Dynamics, Dallas, manufactures horizontal-motion conveyor systems and screening and separation equipment for the food, chemical, agriculture, mining, recycling, foundry, and other bulk solids processing industries.

After returning from the show, company engineers and management reviewed the supplier's brochures and Web site, which has several downloadable movies that show the supplier's conveyor in action handling various food products. The company liked the horizontal-motion conveyor's fast conveying rates and gentle conveying action and decided to purchase one for one of its enrobing lines.

The horizontal-motion conveyor

In summer 2001, the company installed one zero-pitch, floor-supported, portable Slipstick horizontal-motion conveyor with a variable-speed drive. Constructed of Type 304 stainless steel, the conveyor's trough with integral sifting screen is 88 inches long, 30 inches wide, and 6 inches deep, and its vertical lane dividers create 15 single-file pretzel rows. The conveyor's support frame has retractable casters, allowing it to be easily moved between multiple lines. The conveyor, which can move materials at rates greater than 25 fpm, is ideal for conveying materials that are fragile, friable, or abrasive, such as foods, pharmaceuticals, chemicals, and other bulk solids. Georgia Nut

Co.'s conveyor feeds the pretzels at about 10 fpm, which is the enrobing line's current maximum speed. Using the conveyor's variable-speed drive, the company can vary the conveying rate to ensure that it always matches the enrober's belt conveyor speed.

The conveyor's differential horizontal-motion drive, which is mounted underneath the trough, uses two sets of counterrotating weights that are timed to generate a conveying action that repeatedly moves the trough slowly forward and then quickly backward in the horizontal plane. The conveyor operates with a total stroke of 1 inch, moving forward and backward approximately 0.5 inch from neutral. The supplier typically sets the conveyor to run at 280 stroke cycles per minute, but this can vary depending on the customer's actual conveying rate, with fewer cycles per minute for slower rates and vice versa.

"The conveyor's slow forward motion doesn't overcome the friction between the material and the conveyor trough, so the material moves forward with the trough," says Tim Talberg, Triple/S Dynamics sales engineer. "Whereas the quick return motion is fast enough to break the friction so that the material stays in place while the trough moves back to its starting position. Continually repeating this slow-forward, quick-return cycle creates a gentle, nonimpact conveying motion that advances the material to the conveyor's discharge end. Because no vertical motion is involved, the material maintains constant contact with the trough, allowing the conveyor to move materials without causing degradation, separation, segregation, stratification, or dusting."

According to Bocskay, the first conveyor worked so well that in 2004 the company purchased another horizontal-motion conveyor from the supplier. This newer conveyor, which also feeds pretzels at 10 fpm, is made to the same specifications as the first one but with a few dimensional differences. Its trough with sifting screen is 70 inches long, 30 inches wide, and 6 inches deep, and its vertical lane dividers create 16 single-file pretzel rows. Because the company also uses the wider conveyor in a 24-inch-wide enrobing line, the supplier provided special lane dividers that can be clamped on the trough to limit the material stream's width.

The supplier's conveyor is more mobile than a vibratory conveyor because it doesn't require a heavy support base to function properly. "Rather, our conveyor is supported from a set of suspension rods, allowing it to be supported from the ceiling or the floor," says Talberg. "When viewing the conveyor in cross-section, there's mainly just a stainless steel trough, which allows the conveyor to be installed in tight spaces, making it more versatile than other conveyors. Additionally, the conveyor requires little maintenance because there are no fiberglass springs or other vibration-dampening components that can frequently wear out and need replacing."

Improving the pretzel enrobing operation

Since installing the horizontal-motion conveyors, the company has improved the enrobing operation's bottom line. "The new conveyors allow us to put more pretzels per square foot on our enrobing conveyor belts, which has increased the pounds per hour of pretzels that we can produce," says Bocskay. "And because they eliminate shingling even at fast production rates, we're able to operate the enrobing lines without having to manually remove pretzel doubles, which has improved production, reduced labor costs, and helped lower our manufacturing cost, making us more competitive."

In addition, the supplier's conveyors do a better job of sifting out broken pretzels and loose salt than the previous conveyors. "The conveyors are designed to create a single layer of pretzels and remove broken pretzel pieces and loose salt from the material stream," says Bocskay. "We're only allowed a certain percentage of broken pretzels, which often come in with the bulk pretzels we buy, and the conveyors do a great job of sifting most of them out, almost eliminating them. The conveyors also don't knock salt off the pretzels during conveyance, which has helped improve the final product's quality and lessen the enrobers' maintenance requirements." **PBE**

Note: Find more information on this topic in articles listed under "Mechanical conveying" in *Powder and Bulk Engineering*'s comprehensive Article Index in the December 2008 issue and at *PBE*'s Web site, www.powderbulk.com, and in books available through the Web site in the *PBE* Bookstore. You can also purchase copies of past *PBE* articles at www.powderbulk.com.

Triple/S Dynamics, Dallas, TX
800-527-2116
www.sssdynamics.com