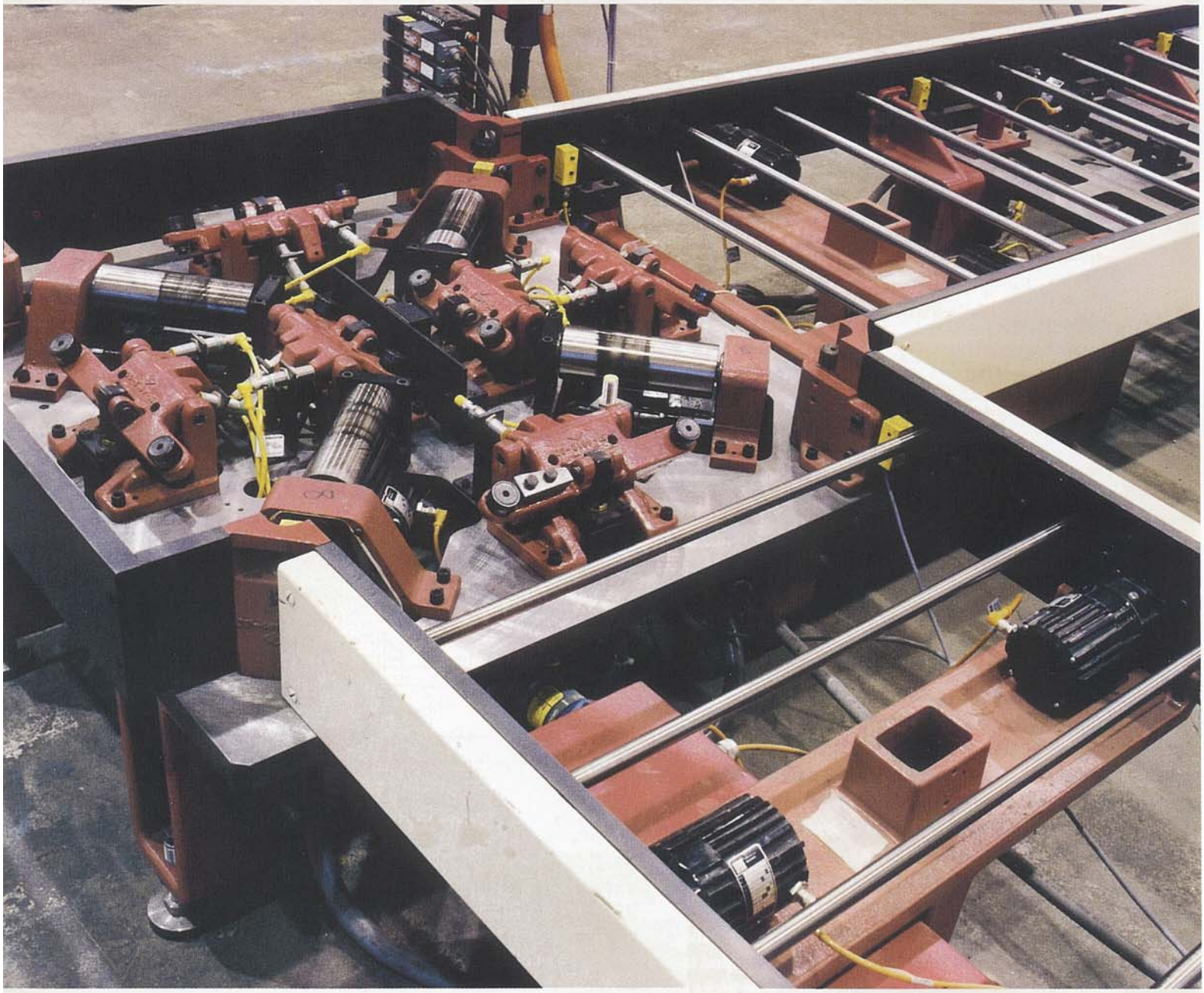
Programmable Transport



for Assembly Lines

By **GARY S. VASILASH**, Editor-In-Chief

From a distance, the Giddings & Lewis Integrated Automation "SmartConveyor" resembles a traditional powered roller conveyor. Yes, it can move pallets—up to 48-in. square—carrying engine blocks and the like, just like the traditional conveyors. But look a little closer and you'll see the differences are startling.

