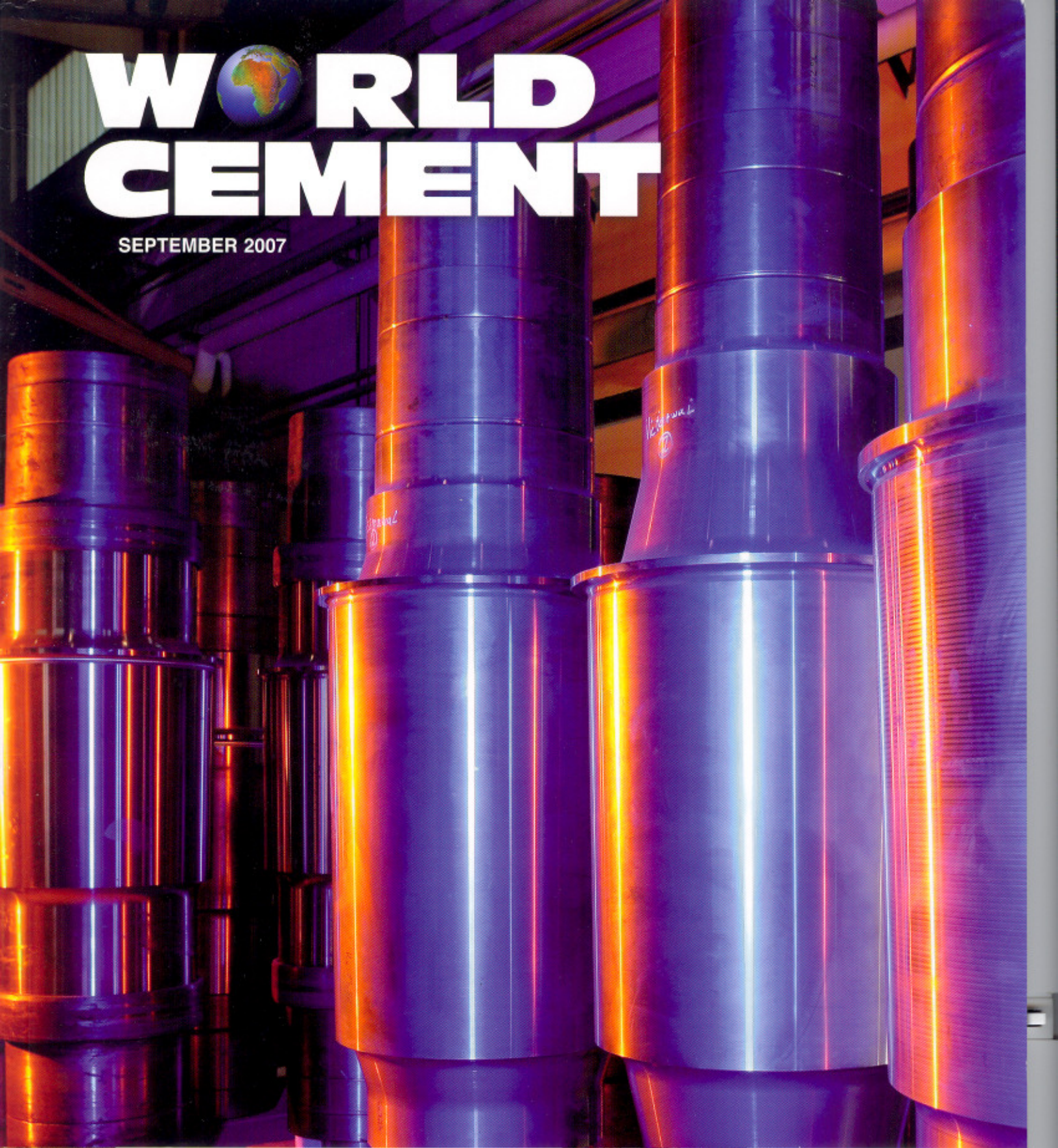
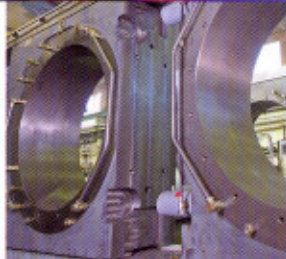


WORLD CEMENT

SEPTEMBER 2007



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The Blending Trend

Nathan Boone, Vice President of Operations, Charah Inc., USA, discusses the benefits the company has discovered using a heavyweight batch mixer.

