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MIXING AND BLENDING



Rotary batch mixer produces uniform blends while maintaining ingredients' original particle sizes

An ash-management company installs a rotary batch mixer in a new processing plant to produce high-quality cement products and keep operation costs low.

New installation

Charah Inc., headquartered in Louisville, Ky., provides ash-management services to the coal-fired electric utility industry, including bottom ash processing and marketing, fly ash sales, ash pond management, engineered fill applications, and landfill construction, management, and operations. In 2004, the company decided to build a processing plant in the northeastern US to mix lightweight bottom ash with sand, gravel, fly ash, and cement to produce and package up to 20 different cement products. When specifying mixing equipment for the plant, the company wanted an energy-efficient batch mixer that would rapidly produce 100 percent uniform blends without degrading the bottom ash.

Looking for a batch mixer

According to Nathan Boone, Charah vice president of business development, for the new plant to be profitable the batch mixer had to meet the company's quality, mixing-speed,

and operational-cost requirements. "We first looked at vertical-shaft mixers, but because they use big plows or paddles that are forced through the materials being mixed, we worried that their mixing action would crush and degrade the friable bottom ash and diminish the final products' quality, making them unusable," says Boone. "Also, the vertical-shaft mixers typically use two high-horsepower motors and require relatively long mixing times, which would have led to high operational costs because of the energy consumed making a batch."

Next, Boone looked at a tumble-style rotary drum mixer manufactured by Munson Machinery, Utica, N.Y., a supplier of dry-blending, size reduction, and metal-finishing equipment. "We found the rotary drum mixer's mixing action was much gentler than the vertical-shaft mixers we looked at," says Boone. "And its ability to produce a completely homogeneous batch without disintegrating or break-



The processing plant mixes lightweight bottom ash with sand, gravel, fly ash, and cement to produce and package up to 20 different cement products.

ing up the bottom ash would ensure that our products always performed properly for the end users. Additionally, the rotary drum mixer's single low-horsepower motor and short mixing cycle meant that we wouldn't have to spend a lot for electricity to operate the mixer."

After comparing the vertical-shaft mixers with the rotary drum mixer, Boone found that the supplier's rotary drum mixer best met the company's requirements and specified that it be installed in the new plant.

The rotary drum batch mixer

The model 700-TH-90-AR rotary drum batch mixer consists of a horizontal drum that rotates on two heavy-duty trunnion rings, a stationary inlet at one end with a self-adjusting face seal for dust-free operation, a stationary outlet at the other end with a steel-reinforced urethane-disc discharge gate, and a single-speed 15-horsepower motor that operates at 1,800 rpm. The mixer's material contact parts and surfaces are constructed of abrasion-resistant Type AR235 steel to reduce wear, and the mixer is

mounted on structural steel support legs to raise the discharge height to 50 inches above the ground. The 90-cubic-foot-working-capacity mixer is approximately 13 feet long, 8 feet wide, and 8 feet tall without the support legs, and its mixing drum can hold up to 8,000 pounds of material.

In January 2005, the company started up the new automated processing and packaging plant. To make a cement product, an operator accesses a control panel to specify a product and initiate the batching system. Several flexible belt conveyors then move the pre-weighed bottom ash, sand, and gravel from silos into a weighbatch hopper mounted on load cells installed above the mixer's inlet. Next, screw conveyors move the pre-weighed fly ash and cement powder from silos into the hopper. After the system verifies the correct total batch weight, it discharges the materials from the hopper into the mixer's mixing drum.

An operator accesses the mixer's simple on-off controller, installed in a NEMA-4/12 enclosure, to start up the mixer. During operation, the mixing

"We found the rotary drum mixer's mixing action was much gentler than the vertical-shaft mixers we looked at."



