

**AMERICAN STOVE APPLICATION ARTICLE: DRAFT (Rev. 3: 2/27/08)**

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Title:           **Precision Dispensing of Epoxy for Engraved Parts**

Author:          Scott Beebe, President of Fishman Corporation

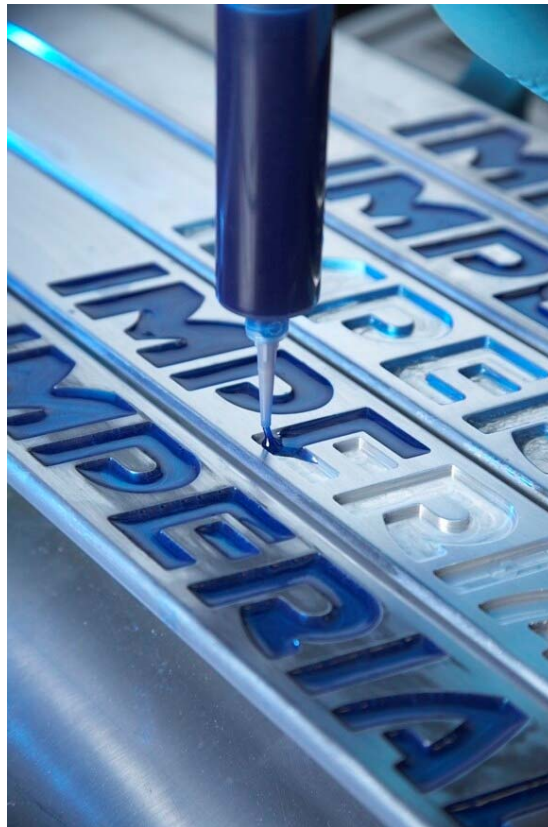
The need to dispense precise amounts of adhesives and sealants goes beyond medical devices and electronics assembly. In the manufacture of products, a myriad of applications — some unique — demand the ability to effectively control the delivery of highly accurate amounts of material, dot after dot after dot. For such applications, air-based delivery systems are simply too imprecise and unreliable. Here is a case in point, where the linear-drive technology of the Fishman LDS9000 provides a more effective solution than pneumatics to a customer material control problem.

American Stove Parts in Temecula, California manufactures and stocks OEM and replacement parts for various types of gas cooking stoves. Parts include filters, tube assemblies, injection molded components, valves and fittings, door gaskets, burner knobs, and oven door handles, which are sold through U.S. distributors and sales technicians, as well as an in-house sales department. The manufacture of parts for a particular stove company has in the recent past, posed a problem that required a creative, consistent, and reliable solution.

Everton Cope, owner of American Stove Parts, recounted the problem and the solution. “One of our customers is Imperial Range, which manufactures gas ranges, ovens, and other cooking products for commercial use. The equipment is heavy duty and is intended mostly for restaurants and institutions.” He added, “While Imperial is only about 40 miles from us, the company is a major supplier to the food service industry throughout the world, and the company is understandably vigilant about product quality

and its image. This extends to the name of the company on oven door handles... which presented us with an interesting challenge.”

The Imperial name on the handle is actually engraved into the metal. (See Figure 1.) The challenge was figuring out how to add color to the name. “ We first tried to paint the color in the engraved area,” recalled Cope, “but we couldn’t get the edge quality and color consistency that we needed. We then looked around for some way of filling in the engraved letters with a urethane-based epoxy that had a colorant mixed in.” Cope settled on a pneumatic system that consisted of a hand-held dispenser and a control unit.



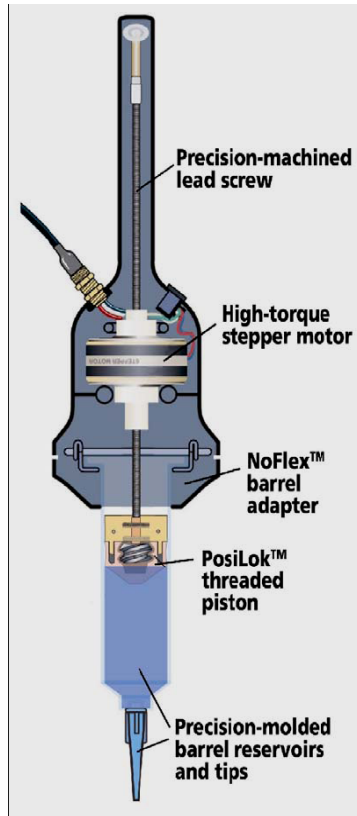
*Figure 1. Imperial Name Engraved in Oven Handles*

“We soon found out,” said Cope, “that the solution was not perfect by any means.” The dispensing system depended on a column of air to apply pressure to the top of the piston in a syringe containing the epoxy. Movement of the piston caused the material to be “pushed” out of the syringe. “The problem was that the amount dispensed varied too much as the syringe went from being full to nearly empty. As a result, not only were we getting partially filled and overfilled letters, but the color of the epoxy would vary from dark blue to light blue, depending on the thickness of the amount dispensed. Neither condition was acceptable.”