Introduction

To increase production of concrete mixes containing coal fired power generation plant ash products, Charah Inc. opened a new manufacturing plant in Emporia, Virginia, USA, which also serves as a

warehouse and distribution centre for other concrete industry products. Profit margins are slim in this high volume business, so management placed great emphasis on the capital and operational costs of the equipment to be purchased, particularly the dry bulk

blending equipment at the heart of the process.

Turning waste into profit

Charah is a pioneer in utilising the byproducts of coal combustion that are typically dumped into landfills, to produce aggregates for concrete mixtures and concrete products. According to President and CEO Charles Price, for every 10 t of coal burned, a power plant generates about 1 t of ash. The fine, powdery residue is called flyash. Bottom ash is primarily the larger, more coarse particles that range from gravel-sized nuggets down to grains of sand.

The company strives to find new ways to utilise coal combustion products to benefit both the utility industry and the environment. Recently, it was a recipient of the Coal Combustion Products Partnership (C2P2) Innovation Award from the US Environmental Protection Agency. The award honours companies that have demonstrated outstanding achievements in the constructive use of



A 2.6 m³ Munson 700-TH-90-AR rotary batch mixer gently yet efficiently blends dry cement mixes in less than 3 minutes with 100% uniformity. Gentle mixing preserves the texture of the coarse material, which is necessary to maximise the strength of the cured product.



The rotary batch mixer totally evacuates blended material, which is gravity discharged into this 4082 kg capacity surge bin.

coal combustion products (CCPs).

Charah developed better methods of processing bottom ash and sorting it by size to ensure consistent batch-to-batch, lot-to-lot properties, and substitutes it for a portion of the sand or other material that is mixed with cement to produce the Project Mix[®] concrete mix and other additional concrete products that it markets to contractors and home users.

The company also sells its premium coal-ash-derived aggregate in pure form to large-scale manufacturers of lightweight concrete blocks and precast concrete products. Called PriceLite[®], it meets ASTM standards for clay lumps and friable particles, organic impurities, unit weight, stain test and loss on ignition.

Lighter concrete blocks generally command a premium price. Using the PriceLite[®] mixture drops the weight of concrete blocks from about 14.5 kg to 11.3 or 11.8 kg depending on the producer, making them easier for masons to handle.

Mixing requirements

The profitability of the operation hinged in part on the ability of the mixing equipment to meet quality, speed and cost requirements. The right mixer would produce 100% uniform blends rapidly, while preventing product degradation and saving energy. After investigating vertical shaft mixers, the company specified a rotary batch mixer from Munson Machinery, Utica, New York, USA.

Producing bottom ash for the retail concrete market begins when it is collected by Charah at the power plant site. The aggregate is screened on vibrating wet screens at the power plant to eliminate oversized particles and excessive fine particles. Once the material is qualified to be marketed as PriceLite[®], the aggregate is hauled by contract haulers to the packaging facility in Virginia where it is then dried and cooled on fluid bed drying equipment before being placed in 120 t storage silos until the 2.6 m³ Munson 700-TH-90-AR rotary drum mixer is ready for a cycle.

The rotary mixer consists of a horizontal, rotating drum with a stationary inlet at one end and a stationary outlet with a discharge gate at the other. A self-adjusting face seal at the inlet allows dust-free operation. Internal baffles (mixing flights) and lifters create a four-way mixing action as the drum rotates on two heavy-duty trunnion rings.

