

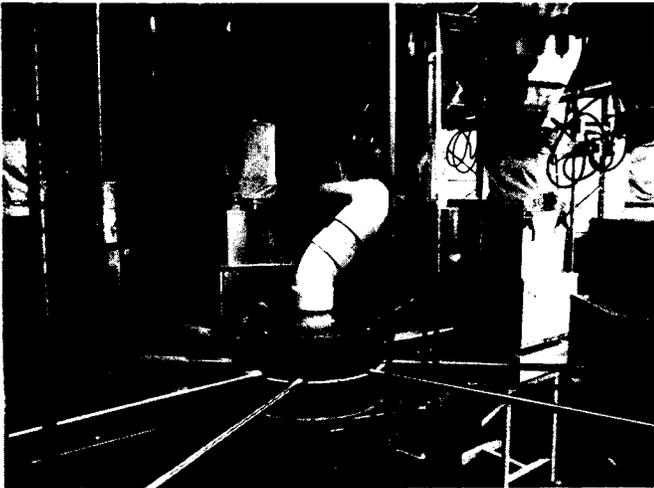
Texas Bakery Automates Minor Ingredient Addition

Bread baking techniques have changed greatly since Stone Age man crushed wheat into flour, then baked his loaves on hot stones. Today's bakery is highly automated and one good example of this is the Mrs Baird's Bread plant in Fort Worth, Texas. The Fort Worth plant has been in full production since June 1992.

In business since 1908, Mrs Baird's Bakeries, Inc. is the largest family-owned bakery in the United States. In eleven bakeries throughout the state of Texas, the company produces over 150 different bread and cake products. Throughout the entire product line, two characteristics are paramount—quality and freshness.

The new plant, adjacent to Fort Worth's south freeway cake plant, replaced a 75-year-old plant downtown. "From the start, our design of the plant was product driven rather than technology driven," explained Mrs Baird's Project Engineer David Pait. "Automation was important because it could provide the consistency we wanted. Consequently we were able to put more science into the art of baking."

One area where product quality took precedence over technology was in the addition of yeast. Yeast needs to be added to the sponge mixer at exactly the right time in the mix cycle. Various methods of doing this were evaluated, but Mrs Baird's decided they obtained the best results by keeping this a manual operation. 50-pound blocks of yeast are kept in cold



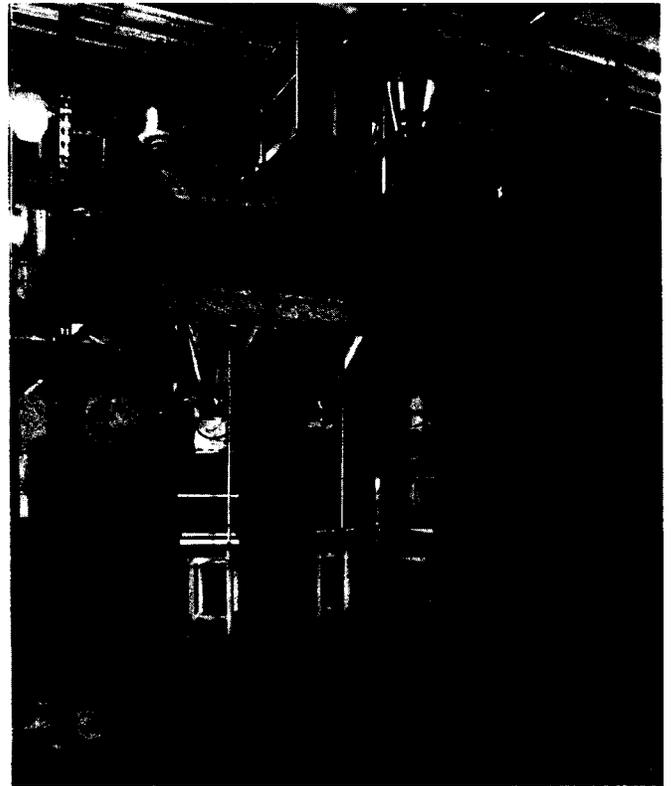
Nine loss-of weight feeders, all with extended helixes, deliver materials simultaneously to a central hopper where they are immediately transferred to one of the six mixers. A second circle of eight feeders completes the minor ingredient feeding system.

storage near the mixers. The computer signals the operator at the proper time and he adds the yeast by hand.

Dry vs. Liquid Systems

One of the key decisions made early on was to go with a dry system for the handling of minor ingredients. Other Mrs Baird's Bakeries used liquid systems where the minors were delivered to the mixers in a slurry state. However, they felt a dry system with individual weigh-up containers could lead to a more flexible system and a cleaner operation.