The name "SmartConveyor" may strike some people as a bit much. After all, this is a heavy-duty device meant to transport things like auto engines-and-transmissions-in-becoming. But to hear Paul Terpstra, senior R&D engineer at Giddings & Lewis Integrated Automation (Janesville, WI), and a man instrumental in the development of the conveyor for automatic assembly systems describe it, the patented device is far more brainy than the run-of-the-mill conveyor. (And lest you think that "brainy" automatically signifies "big bucks"—as in "Yes, this thing probably is wonderful but too expensive," Terpstra, who is admittedly not a marketing guy, maintains that a given size of SmartConveyor, depending on such things as the number of necessary stops, can be quite cost-competitive with less cerebral options.)

The SmartConveyor is described as a "zone-control conveyor." Translated, that means that unlike a standard powered roller conveyor, which includes a driveline that runs and runs, even when the pallets are stopped in position (there is usually either a clutch that kicks in to keep the rollers running under the pallet while it is stationary so the rollers don't damage the bottom of the pallet or there may be a roller-within-a-roller arrangement so that the outer roller will stay stationary while the inner keeps moving), the SmartConveyor employs a multiplicity of fractional horsepower motors and programmable controllers (PLCs) that activate the areas of the conveyor that need to be activated when and only when needed. When the rollers must roll to move the pallets, that section, or zone, of rollers is running. When the pallet has passed by, or when it needs to stop in a zone, the rollers are not rolling.

Stopping is also performed in a different manner than is typical of powered roller conveyors. It isn't a matter of having an 800- to 1,500-pound object traveling at from 40 to 60 fpm slamming into a mechanical stop. The power in a zone is simply deactivated as required. Terpstra says that when a pallet comes to a stop on a smart conveyor, it is located within $^1/_8$-in., thanks to the use of sensors. If finer positioning is needed for the assembly operation, then shotpins are engaged—as they are when conveyors with mechanical stops are used.

The development of what has become the SmartConveyor began in 1989. Terpstra, who says he's mechanically oriented by training but drawn to electronics and controls by interest, explains that he was initially grappling with the problems related to the sliding friction generated in conventional powered roller conveyors. That is, within the roller-within-a-roller arrangement bits of rust or other grit can cause a seizing of the rollers, which isn't beneficial to system performance. When there are numerous stopping positions along, say, a 1,000-foot assembly line and clutches are used, there are numerous clutches involved, all of which need care and adjustment, lest there be serious damage to the drive motors. (Apparently, clutch adjustment on a long line is akin to trimming the hedges at Buckingham Palace: by the time the

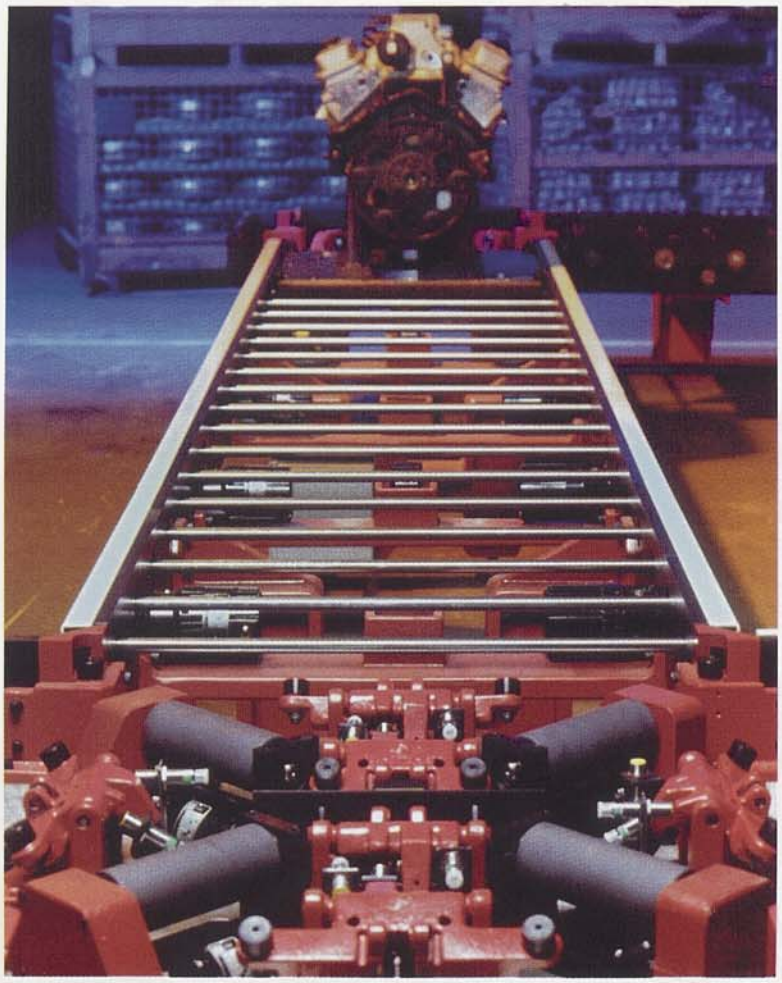
groundskeeper reaches the end he has to immediately start all over again because the bushes have grown up at the front.)

