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November/December 2011 Volume 4 Issue 6

PERFECT PITCH

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Burkart-Phelan Case Study Parts Made on DATRON M8



Brass Fixture (right) designed by shop manager, John Dionne, to hold multiple platinum flute parts during machining.



In harmony: micromachining and musical-instrument making

SOME MICROMANUFACTURERS MARCH to the tune of a different musician.

James Phelan is a horn player who repaired brass and woodwind instruments to pay for his music degree from the New England Conservatory. Later, when working for Boston flute maker Verne Powell, Phelan decided to bring modern manufacturing technology to flute making, and acquired a small, manual Wade screw machine for the company's shop.

He then earned an engineering degree at Northeastern University, after asking himself, "Is it easier to teach an engineer flute making or teach a flute maker engineering? I decided on the latter." While at the flute-making shop, Powell met his wife, flute maker Lillian Burkart, and together they founded Burkart-Phelan Inc. Lillian developed the Lillian Burkart custom piccolo and the Lillian Burkart flute. Today, Burkart-Phelan flutes and piccolos are played around the world.

Burkart-Phelan occupies a 10,000-sq.-ft. facility with a machine shop that includes a Haas VF03 machining center, a Haas turning center, a Sodick wire EDM and a Datron Dynamics VelociRaptor micromachining center (a newer version is called the M8). Acquired on the recommendation of shop manager John Dionne, the machine has a 40"x30"x9" work volume and a 2½-hp, 60,000-rpm spindle.

"It is the perfect machine for what we do," Phelan said. To effectively use microtools, the shop doesn't need horsepower. "What we need is speed. For example, the smallest thread we make is 00-90 (0.0350" in diameter), and we threadmill it." Dionne said. "The machine can run an endmill as small as 0.002" in diameter."

The shop machines most of its parts from precious metals, including silver, gold and platinum. Because some precious metals are sensitive to standard metalworking fluids, the shop applies 200-proof ethanol as a coolant on the Datron machine.

"Silver machines like aluminum," Phelan said. "Gold machines a little bit more like brass or a bronze. The gold alloy that we use is a little harder than sterling, and it is not as gummy. Cutting characteristics are a little bit better in gold than they are in silver."

Early in the shop's evolution, most of the work was done by hand, and results were inconsistent. Said Phelan, "It was like throwing darts."

Dionne pointed out that everything was handmade to match the step before it. While the staff was skilled at handwork, a machine tool could perform the work more precisely, so certain parts were transferred to CNC machining. "Our staff developed the skill needed to design the parts so they can be machined and still work with the handmade parts," Dionne said.

The shop machines a family of small parts called "pointed arms" on the Datron mill. They are beveled levers about 0.200" wide x 0.100" thick x 0.300" long. Before acquiring the mill, the shop had been roughing them and sending them out for EDMing.

"We were considering buying a wire EDM," Dionne said, "but the Datron mill does the process just as well and way faster." He noted the importance of support from the machine tool builder. "When [Burkart-Phelan] was looking at a machine purchase, I gave Datron a piece of silver [from which] to make a part. The material cost \$7 and the part took us 1 hour to make. The Datron mill did the job in 2 minutes."

Micromachining provides the flute maker with other benefits, too. Previously, the shop would get about eight parts out of a 2"x3" silver plate. "Now we average 20 to 30 parts out of the same plate," Dionne said. Considering the shop's workpiece materials, waste is an even greater concern than it is in most other shops. "We reclaim all the material," Dionne said, adding that runs vary from 100 to 1,000 parts. "Even though it might be efficient to make a year's worth of parts, we don't want to be holding on to that much gold or silver."

The Datron mill's relatively large worktable makes the machine flexible and appropriate for a shop with small runs and multiple design changes. Operators often mount fixtures



John Dionne, machine shop manager at Burkart-Phelan, uses a Datron M8 machining center with a 60,000-rpm spindle and an integrated 4th axis to mill intricate parts on a solid gold flute.

on subplates that can be installed on and removed from the table quickly and accurately, Dionne said. "Getting the job on to the machine and making the changes needs to be efficient; otherwise, you make very few parts. When I put my subplate on the machine, I'm right there. Setup is very quick."

—B. Kennedy