Aeromechanical conveyor helps make a smooth paint film binder

A company installs an aeromechanical conveyor to automate part of its paint film production process.

Soliant LLC, Lancaster, S.C., produces thermo-formable color-matched paint films for use on exterior OEM automotive parts, such as bumpers and trim pieces. The company color-matches the paint films to an automobile's original color standard. The company then sends the paint films to other companies that thermo-form or injection-mold the automotive parts and apply the paint films to the parts. In one production step, the company was experiencing problems manually adding a powder ingredient into a mixing vessel. Because of this, the company worked with an aeromechanical conveyor supplier to automate the ingredient addition process.

Making a color paint film

To make a color paint film, the company first makes a clear base (or binder). The clear base is made by adding several hundred pounds of a resin powder and smaller amounts of other ingredients into a 400-gallon-capacity heated mixing vessel containing a liquid solvent. The company makes the clear base in standard-quantity batch sizes.

After completing the clear base, operators follow a standardized color formulation, manually weighing and adding various pigments and other components (aluminas, micas, and other color-producing compounds) to the

An operator can easily move the mobile aeromechanical conveyor onto a floor scale located near a mixing vessel.

clear base. At this time, the operators make any necessary minor adjustments to color-match the paint to the specific color standard being produced.

"Operators weigh out most of the ingredients by hand using floor scales located next to the mixing vessel or mobile scales that can be rolled up to the mixing vessel," says Mark Beard, Soliant staff product development engineer. "The operators then manually dump or pump the proper ingredient amounts into the mixing vessel."

After completing the paint batch, operators roll-coat the paint onto a clear film. This finished product is sent to other companies that apply the paint film to automotive parts.

Experiencing problems making the clear base

The resin powder, which has particles about the size of sugar particles, is stored in fiber drums. In the past, to add the resin to the mixing vessel, two operators first manually moved a drum onto a floor scale located next to the mixing vessel and weighed the drum. The two operators then used hand scoops to add the resin to the mixing vessel.

Since the resin is moisture-sensitive (hygroscopic), it has a tendency to form soft clumps over time. (The clumps are more abundant in resealed, partially used drums.)

"If the operators dropped a resin clump into the solvent, the solvent would wet the clump's outer surface and form a glob that was extremely difficult to dissolve," says Beard. "Or if the operators added the resin too quickly to the solvent, the resin would form lumps in the solvent that didn't dissolve easily. It's kind of like when you make gravy and add the flour to the water — you get lumps if the flour is lumpy or added too quickly."

To prevent lumps from forming in the mixing vessel, the operators used their hand scoops to break up the resin clumps in the drum, then scooped out the resin and slowly poured it into the mixing vessel at a rate that allowed it to dissolve without clumping. Periodically, the operators moved the drum back onto the floor scale to weigh the drum and determine how much resin they had used. This ensured that they added the proper resin amount to the mixing vessel.

Manually scooping the resin into the mixing vessel took the two operators about 20 minutes per batch. "The two operators were each spending up to one-and-a-half hours a shift scooping the resin into the mixing vessel," says Beard. "This was time when they could've been doing other jobs around the plant. And toward the end of a shift, the operators could lose their diligence for breaking up resin clumps and let a few get into the mixing vessel.

"Also, manually moving the drums created unwanted ergonomic issues. So to improve labor efficiency, ensure resin-addition consistency, and minimize ergonomic concerns, we began looking for a better way to add the resin into the mixing vessel."

Finding a solution nearby

Several years ago, the company purchased a stationary aeromechanical conveyor to move a PVC vinyl powder into a dedicated mixing vessel. For this application, an operator drops a bag of vinyl powder into the conveyor's hopper, and the hopper vibrates the powder down into the conveyor's conveying tube. Once inside the conveying tube, a continuously moving cable-and-disc assembly moves the material to the outlet and discharges the material into the mixing vessel at constant and consistent rate.

"Based on our positive experience using this conveyor, we began searching various trade magazines for aeromechanical conveyor suppliers," says Beard. "That's when I ran across an ad for Spiroflow Systems and saw that they're located in Monroe, North

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Carolina, which is just to the north of us. Being only a short morning drive, I thought it would be prudent to drive up there and meet their people and see their operation."

After visiting the supplier's facility, the company sent the supplier some resin powder for testing. "Since the tests showed that the supplier's conveyor is perfectly suited for handling our resin powder," says Beard, "we purchased a mobile aeromechanical conveyor so that we can add the resin into any of our mixing vessels."

