Centrifugal screener pulls flour mill into 21st century

More than 400 years ago, in what is now Powys County, Wales, a flour mill was built on the banks of a spring-fed pond to turn wheat into flour and bran. When the mill first started operating in 1575, falling water was used to turn a water-wheel that provided power to the millstones that ground the wheat and the wooden screeners (called dressers) that separated the flour from the bran. Throughout the years since, the mill’s storage, material handling, and packaging equipment was updated as new technology became available, and by 2000, most of the mill’s operation had been modernized, with the exception of two sets of traditional millstones and two old-style dressers.

Now known as the Bacheldre Watermill, the flour mill makes various high-quality, organic, stone-ground flours that are sold in top-end supermarkets and delis throughout the UK and Russia. The award-winning artisan flours are also used by the top chefs of several highly rated restaurants. A few years ago, as demand for the mill’s flour was increasing, the mill’s owner realized that it was time to finish modernizing the flour screening operation.

Making flour the old-fashioned way

When Matt Scott bought the mill in 2002, he decided to continue making flour the old-fashioned way, using the water-powered millstones and dressers to produce about ½ metric ton of flour per month.

“The traditional grinding stones slowly and gently mill the flour, retaining all the natural goodness of the wheat germ,” says Scott. “This milling method only slightly warms the flour, which leaves all the natural flavors intact. In contrast, modern mills that use steel rollers to crush water-conditioned grain typically remove the wheat germ from the flour.
because the rollers can generate excess heat that damages the wheat germ, causing a bad flavor.”

each millstone consists of a flat circular rotating stone (or runner stone) set atop a flat circular stationary stone (or bedder stone) of the same size. To make the flour, grain is fed at a controlled rate into a hole in the runner stone’s top center. As the runner stone slowly rotates, the grain moves into a small gap between the runner and bedder stones and is ground into flour. (The narrower the gap, the finer the flour, and vice versa.) The flour moves from the center of the stones to their outer edges and discharges from the gap onto a staging platform that encircles the bedder stone. A paddle attached to the runner stone continuously moves the flour to a hole in the platform, where the flour discharges into either a sack or a vacuum conveying system.

Most of the whole-grain flours the mill makes discharge directly into 1.5- to 25-kilogram-capacity sacks that are sealed and distributed to various retail markets. However, white, durum, and brown flours need to have a certain percentage of bran removed before they can be packaged for shipment. To remove the bran, the flour is vacuum-conveyed from a millstone to several hoppers that feed the mill’s screening operation.

**Screening operation needs updating**

As recently as 2005, the mill screened the flour using the two water-powered dressers. “The two dressers each produced a quality product, but they required a lot of downtime to change a screen,” says Scott. “We could only screen two types of flours a day—one type per dresser—since it took about a half day’s work dealing with lots of piddly screws and things to change just one screen to produce a different flour.”

These milling and screening methods worked well enough when Scott first purchased the mill and was only screening a relatively small amount of flour. But as business grew, Scott realized that changes needed to be made to the mill’s operation if he was going to be able to meet his customers’ increasing demands.

“We’re just a small company that has grown and continues to grow very rapidly because of our reputation for supplying a high-quality basic ingredient for culinary uses,” says Scott. “When we started getting more customers, the first thing we did was stabilize the flour production to make it less dependent on the pond’s seasonal water levels. To do this, we disconnected the millstones from the waterwheel and connected them to an electric motor that provides a constant power source. About a year later, when demand for the white, durum, and brown flours began to exceed our daily screening capacity, we began looking for ways to improve the screening operation.”

**Finding the right screener**

Scott gathered information about several screeners. After evaluating the information, he decided to call a centrifugal screener supplier located a short distance northeast of the mill. Kason Corp., headquartered in Millburn, N.J., operates a facility in Staffordshire, UK, that supplies centrifugal and vibratory screeners, static sieves, and fluid-bed dryers, coolers, and moisturizers to UK and European powder and bulk solids industries.

Scott sent flour to the supplier’s facility for testing. The supplier used the tests to specify the screener’s size, its operating parameters, and the necessary screens for the mill to produce the white, durum, and brown flours. “We decided to purchase one screener to replace one water-powered dresser,” says Scott. “Now we use the new electric-powered screener along with the other water-powered dresser in our screening operation.”

**The centrifugal screener**

The model KO Centri-Sifter centrifugal screener is constructed of Type 304 stainless steel and is for food and pharmaceutical applications requiring 3-A and dairy sanitary standards.
At approximately 60 inches long, 20 inches wide, and 30 inches tall, the screener’s small footprint makes it suitable for use in space-restricted areas. The screener is powered by a single-speed, 2-horsepower electric motor.

The screener’s housing contains a horizontal cylindrical sifting chamber above a tapered discharge chamber. The material inlet is at one end of the sifting chamber and an outlet for oversize material is at the other end. The sifting chamber contains two concentric cylindrical screens that run nearly the length of the chamber. In the chamber’s center, on the same horizontal axis as the screens, is a rotating helical paddle assembly that resembles the front of a combine harvester, except that its multiple slats are slightly angled to move the material from the inlet to the oversize outlet. The screener’s motor, which is directly connected to the paddle assembly’s axle, rotates the paddle assembly at 1,000 rpm.

The screener’s discharge chamber tapers down to a circular flange, through which the good-size material discharges. Piping connected to the flange transfers this material by gravity to the mill’s packaging area.

To operate the screener, Scott simply pushes a switch to the ON position and the motor starts rotating the paddle assembly. A feed auger then moves the flour at a constant rate into the screener’s material inlet. As the flour enters the screener, the paddle assembly’s paddles fling the flour at the screens while moving it toward the oversize outlet. A 2-inch gap between the screener’s interior wall and the outermost screen allows the flour that passes through the screens to pass around the outside of the screen to the tapered discharge chamber. The oversize material that doesn’t pass through the screens moves to the oversize outlet, where it discharges into a holding hopper.
Scott typically uses two different screen sizes in the screener to maximize flour output. "For example, we'll use a two-hundred-fifty-micron screen for the inner screen and a one-hundred-fifty-micron screen for the outer screen," says Scott. "This makes the screening operation more efficient because we separate most of the bran from the good flour first, which allows more good flour to pass through the outer screen. The flour and bran that doesn't make it through the outer screen discharges from the screener with the other oversize material, which we collect and sell to local farmers as an animal feed supplement."

Modernizing the screening operation pays off

Scott operates the mill 8 hours a day, 5 days a week, and is currently producing 15 to 20 metric tons of flour per week. "During business hours, the screener runs pretty much all day long," says Scott. "And since we make a lot of different flour grades for our customers, we'll change out the screener's screens about two or three times a day."

Changing out the screens doesn't take much time. The screener's oversize outlet is attached with hand-operated screws, so no special tools are required to gain access to the screener's interior. "The oversize outlet is easily removed from the screener, making for fast screen changes and trouble-free maintenance," says Scott. "It only takes about ten minutes to remove the outlet, pull out the circular screens, brush down the internal components, vacuum out the interior, put in the new screens, and reattach the outlet. We don't have any concerns about cross-contamination because it's so easy to clean."

Scott says the screener's reliability, high screening efficiency, and quick screen changes have helped keep the mill's operation commercial. "Also, the stainless steel screener has brought our operation up to food hygiene standards. And it takes up less space and isn't as big and clumsy as the old dresser," he says. "Addition-