The tumble-style rotary drum mixer can uniformly blend and completely discharge up to 8,000 pounds of materials in about 9 minutes.

drum's internal lifters and baffles create a rapid but gentle mixing action that fluidizes the material. According to Steve Knauth, Munson Machinery general sales manager, the continuously welded lifters and baffles gently lift, fold, and tumble the material onto itself while directing it to the mixing drum's discharge end. When the discharge gate is closed, the material is redirected back toward the mixing drum's center where the gentle blending action continues. This is how the

mixer achieves a 100 percent homogeneous blend in such a short time while preventing the separation of ingredients with varying bulk densities and particle sizes and shapes.

After 6 minutes of mixing, the mixer's discharge gate opens and the material fully discharges in about 3 minutes from the rotating drum as a completely uniform blend into a 9,000-pound-capacity surge hopper located



A product blend discharges from the mixer into a surge hopper, which then discharges the blend onto a flexible belt conveyor that conveys it to a packaging machine.

below the mixer. The material discharges from the surge hopper onto a flexible belt conveyor that moves it to a packaging machine with a capacity of 10 to 12 bags per minute, depending on the product and bag size.

During operation, the mixing drum's internal lifters and baffles create a rapid but gentle mixing action that fluidizes the material.

To maintain production efficiency, as soon as a product batch discharges from the weighbatch hopper into the mixer, the batching system immediately recharges the hopper with the next product batch to be mixed. This allows the company to make about 6 to 7 batches an hour.

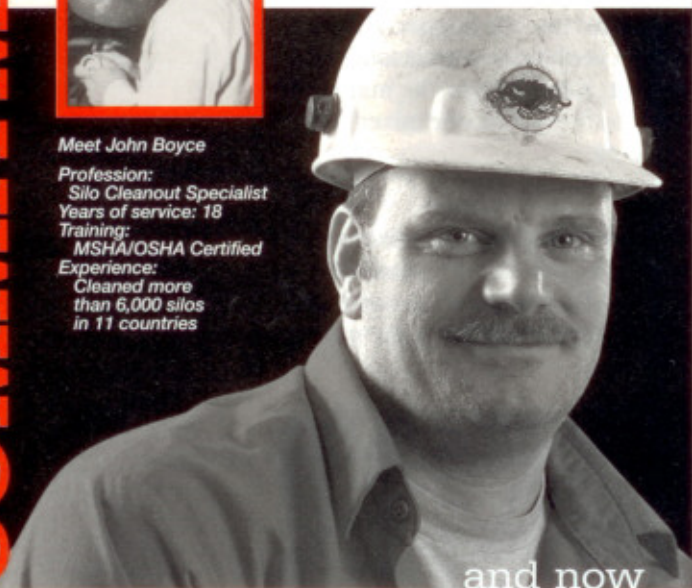
At the company's request, the supplier added a second inspection door to the mixing drum directly opposite the main inspection door, allowing two entry paths for easy access to the drum's interior for cleaning and inspection. "However, since the mixer discharges nearly one hundred percent of the material, we don't have to clean or prep the mixer between batches to prevent cross-contamination," says Boone. "With no delays between batches, we're able to make up to seven batches an hour."

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THE FACE

Producing top-quality products

The tumble-style rotary drum mixer provides gentle and thorough mixing with minimal energy consumption and no bottom ash degradation. "The rotary drum mixer's mixing action and short mixing time maintain the bottom ash's original particle sizes, which allows us to consistently produce top-quality cement products," says Boone. "The mixer uses less than one-third the power that's required by vertical-shaft mixers of equivalent capacity, and considering how tight the plant's profitability numbers are, we find that to be a pretty significant savings. I also like the fact that the mixing drum discharges all of the material during the discharge cycle, which adds to the operation's efficiency because we don't have to spend extra time cleaning it out between batch runs." **PBE**

Note: To find other articles on this topic, look under "Mixing and blending" in *Powder and Bulk Engineering's* Article Index at www.powderbulk.com or in the December 2008 issue.

Munson Machinery, Utica, NY
800-944-6644
www.munsonmachinery.com

Editor's note: We welcome your ideas and responses to *PBE's* content. Send them to Editor, *Powder and Bulk Engineering*, 1155 Northland Drive, St. Paul, MN 55120 fax 651-287-5650 toneill@cscpub.com

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