

Linear Actuator Improves Accuracy/Speed Of PCB Drilling

Using fewer parts eliminates lost motion, enhances stability of drilling equipment

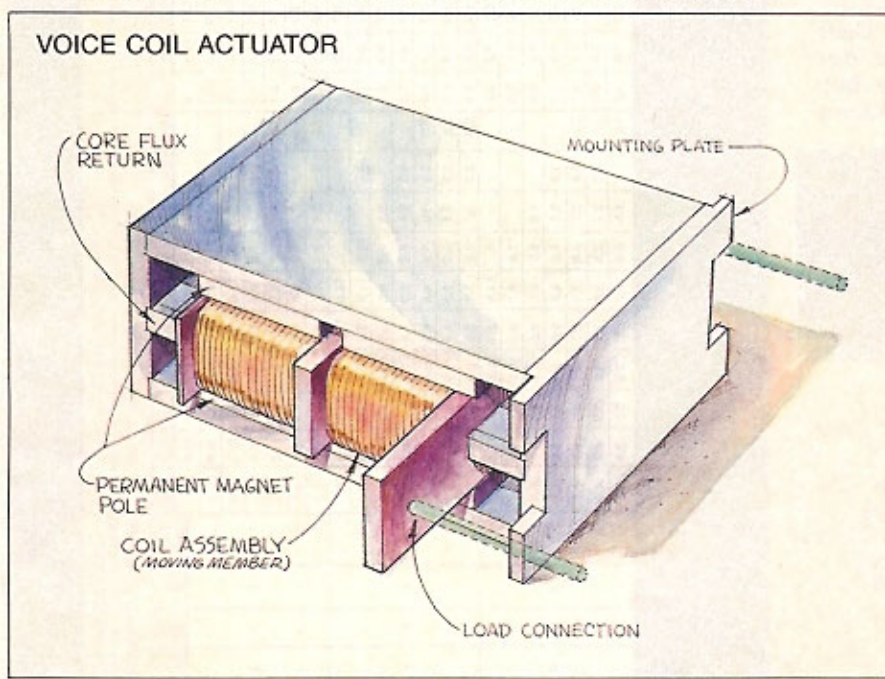
Lyle H. McCarty, Western Editor

San Marcos, CA—Volume production of PC boards requires multi-head machines to drill the component mounting holes. The holes must be precisely located, burr-free, and highly circular. Hole diameters range from 0.010 inch to 0.625 inch (down to 0.002 inch in special cases). Spindle speeds range from a few thousand to 120 thousand rpm. The force of a drill against the workpiece must be precisely maintained—failure to do so can cause

drill breakage, premature drill wear, and board damage.

The conventional way to meet these requirements has been to use a motor/lead screw Z-axis drive and a ball-bearing, low-speed spindle for the larger-diameter holes. For smaller holes, another spindle with air bearings and a more-precise higher-speed motor/lead screw drive has been employed. Most PC boards require both large- and small-diameter holes, so this ar-

Configuration of voice coil actuator from BEI is simple. A single moving part minimizes inertia and eliminates lost motion that can exist between multiple mating parts.



Morcos (right) with engineer Ha Pham.

