

MIX AND MATCH

With improved flexibility, the latest generation of continuous mixers consistently creates a greater variety of quality products, saving energy, sanitation and labor.

BY DAN MALOVANY

Often, the fundamentals for success in business today lie in the ability to adapt to a constantly changing marketplace. Many bakers and snack manufacturers are searching for proven technologies that have evolved and become flexible enough over time to produce a plethora of new products. In other cases, they're mixing and matching systems to target emerging trends or burgeoning niches in the retail and food service channels.

As ingredient, energy and labor costs continue to climb, continuous mixers are getting a second look primarily because they can provide product consistency, waste reduction and improved yields, according to Jim Warren, director, Exact Mixing, Reading Bakery Systems, Robeson, PA. Unlike in the past when many models came in a one-size-fits-all design, continuous mixing today actually refer to systems designed to serve a variety purposes, Mr. Warren said. For Exact Mixing, a brand of Reading Bakery Systems, that means offering a family of continuous mixing styles that target the production of select products.

"There is a suitable type of continuous mixer for most any primary product," Mr. Warren noted. "These products include low-moisture [foods] such as pretzels and bagels to high-moisture bread and buns," he said. These snacks and baked goods can also be wheat-, potato-, rice- or corn-based as well as multigrain.

ADVANCES IN TECHNOLOGY. Unlike decades ago, when continuous mixers were affiliated with fluffy, tight-textured bread, systems have evolved to create everything from pizza and pastry dough to sponge or no-time doughs, observed Bernhard Noll, PhD, food technologist with Rapidojet, GmbH, Michelbach an der Bilz, Germany, represented in the North America by Bakery Concepts International, Enola, PA.

"The advantages offered by Rapidojet are revolutionary and substantial," Dr. Noll said. Among them are increased absorption by at least 5% and substantially reduced energy required for mixing, and they can handle an extreme range of hydration from approximately 50 to 200% in doughs." The Rapidojet mixer's compact size



▲ Design of the new generation of continuous mixers emphasizes gentle blending and mixing of ingredients to produce well-developed doughs for breads, buns, English muffins, tortillas, hamburger buns and more.
READING BAKERY SYSTEMS

can result in reduced preventive maintenance, fewer spare parts, better sanitation and lower labor costs. Additionally, he said, there is almost zero temperature increase during the mixing process, resulting in better control of fermentation and the reduced need for cooling of the dough with ice.

In some cases, international bakeries are using continuous mix technology to make American-style hamburger buns. In 2008, Wback, a German baking company, opened one of the world's first continuous-mix bun production operations in Leipheim, Germany, where it bakes 50,000 buns per hour on two shifts a day. The line features automatic ingredient handling and a mix-

ing process using Codos continuous mixing technology developed by Reimelt (now known as Zeppelin Systems). The bun process relies on a continuous liquid-sponge-and-dough production process that includes two separate stages for blending ingredients and mixing the dough, noted Stephen Marquardt, sales and product manager, Zeppelin Systems USA, Odessa, FL.

"In the first stage for lump-free blending, we mix all of the ingredients together in a very short period of time, which hydrates the flour and provides an instantaneous start of the biochemical process," Mr. Marquardt said. "The highly efficient mixing process results in an increased absorption of water up to 5%, which, in turn, delays the aging process of the products and extends shelf life."

Before entering the second stage, the system uses a conveying belt to transfer homogenized raw materials to the kneader. The belt also provides dough resting time, during which the raw materials can bulk-ferment and support dough development.

CONTINUOUS IMPROVEMENT. Continuous mixing is an uninterrupted process where measured streams of dry and liquid ingredients are delivered to a twin-screw pre-mixer before entering the mixing chamber, according to Chuck Copenhaver, principal, Miranda Automation North America, Cypress, TX. Recipe-driven dough development takes place as the dough moves along the mixing cylinder through predefined mixing shaft speed and design. At discharge, the developed dough rope is cut and delivered to makeup equipment.

Keep Baking in Balance

Pretzel and extruded snack manufacturers face a special challenge because they are producing thin products that depend on volumetric sizing, meaning the individual pieces are sized by dough volume and not dough weight, according to Jim Warren, director, Exact Mixing, Reading Bakery Systems, Robeson, PA. This means changes in product density due to batch mixing variations or mixing cycle time will result in changes in piece weights. This also alters the amount of moisture in the oven.

Lighter products often burn in the oven, while pieces that are too heavy are not dried properly. This effect is

made worse when varying piece weights change the moisture in the oven," Mr. Warren said. "The oven is continually attempting to adjust to the new moisture level but never seems to catch the moving target."