The entire packaging facility is automated. When the control panel initiates the batching process, flexible belt conveyors transport ash, sand, and stone from storage silos to a weigh-batch hopper on one side of the blender. Screw conveyors move fine cement powder and flyash from silos into a weigh-batch hopper located on the opposite side of the mixer, after which both weigh hoppers discharge into the inlet of the rotary batch mixer.

Approximately 3084 kg of material per batch is being loaded into the mixer – below its rated capacity of 3629 kg.

Although the application is a batch process, the mixer's drum rotates continuously, with the internal

mixing flights tumbling, folding, cutting and turning the material in a multi-directional manner throughout the filling, mixing and discharging phases, achieving 100% batch uniformity in less than 3 minutes, and preventing the separation of ingredients of varying bulk densities and particle sizes and shapes.

The blender's ability to gently tumble the materials yet mix them homogeneously is vital to the mix. Homogeneity is essential for uniform product in the bags and to ensure the product properly performs for customers.

Coarse material is also a required element in a mix. Rock and stone can be up to 12.7 mm in size, which achieves the necessary end product strength not always possible with finer sized particles. Additionally, some types of bottom ash can be friable, which means it can be easily crushed. The vertical shaft mixers that were investigated had big plows, also mixing in a horizontal direction, but with a force that might crush the ash material. A rotary drum mixer seemed to offer both the thorough and gentle mixing action required.

After 3 minutes of mixing time, the discharge gate opens and the internal flights elevate the material and direct it through the gate as the drum rotates, fully discharging the batch with no residual into a 12.7 m³, 4082 kg capacity surge bin located below the mixer.

The surge bin holds blended material until a sensor on the bagging equipment signals a door on the bin bottom to open, discharging material onto a flexible belt conveyor that leads to a bagging machine with a capacity of 10 to 12 bags/minute. Charah is the only company in the United States to package cement mixtures in plastic two-handled bags rather than paper bags. Plastic virtually eliminates common problems of paper packaging, such as dust and breakage. The company believes that plastic packaging is the way of the future: improving bagging technology is expected to increase the bagging rate.

Within seconds of the previous batch's discharge from the mixer, a subsequent batch of aggregate and powdered ingredients, which were being weighed batched during the mixing cycle, are released into the rotary batch mixer. It is not necessary to shut off between batches. The mixed batches exit the drum so cleanly, there is no cleanup or prepping of the mixer required between batches, so there are no delays between batches. This enables the company to run about ten batches an hour.

Since wash down is unnecessary, the mixer



Contract haulers deliver flyash and bottom ash from coal fired power plants to Charah's manufacturing plant in Emporia, Virginia, USA.

never needs to dry. This feature was also critical to Charah because any moisture that got in would start hydrating the cement. Other mixers usually mention washout doors and cleanout doors, which are not routinely necessary. When one has a dry product and wants to avoid the possibility of moisture entering equipment, the fact that the mixer moves all material out at discharge is very appealing.

Savings

Unlike stationary blenders whose agitators are forced through the material throughout relatively long cycle times, rotary batch mixers create a gentle tumbling action over short cycle times, with two outcomes: product degradation is virtually eliminated, and power consumption is greatly reduced. Charah's mixer requires only an 11.2 kW motor to mix 3084 kg batches, less than one-third of the power required with stationary blenders of equivalent capacity. As profitability numbers were going to be tight, the company found the electrical savings of an 11.2 kW motor versus two 22.4 kW motors found on other blenders pretty significant.

The rock and stone comprising concrete mixes are abrasive materials that will gouge, dent and scratch surfaces. To reduce wear, all product contact surfaces are constructed of abrasion resistant AR235 steel. Depending on the material mixed and the cycle times, flights and baffles can last from three to five years before replacement. The flights and baffles are bolted to brackets welded to the drum wall, allowing rapid replacement.

After operating the Munson rotary batch mixer for one year at the Emporia facility, Charah have ordered a second one for its new Midwest facility, which is currently under construction.