The aeromechanical conveyor

The model AMC3 aeromechanical conveyor consists of a hopper, a rotary valve, two parallel 3-inch-diameter conveying tubes (a convey tube and a return tube), two U-shaped end housings, two sprockets (a drive sprocket and an idler sprocket), a continuous-loop wire-rope assembly with molded discs, two pneumatic motors, and a control panel. The conveyor is mounted on a mobile stand with wheels, making it easy for operators to move throughout the plant. The stand's dimensions allow it to fit onto the company's floor scales.

The conveyor's conveying section consists of the convey and return tubes, the two U-shaped end housings, the drive and idler sprockets, and the wire-rope assembly. The convey tube and return tube connect to the end housings' openings to form a continuous conveying circuit. The convey tube is positioned directly above and parallel to the return tube, and its bottom end is located just below the rotary valve and hopper. Material enters the convey tube through a material inlet in its bottom end and discharges out an outlet in its top end. Both the conveying tubes and end housings are made of Type 304 stainless steel.

One end housing, located below the hopper, contains the drive sprocket. The other end housing contains the idler sprocket. The drive sprocket is connected to one pneumatic motor, and the idler sprocket moves freely. The wire-rope assembly forms a continuous loop through the conveying section. The molded discs are located at set intervals on the wire rope and fit into the sprockets' grooves (like a bicycle chain fits onto a pedal sprocket), so that when the drive sprocket turns, the wire-rope assembly moves through the conveying section.

To use the conveyor, an operator first rolls it onto a floor scale. The operator tares the scale so that it reads zero and then pours the resin into the conveyor's 6-cubic-foot-capacity hopper. The hopper has a grate that catches any resin clumps and also prevents operators from sticking their hand down into the rotary valve. During operation, the vast majority of the resin flows through the grate, leaving behind the clumps, which the operator breaks up and pushes through.

When the scale reads the appropriate weight, the operator stops adding the resin and pushes the start button located on the control panel. Pushing the start button actuates a solenoid valve that allows compressed air to flow to the pneumatic motors, which power the rotary valve and drive sprocket. As the conveyor starts up, the drive sprocket moves the wire-rope assembly through the conveying section at 234 rpm, and the rotary valve evenly meters the resin into the convey tube, preventing material surges.

As the resin enters the convey tube, it falls down into the spaces between the moving discs. The rapidly moving discs, which fit snugly within the conveying tubes, generate an airstream that suspends and moves the resin 90 inches at a 45-degree angle from the inlet up to the discharge point. Virtually 100 percent of the resin discharges into the mixing vessel so that the return tube is material-free.

The resin discharges from the aeromechanical conveyor into a mixing vessel at an even and controlled rate.

Simplifying the resin-addition process

Since installing the aeromechanical conveyor in summer 2000, the company has improved its labor use in the clear-base production process. "Instead of two operators taking twenty minutes to manually add the resin to the mixing vessel, we now have a machine that does that for us, allowing the two operators to work somewhere else in the plant," says Beard. "Only one operator is needed to load the conveyor's hopper with the correct resin amount. After loading the hopper, the operator turns on the conveyor and walks away. The conveyor is set up to do everything else."

The aeromechanical conveyor has also improved the resin-addition process. "In the past, some resin clumps were inadvertently added to the mixing vessel, and the resin-addition rate varied because the operators had to periodically stop and move a drum back onto the floor scale to weigh it," says Beard. "With the conveyor, we consistently have clump-free resin going into the mixing vessel at a specific rate over a set time with no breaks."

Additionally, Beard says, "The conveyor has improved the ergonomics of the production process in that operators no longer have to move several hundred-pound drums across the floor to the floor scale, which has minimized their risk of injury."

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Since the conveyor is mounted on wheels, it can be easily moved to the various mixing vessels that require resin powder. "It's also easy to use, doesn't take up a lot of floor space, and can be stowed away when it's not being used," says Beard.

"We've been using the conveyor for more than six years now, and I've heard no complaints. It's done a lot of batches and has been very consistent and reliable. We just have to go in every now and then and tension the wire-rope assembly and keep it lubricated and maintained as the supplier recommends." **PBE**

Note: To find other articles on this topic, look under "Mechanical conveying" in *Powder and Bulk Engineering*'s Article Index at www.powderbulk.com or in the December 2006 issue.

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