From the pages of Design News + Product Design and Development

Dawn of the smart conveyor

By Charles J. Murray ,Senior Regional Editor -- 3/24/1997

Janesville, WI--Anyone who has ever walked the floors of a large manufacturing operation has seen it: pallets, rolling down a conveyor line, then slamming into one another as they reach a mechanical stop. It's a crude method of material handling, but one that has satisfied manufacturing engineers for generations.

Giddings & Lewis engineer Paul Terpstra, however, wasn't satisfied with that status quo. Terpstra, who works for the company's Assembly Automation group in Janesville, WI, believed conventional conveyor stopping techniques were in-efficient. Increasingly, he noticed that they required considerable maintenance. "When you have that much weight banging into the stops all day long, you create a real maintenance headache," he observes.

Worse, conventional techniques required special clutching mechanisms, which sometimes seized up or needed adjustment. So Terpstra met with other Giddings & Lewis engineers and eventually devised a simple alternative--supplying each of the conveyor's rollers with its own electric drive motor.

Now known as the SmartConveyor, the concept offers users a multitude of advantages--some of which, even Terpstra hadn't foreseen. Because each motor drives a single roller, instead of a team of rollers, it eliminates clutches, belts, and drive chains. As a result, it vastly simplifies maintenance and improves uptime.

It also uses far less energy. When all of the motors are networked to a programmable logic controller, the conveyor operates like a giant inchworm, engaging only those motors in the vicinity of the load, then pushing it forward. In the meantime, the other rollers and their motors lie idle. In tests, the concept has reduced energy use from 25% to 75%. "By transferring power directly from the motor to the roller, you gain efficiency," Terpstra says.

The SmartConveyor concept requires few components: specially designed torque motors and gearheads; drive rollers; proximity switches; a programmable controller; and custom-built "motor blocks." Used in conjunction with networking protocols, such as DeviceNet, it also requires a network cable between motor blocks.

How it works. During operation, SmartConveyor's proximity switches sense the position of the load, then communicate with the controller. The controller activates motors in the area of the load and the rollers push it forward. Afterwards, the rollers stop and a new set of motors is engaged.

Giddings & Lewis engineers designed the system to accurately stop loads, as well as convey them. To accomplish that, SmartConveyor reverses its rollers, thus imparting a stopping force to the load. "If we merely shut off the power to each motor, the pallet will coast, instead of stopping" Terpstra explains. "But by reversing the motors, we can decelerate the pallet and stop it repeatably."

Among the keys to the success of the system were Giddings & Lewis' work with two suppliers: Bodine Electric, Chicago, IL, which provided the torque motors; and Turck, Inc., Plymouth, MN. Early on, Giddings & Lewis engineers teamed with Bodine to develop a motor and gearhead for the project. The engineering team wanted a motor that could operate in a stall condition for prolonged periods while not in use. Bodine provided a torque motor rated at 10 lb-inches for the application, then built a special gearhead, enabling the rollers to operate at a slower speed.

Working with Turck's engineers, Giddings & Lewis also selected a special square proximity switch, Turck's Q26. The Q26's square shape and relatively long sensing distance (about 10 mm) made it a desirable choice for the application, Terpstra says. "The square prox switch mounts right up against the side rail of the SmartConveyor and doesn't need adjustment," he says. "Conventional cylindrical switches would have required a height adjustment."

Turck engineers also designed the motor block, a sealed aluminum housing that contains eight receptacles for the plug-in connection of the motor, proximity switches, and DeviceNet cable. Each straight section of SmartConveyor "track" uses two motor blocks. By communicating with the PLC, the motor blocks help monitor the performance of the motor and prox switches. If, for example, a motor short circuits, the controller knows it immediately.

The SmartConveyor has been used extensively for trimming of engines at General Motors' Flint, MI, V-8 engine plant. Engineers there say that it has dramatically reduced maintenance

time and improved throughput by as much as 10%. Similarly, engineers at Ford operated a SmartConveyor test loop for more than a million cycles, saying that it achieved an operating uptime of 99.6%. "Few conveyor lines of any kind have uptimes that high," notes Ken Smerecki, a production superintendent for Ford who was involved in testing the system.

Though Giddings & Lewis plans continued improvement of the system, its engineers say it has met its initial goals. It also minimized part count, simplified the drive train, and reduced downtime. Says Terpstra: "It has already exceeded all of our expectations."