“Clearly,” Cope remarked, “we had to have a better solution, and we began to look around for other means of dispensing the epoxy. Eventually, we came upon the Fishman LDS9000, and turned to Tom Blanchard, Vice President of Sales, who evaluated our requirement and provided applications support. Within days, we had a prototype up and running, and the improvement was dramatic, both in terms of precision and repeatability.”

What was different about the LDS9000? Unlike the other types of dispensing products on the market, with the Fishman dispenser, movement of the piston in the syringe (or barrel) does not depend on pressure provided by either air or hydraulic fluid to force the material out of the tip. Instead, a flexible electrical cable assembly connects the microprocessor control unit with a linear actuator in the dispense gun, which provides a highly controllable positive displacement force on the piston.

As can be seen from the cutaway illustration of the gun (Figure 2), a stepper motor and a mechanical lead screw are employed to extend or retract a piston attached to the end of the screw. The stepper motor rotates a nut between electrically charged poles. Though the nut turns, its axial position does not change. The lead screw, threaded through the nut (and secured from turning itself), moves up and down on command from the control unit.



*Figure 2. Cutaway View of Fishman LDS9000\**

As a result of the precisely controlled motor rotation, the piston pushes exact and repeatable amounts of adhesive through the syringe and dispensing tip. To accomplish this, key data are programmed and stored in the control unit: the syringe size (3, 5, 10, or 30cc), dispense volume, dispense rate, drawback, and drawback delay. With these parameters entered, the software calculates the exact movement of the piston in the barrel to dispense the required amount. Because of the stability of the drive mechanism, the viscosity of the material and the amount left in the syringe have minimal impact on dispense volume. Simply activating the control, either manually or automatically, ensures

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\*LDS = Linear Drive System

high repeatability in delivering the desired amount. After a dot of adhesive is dispensed, a programmable pullback of the piston prevents fluid ooze.

“A big help to us,” remarked Cope, “was the fact that dispensing of the epoxy is unaffected by either temperature, changing viscosity, or the amount of material in the syringe. You get the same preprogrammed amount of epoxy with each shot. As a matter of fact, the gun can’t deliver anything but that amount, until the control unit is programmed for a different amount.”

Fishman dispensers can be hand-held, mounted in bench-top stands, or even ganged in fixtures and programmed for automated operation. When mounted in automated equipment, the equipment controller begins the dispense sequence with a signal to the Fishman controller. For the manually operated stations, the dispenser is generally fixtured and is actuated through the foot switch included with the dispenser.

According to Cope, in the case of American Stove Parts, “We initially dispensed the epoxy manually from the LDS9000, but ultimately decided to secure the dispenser in a benchtop mount designed for our purposes.” A robotic system (Figure 3) was developed with the help of Fishman, the dispensing gun being mounted on a robotic arm. A foot pedal is employed to initiate both the mechanical movement of the arm and the programmed dispensing of the epoxy. “Movement of the arm is controlled and does not change from part to part. Between the dispensing system and the robotics, we achieve the precision and repeatability we need and we’ve eliminated possible causes of variations in the results.”



*Figure 3. Fishman LDS9000 Mounted in Robotic Arm*

What kind of precision is required? “We found,” said Cope, “that the epoxy layer must be between 0.010 in. and 0.015 in. in thickness to fill the letters sufficiently and to ensure consistent color. We have no problem achieving those results with the Fishman product,” he adds. “The LDS9000 setup is configured to meet our specific requirements. We use 30cc syringes of epoxy, which enables the filling of six handles from one tube.

The robotic system is designed with quick-disconnects, so that when a syringe empties, the arm, dispenser and syringe are quickly replaced with another assembly that contains a syringe pre-filled with the epoxy.”

Currently, the company is operating a single workstation, but plans to add a second in the near future. “We are also looking at other uses for the LDS9000,” claims Cope, “including filling engraved areas on chrome and plastic nameplates and applying sealant in manifold assembly. While the nameplates will require a smaller dispensing needle, I have no doubt but that the Fishman system will provide us with the precision and repeatability necessary.”

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