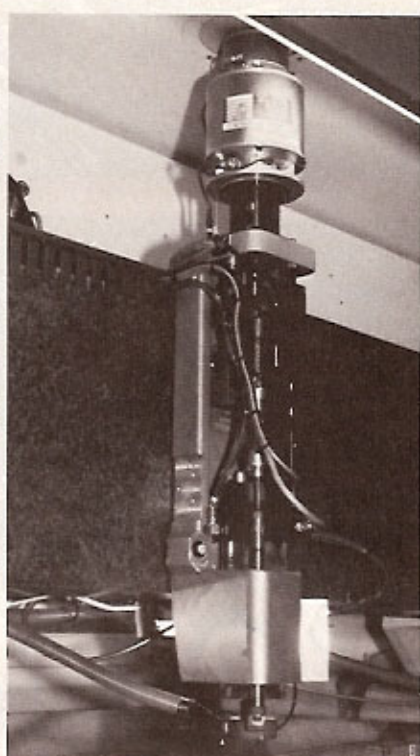
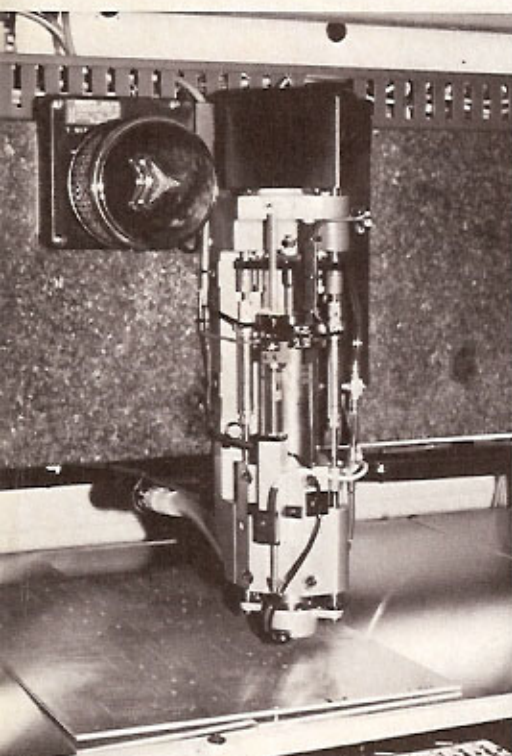
A linear actuator has only one moving part, so it meets the customer's need to eliminate lost motion

—Tony Morcos

angement involves shuttling the work from one spindle to another. The result is both reduced throughput and increased risk of an error in positioning.

To find a way around these problems, a vendor's design engineers joined with their customer, Dynamotion Corp., to investigate application of a voice coil actuator to the PC board drilling job. The device they came up with is an interleaved magnetic-circuit-design linear actuator capable of meeting the entire range of Z-axis feed requirements.

Their interleaved magnetic circuit modification improves the



In the latest PC board drilling head (left), only the spindle itself, attached instrumentation, and a linear actuator coil assembly move in the Z-axis. This design reduces the moving mass by a factor of three or more, and essentially eliminates lost motion. The older, heavier motor/lead screw design is shown on the right. (Design News photos)

overall characteristics of the voice coil actuator through the use of serialized magnetic paths. This design approach reduces the amount of material required to support the magnetic flux, thereby reducing the overall size and cost of the actuator. It also reduces the electrical time constant via opposing orientations of the serialized electrical circuits.

"A linear actuator has only one moving part—the coil assembly—so it meets the customer's need to eliminate lost motion between mating components," says Tony Morcos, director of engineering at BEI Kimco Magnetics Div. "And in servo applications, the coil assembly's low weight minimizes total system inertia. Because voice coil actuators are often built with hollow, wound armatures, their mechanical time constants are orders of magnitude lower than those of moving magnet actuators."

Morcos points out that in addi-

tion to low mechanical and electrical time constants, conventional voice-coil actuator designs offer cog-free, ripple-free, and hysteresis-free motion, and infinite position sensitivity. Patented by BEI, the interleaved magnetic circuit design enhances peak force, continuous force, and volumetric efficiency, while reducing the electrical time constant.

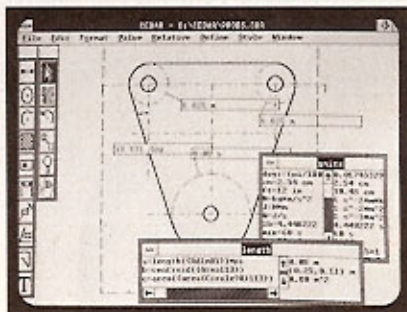
Additional details... Contact Mike B. Lopez, Director of Sales and Marketing, BEI Motion Systems Co., Kimco Magnetics Div., 150 Vallecitos de Oro, San Marcos, CA 92069, 619-322-1168. □

OTHER APPLICATIONS

- Transfer mechanisms
- Grinding wheels
- Dressing wheel feed
- Pick and place robots

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