With continuous mixing, he added, all dough is the same age when reaching the extruders, and that allows the volumetric extruding process to consistently produce pieces of the same weight. "This keeps the oven moisture in balance and results in much more consistent finished product. Improvements can be seen in both bake consistency and appearance," Mr. Warren said.

Not long ago, continuous mixers were perceived as complicated, difficult to maintain and cumbersome for employees to use, Mr. Warren observed. "Nothing could be further from the truth," he said. "Continuous mixing systems are custom-designed for individual customers, but the systems also are simple to understand and maintain. In fact, manufacturers in underdeveloped countries have become customers because an unskilled workforce can easily operate these continuous systems."

Exact's line of mixers includes the MKX continuous mixer, a new system designed to gently mix and knead ingredients, producing properly developed doughs for breads, buns, English muffins and tortillas. The company's EX continuous system can be used to make stiffer,

low-absorption, wheat-based doughs with production volumes up to 20,000 lb per hour. The company recently installed the first two continuous mixers in the US cracker industry. These lines produce specialty snack crackers and graham crackers. "We are now developing continuous mixing for saltine crackers," Mr. Warren said. "Other new applications include baked potato chips, sweet goods and multigrain snacks."

Meanwhile, the Exact FX high-intensity mixer can be used to make produce potato-, corn- and rice-based products and specialty baked snacks.

During the past five years, Mr. Warren said, the emphasis has been on sanitary design. That's why systems like the EX mixer feature retractable shafts or clamshell barrels for

Continuously and Consistently Mixing Batters and Cremes

For the constant production of batters, icings, toppings or fillings, a continuous mixing/aeration system helps bakeries automate this processing step and offers superior product consistency.

Continuous mixing/aeration systems are typically composed of several separate machines. First, a slurry premixer blends dry and liquid ingredients, which can be added either manually or with automated ingredient handling systems. This medium sheer mixer incorporates oils, flour, water, eggs and other ingredients into a uniform mix.

The slurry is then pumped to an intermediate buffer holding tank, which is often jacketed for cooling and heating. Buffering tanks are available with or without agitation and are generally two to three times as large as the slurry mixer.



▲ Continuous mixing/aeration systems feature several different pieces of equipment including slurry premixers, buffering tanks and aeration mixers. Pumps are used to transfer the batter to the various pieces of equipment and eventually to a hopper/depositor.

TONELLI

Batter from the buffer tank is continuously fed to a continuous/aeration mixer, where air or nitrogen can be mixed at a controlled pressure. The batter or filling exiting the mixing head is measured with an electronic metering device for density and flow rate. Sophisticated control systems can adjust several variables in the continuous mixer, thereby controlling the finished products' characteristics such as specific gravity, density and temperature.

Continuous batter mixers offer many advantages to bakeries in automation and product consistency. "Continuous mixers allow for uninterrupted continuous flow of constant batter or creme topping and fillings at a consistent flow rate and with precise specific gravity and in certain models at consistent temperatures," said Kevin Wilkinson, president of Tonelli Group, Woodside, CA.

E.T. Oakes Corp., Hauppauge, NY, uses Micro Motion Coriolis flow and density meters to constantly measure the specific gravity of batters as they are pumped to the hopper or depositor. Also, the company's mixers feature Flowrators to control the amount of air or nitrogen that is being injected into the batter. This computer-controlled system allows processors to main-

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quick cleaning. “Crevices and seams are eliminated, and clean-in-place is often available,” he noted. “Mixers are built so they are easy not only to clean but also to inspect.”

Continuous mixing is based on proven technology that has been refined over the years, Mr. Copenhaver said. Systems now include variable-speed motors and drives. To achieve control over dough temperatures during the mixing process, designs offer mixing chamber jacketing, while heat transfer pins can be located inside the chamber barrel and along the mixing shaft. Modular plug-and-play designs result in timely installation and start-up. PLC control applications such as alarm messaging and on-line diagnostics to ensure greater uptime and reliability are among a variety

of other improvements made since continuous mixers were originally introduced.

“PLC and control technologies became operator and user friendly, weighing and scaling accuracy improved and delivery of dry materials became dependable,” he said. Additionally, liquid metering improved in accuracy, and tool-free reconfiguration of the actual mixing chamber was made standard.

Many systems also provide sustainability benefits. Rapidojet, for instance, can produce 1,000 kg (2,200 lb) of dough with less than 2 kWh of electricity, and the dough temperature can be controlled just using the proper water temperature because the mixer doesn’t heat up the dough. Moreover, the continuous process can eliminate bowl handling.

