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BASICS OF DESIGN ENGINEERING

MOTION CONTROL

Advances in electric motors and mechanical components let engineers design motion-control systems that are reliable and easy to assemble.

Turning beverage cans into works of art

Beverage companies are gearing up to add yet another dimension to their already aggressive marketing strategy to make more attention-grabbing products. Cans are now being embossed with brand logos in addition to their normal decorations. But artfully distorting cans like this can be a challenge to machine designers who must consider production rates in thousands of cans per minute.

To put this in better perspective, people in the U.S. consume the contents of about 275 million cans in one day, or 100 billion per year. Alcoa Packaging Machines (APM), Englewood, Colo., High-Tek innovations Inc., Idaho Springs, Colo., and Industrial Indexing Systems (IIS), Victor, N.Y., combined expertise to design and manufacture a system capable of turning out 1,700 cans/min or 28 cans/sec. APM, under license from American National Can, Minneapolis, Minn., had worked together earlier on a similar project and developed a so-called flutter machine or can profiler that embosses a Roman-column shape on a can. But they needed High-Tek to modify the machine and IIS to design the advanced servosystem to make the new embossing procedure fast and accurate.

The delivery system separates cans from an infeed stream and delivers a can to one of 24 servocontrolled lift pads. Each liftpad contains a motor with a hole in its rotor that connects to a vacuum source and holds the can in place during embossing.

Their biggest challenge was designing equipment that could handle a cycle time of less than 1 sec to feed in the can, register the label decoration to a known position, emboss, release, and feed out the finished can. The can feeds into the rotating machine at 35° and exits at 338°, or only 303° and 713 msec to complete the process.

A starwheel delivery system separates previously printed cans from an

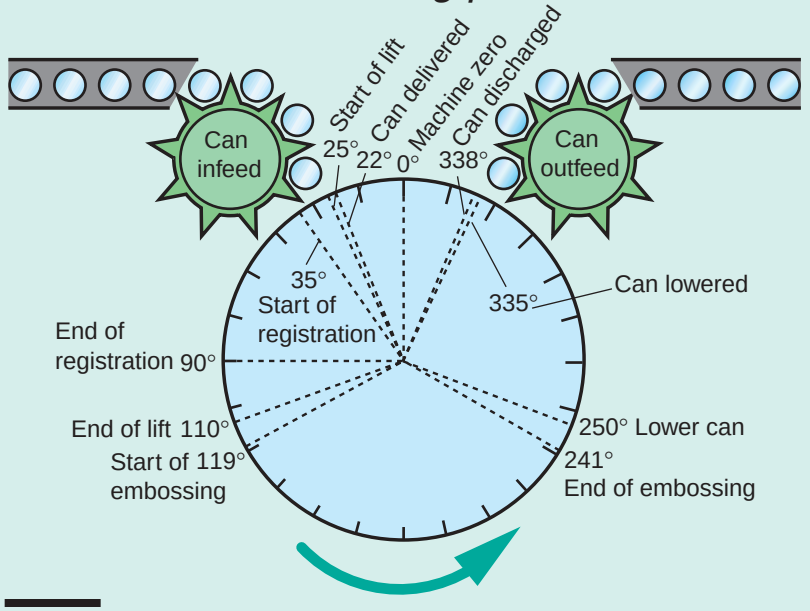
infeed stream and synchronously delivers a can to one of 24 servocontrolled lift pads. Each liftpad houses a custom motor with a hole through its rotor that connects to a vacuum source. The vacuum holds the can firmly in position during the embossing process.

The lift pads travel a circular path around a central column — the main body of the embossing machine. Cans to be registered sit upright on each lift pad while miniature sensor heads mounted to each motor assembly look for a laser beam reflected from the can's surface. The sensor searches a can rotating at 200 in./sec for a registration mark, giving the motion-control system a point of reference. From this reference, the motion controller aligns the can with the embossed tooling fixtures, lining up printed logos and trademarks on the can with their textured counterparts.

Cans are registered between the 35° mark and the 90° mark in less than 129 msec. With the servosystem controlling the can position, the motor assembly, riding along a rotary cam rises to meet the embossing tools. Each tool set consists of a positive and a negative image of the features to be embossed. One tool enters the can which then mates in rotation to its counterpart on the outside of the can wall. Having the servomotor rotate in synch with the tooling makes it possible to precisely match the decorated label and its embossed image each cycle. With the embossing operation complete, the can drops away from the tooling.

The can is embossed between the 119° mark and the 241° mark, at which point the servocontrolled lift pad delivers the can to an outfeed process. Removing the vacuum releases the can from the lift pad.

Through a touchscreen interface, users can compensate for mechanical harmonics, review machine performance history, and communicate by a variety of fieldbus protocols. With each servoaxis linked by a CANbus network, individual servostations can provide statistical performance criteria. This allows greater quality control and tooling setup analysis such as can registration offsets, can rejection counts, station performance, and productivity statistics. The entire motion control system interfaces with the overall machine control PLC by serial communications, interlocking all of the machine's mechanical and electrical systems into a central controller. ■



Each can is processed in one machine cycle or 360° of the carrousel. The procedure begins with registering the can position, then lifting it into position for embossing, embossing, and finally discharging the can — all within 847 msec.

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