So Terpstra thought of the possibility of an electronic clutch—built right into the motor itself. In other words, the output shaft of the motor could be locked, yet the motor would continue to run without burning up or shorting out. Giddings & Lewis worked with Bodine Electric (Chicago) to develop what is called a "torque motor." By way of determining the functionality of this type of motor and to prove that it could do what it is intended to do, such a motor was run for 11 months straight with the rotor locked. There was no problem.

"Instead of having one $^{3}/_{4}$-hp motor for 10 to 20 feet of conveyor, as is normally used," Terpstra says, "we decided to use a $^{1}/_{40}$-hp torque motor on every roller." He adds, "You'd be surprised at the small amount of torque necessary to move a 1,500-pound pallet." Of course, this movement is facilitated by the extensive use of antifriction bearings.

Next, there was the idea of using a network of small PLCs to control the sequencing of motors so that as a pallet is moved from section to section, or zone to zone, the motors are activated and deactivated. Generally, there are four rollers per fixture length. So each set of four rollers can be considered a zone. There are proximity switches, or sensors, at the leading and trailing edges of each zone. This not only permits the necessary sequencing to move a pallet along the line, but it permits knowing where a given pallet is at a given point in time.

There are several benefits to this arrangement. Motors are running only when necessary. Take into account the time during an eight-hour shift when areas of a traditional roller conveyor are pointlessly spinning in space: it could be as much as 80% of the time. Since the motors on the SmartConveyor run only when necessary there are comparative (1) energy savings and (2) reductions in maintenance. No mechanical stops are needed because the motors driving the rollers where the stopping is to occur are simply shut off and the rollers stop rotating in short order. This means wear and tear on the system from slamming into stops is eliminated. There is a bit of operational insurance provided in that torque motors are used, so the chances of motor burnout due to some sort of jamming are greatly reduced as compared with traditional drive motors.



According to Terpstra, the construction and installation of the conveyor is rather simple. An entire system (with the exception of corners) consists of duplicate sections of conveyor. These sections can be built-up and put together as needed. The wiring diagram and the program for each section are near duplicates, with the differences, mainly, being the addresses of the sections. (Of the wiring diagram, he says, "It's a couple of pages—not a book as is normally the case.")

About the corners: this, too, is a patented device, called "RoTrans." That, Terpstra says, stands for "rotate" and "translate." Instead of having a radiused corner or a turntable that lifts the pallet then turns it 90°, the RoTrans makes use of four rollers that are rotated in a coordinated manner such that the pallet pivots about its center. One of the drivers behind the design was a request by a customer that there be the capability to manually move a pallet through a corner.

The first SmartConveyor is in place in the GM Powertrain plant in Flint, Michigan. Ford's Alpha operations is analyzing a modified version.

"We're an assembly company," Terpstra says. "We're not a conveyor company. But we think that SmartConveyor allows us to do a better job with our assembly systems."