Continuously and Consistently Mixing Batters and Cremes

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tain their specific gravity, according to Jeremy van Bemmelen, the company’s sales engineer.

Bakeries commonly use continuous mixers when they need constant density, flow rate, specific gravity and temperature of cake batters, whipped toppings, icings and fillings, according to Mr. Wilkinson. “Producers needing high levels of automation with minimal product changeover and longer production cycles generally benefit most from continuous mixers,” he added. “However, it should be noted that Tonelli continuous mixers are also used in smaller operations by customers demanding precise control of their operations. ‘Continuous mixers,’ as the name implies, means continuous production, which allows for high efficiency and product accuracy.”

Continuous batter mixers are not for every operation, and the lack of quick changeovers between products and relatively narrow range of production applications for a specific model can limit the usefulness of continuous mixers in smaller bakeries with a variety of products.

“Continuous mixers, however, are the most efficient way to produce cake batters or creme toppings and fillings for larger producers requiring low labor and consistency in product results such as density, temperature and production rate,” Mr. Wilkinson added.

The Tonelli Group manufactures a wide range of continuous batter and creme mixers for production rate ranging from 350 lb per hour up to 10,000 lb per hour. “Some of the newer Tonelli systems include internal scrapped surface heat exchangers, which allow for the production of very cold products and even with the option of pasteurizing of dairy products inline in a continuous process of heating, cooling, aerating and depositing,” he said.

The Mondotherm is a scraped surface heat exchanger from Haas Mondomix B.V., Almere, The Netherlands. It continuously heats or cools viscous products or products with particulates. The Mondotherm features a sanitary design with no dead corners and stainless steel product surfaces.

The Peerless Group, Sidney, OH, has focused on improving sanitation of its Fedco continuous mixing systems. After being asked by a client to reduce the amount of water to clean its machines, Peerless redesigned the discharges on the mixers and the radius at the bottom of the bowl as well as improved seal designs. And by using flush-mounted stator blades as well as a flush mount on the batter discharge outlet, the company eliminated pockets where batter, flour, sugar or shortening could collect.

— *Shane Whitaker*

ADDING VERSATILITY. Previously, continuous mixers were seen as a better fit for dedicated production lines or operations with minimal changeovers, according to Dr. Noll. Rapidojet, he said, can adapt to changes

in formulation, especially in the water level, within seconds. Moreover, the combination of the Rapidojet with an inline laminator provides bakers and baked snack manufacturers a flexible tool box to help fine-tune

dough characteristics. Producing a variety of products ranging from low-moisture pretzels to soft rolls can be done by changing the diameter of the high-pressure nozzle.

“Dough is formed instantly by means of a high-pressure water jet, which hits free-falling flour particles,” Dr. Noll noted. “The energy for dough development is introduced by the high velocity of the water jet ranging from 250 to 500 km



◀ With this continuous mixer, the water jet nozzle on the left hydrates flour, and the dough is developed in the mixing tube, then transferred into the hopper.

RAPIDOJET



◀ A number of international bakeries employ continuous mix technology to make American-style hamburger buns using a liquid-sponge-and-dough process.
ZEPPELIN SYSTEMS USA

dients at any phase of the blending and mixing process. “For the production of specialty products, ingredients such as flakes or fruit can be added at the end of the mixing without significant ingredient degradation and minimal cross contamination,” he said. Changeovers often take less than 10 minutes, and the continuous mixers come in sizes ranging from 1,000 to 15,000 lb per hour for standard doughs.

Certainly, long runs tend to maximize the strengths of continuous mixers, but it’s not uncommon to use these systems

per hour, and the increased hydration results in more water uptake and a savings of flour. In a second step, a dough pump feeds the inline laminator that mimics the folding and stretching of lamination within a closed tube. Every part of the dough is treated in exactly the same manner.”

For more delicate handling of doughs, Zeppelin’s Codos mixer relies on double shafts to develop and stretch the gluten without shearing or cutting, Mr. Marquardt said. Moreover, the Codos mixer has an open design to allow operators to incorporate ingre-

in operations where runs are as short as 3 or 4 hours, Mr. Warren said. “There is no doubt that high-capacity lines with fewer changeovers are prime targets for continuous mixing success, but as the technology develops, changeovers have become quicker and costs of continuous mixing lines have decreased,” he added. “Now continuous lines make products at 1,000 to 20,000 lb per hour with changeovers of twice per shift or more often.”

Bakers and snack manufacturers just need to mix and match to find the right fit. ■