After evaluating three dry systems, one supplied by Frank Haile & Associates was chosen. Haile provided the design engineering and installation of the dry system which included silos, butterfly valves, feeders/ hoppers, receivers and check scales at the mixers. "Accuracy was critical to our equipment selection," Mr. Pait stated. "Delivery and price entered into it, but



The two-story structure includes bag dump and receiving hoppers on the second level supplying material to the loss-of weight feeding systems below.

we had to have the accuracy to achieve our consistency goal." There are up to 17 minor ingredients currently added to the various recipes. Because of this wide variety, material handling expertise also became an important factor in vendor selection. Bulk densities varied from very light—almost fluffy—materials such as bran to fairly heavy materials like salt. Challenging materials to feed included one that was hygroscopic and one that caked easily.

The 17 minors in total comprise only about 10% of the 1600-pound batches. Each of the 17 ingredients had to be delivered within 1/10 pound of the desired weight. AccuRate, Inc. of Whitewater, Wisconsin was able to feed all the materials, meeting the required accuracies, and was selected to provide the system's loss-of-weight feeders.

Flexible Hopper Feeders

The stainless steel feeders contain a Tuf-Flex vinyl feed hopper. Two alternating paddles press against the outside of this flexible hopper. This conditions the material inside to a uniform bulk density. Each flight of the extended feed screw is completely filled with material, resulting in precise delivery of material into the central hopper.

Each feeder sets atop a scale that counterbalances out the dead weight of the feeder and hopper, weighing only the material inside. "We have level controls on the storage hoppers and keep the scale size as low as practically possible," Pait explained. "This way we maximize the resolution of the load cell and get the best accuracies."

The feeders are set up in two circles, with nine feeders in one and eight feeders in the other. Each feeder has an extended helix, varying in length from 3' to 5', to transport the respective ingredients into a central receiving hopper.

Eleven of the feeders are supplied from bag dump stations on the second floor of the dry system. The mixer operator loads 40-50 pound bags into these bag dump hoppers. The powders drop from the bag dump hoppers into extension hoppers atop the feeders. The other six ingredients are purchased in larger bags or super sacks. These bags are unloaded on the ground floor and piped up to the mezzanine into receivers and 50 cubic foot storage hoppers above the feeders.

All the minor ingredients must be fed and transferred to the mixer within 2 minutes. The AccuRate loss-of-weight system, with each feeder atop its own scale, allows the transferring to begin as soon as the weighed feeding begins, as opposed to a gain-in-weight system where the ingredients discharge into a central scale and the entire batch is transported to the mixer after being weighed. The loss-of-weight system allows a longer actual batch time for the feeders, which contributes to their precision.

"The feeders are so consistent we haven't had to use their DRIBBLE speed. We deliver the entire batch in the FAST speed," Pait said. "We use the Preact setting to zero in on the exact amount we need. Once we learned the proper Preact for each ingredient, we were always within our 1/10-pound tolerance. We've even sped up our feed rates three times with no problem."

Sponge and Trough Process

There are six mixers in the plant—two sponge mixers and four dough mixers. The two-stage mixing process begins with the addition of flour, water, yeast, and yeast food into a sponge mixer. After about 12 minutes, the sponge is discharged into a 1600-pound sanitary steel trough (pronounced *tree*) and automatically taken to the fermentation area. Here it rises naturally under controlled temperature conditions for about 3½ -4 hours.

The expanded sponge then goes to one of the two final mixers. More flour and other ingredients are added and mixed for about 12 minutes. The dough discharges into a trough and is moved to the divider where it is cut into pieces.

After being rounded, the loaves go into the intermediate proofer where they "rest" for 4 minutes while being conveyed to the moulder.

Expert Control System

After a mixer discharges its sponge or dough, it automatically calls for a new batch. A working table inside the computer picks the proper recipe for the requesting mixer, and the bulk, liquid and minor systems begin operating.

An Allen Bradley PLC system with a UNIX platform host computer controls all plant operations. Next to each mixer is a panel view screen which gives the operator an up-to-the-minute report on variables such as desired/actual amount of each ingredient; number of batches completed; and mixer parameters such as motor RPM, temperature and mix time.

"Basically, we have an expert system that's been taught how to bake a loaf of bread," explained Mrs Baird's Ron Huffman. Huffman was instrumental in developing the host computer software for the bakery. The host computer has access to everything on the PLC level. It can function as an operator, making decisions based on available information, or it can be interactive.

Just-Baked Freshness Still Possible

Time is critical throughout every stage of the Mrs Baird's process. "It takes six hours from raw ingredient to wrapper. Then we have to get it to the shelf," Pait stated. "This is another area where we can excel. With eleven bakeries, plus a large truck fleet, we know we're delivering the freshest product possible"

Each driver has a hand-held computer to record data at each route stop. At the end of the day, each unit is plugged into the main computer at the plant and the next day's production schedule is generated.

Even with automation leading to a production rate of 100 loaves per line per minute, Mrs Baird's still promises each customer a product "Baked With Family Pride."