➤BY ALAN RICHTER, EDITOR

Roger Duffy (left) and Blake Slack, owners of F&F Screw Machine Products, in front of a Tsugami BU26-SY Swiss-style CNC machine.

All images: A. Richter

A Turn to Medical

F&F Screw Machine Products continues to diversify by producing the thread whirling tools applied to produce many medical parts.

F&F Screw Machine Products believes in the old adage that if you want something done right, do it yourself.

That is the result of a problem F&F faced after getting a big medical job about 5 years ago. The shop ended up addressing the problem by making the required tool itself. This has led to the job shop producing even more tools for its own consumption and for other manufacturers. In the process, it has garnered more business in the growing medical parts field and has plans for even more.

"If somebody gives us a new job, we don't have to wait for tooling," said Roger Duffy, co-owner of F&F Screw Machine Products. "We can make it ourselves."

The medical job that started this process required producing 0.199"-dia. half pins 4" to 9" in overall length with thread lengths from 0.750" to 4.5". The half pins were made of 316 stainless steel and required a self-tapping bone screw thread.

F&F applied a single-point threading tool and found "it was taking forever," Duffy said. "The demand they had for us to make those parts was far more than what we could produce at the rate we were doing it."

So Elkhart, Ind.-based F&F turned to REM Sales Inc., East Granby, Conn., the North American importer for Tsugami Swiss-style automatic lathes, machining centers and multitask machines. REM Sales recommended that F&F thread whirl the part on F&F's Tsugami 7-axis Swiss-style machine. "We had never even heard of thread whirling at the time," Duffy noted.

When thread whirling, a cylindrical workpiece rotates while a circular cutter body tooled with inserts on its ID whirls around the workpiece and cuts the thread. The cutter body is off-center in relation to the workpiece axis and is tilted to create the thread's helix angle.

Life Expectancy

F&F began thread whirling the part, but noticed that tool life was poor. The

shop was producing more than the 50 parts a day it was able to do when single-point turning, but was changing the tools too often and knew there had to be a better way.

F&F again consulted REM Sales and was informed that it needed a different cutter body, or whirling ring, so the inserts would be held closer to the workpiece. The snag was that REM Sales didn't have such a cutter body in stock, but a special could be ordered. The lead time would be 8 weeks.

"That's when we said, 'you know what, we'll just make it ourselves,'" Duffy recalled.

Based on REM's idea, "We ended up coming up with our own design," Duffy said. "We shrunk it down, which got the inserts closer to the stock diameter, and we got better tool life. We really started cranking out parts." The result was a fivefold increase compared to single-point turning.

REM Sales didn't want F&F to sell the cutter body, which has a patented design, to other shops, but did want F&F to make cutter bodies for the machines REM Sales sold. "Every time they sold a machine, they'd have us make a different head for the screw that they sold that machine for," Duffy said.

Producing each cutter body is a time-consuming operation, so REM Sales eventually started making them based on F&F's design. "But we still make some cutter bodies for REM," he added.

Initially, F&F produced cutter bodies that accepted three inserts and then developed a body that accepts six inserts—three for roughing and three for finishing—to boost productivity. The roughing inserts are 0.010" ahead of the finishing ones.

"We've even designed a tool with a double lead on the insert itself to cut a double lead all in one pass," Duffy added. (On a double lead thread, which has two starting points, the lead, or the distance a screw thread advances in one revolution, is twice the pitch.)

Insert Production

F&F also makes its own inserts. "We have quick turnaround and that's really our strength in making inserts," Duffy said.

Examples of bone screws with whirled threads.

Primarily, the shop makes inserts using a Charmilles 240cc wire EDM. The cc signifies the machine has a Clean Cut generator, which reportedly prevents the cobalt binder from leaching out of the carbide. With less cobalt, tool life suffers.

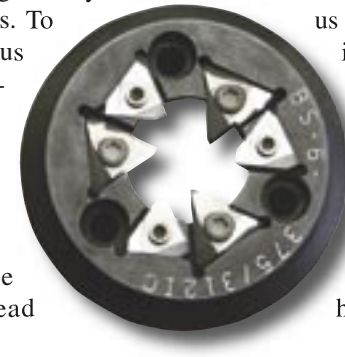
Duffy emphasized the importance of understanding tool geometry when producing inserts. To produce a 0.002" radius on a corner, for example, F&F applies a 0.004"-dia. wire because it's twice the size of the radius.

Having inserts with the proper clearance is critical when thread whirling to prevent the cutting edge from rubbing the workpiece and shortening tool life. "Too much clearance is not good either," Duffy said. That's because too much clearance does not allow the heat to dissipate through the tool, causing premature tool breakdown.

Determining the appropriate geometries for inserts is relative to the thread being produced and often requires trial and error. "There's not a standard," he said, and that's good for F&F because it can react quickly—in 2 weeks or less—to requests for orders of three to 300 special inserts.

Making inserts for thread whirling medical screws is even more demanding because of their unique threads. "It's not a standard thread that comes out of the book," Duffy said. "They all have something that's really [unusual]. It might be a reverse angle or a buttress thread."

In addition to making inserts for in-house use, F&F sells inserts to REM Sales as well as Mahar Medical, Warsaw, Ind., an industrial distributor.



An F&F-designed thread whirling body tooled with three roughing and three finishing inserts.

Toolholders Too

F&F's tooling production isn't limited to whirling tools. It also made 120 dovetail toolholders for its 60 Brown & Sharpe single-spindle screw machines. Duffy explained that a screw machine's front and back slides typically hold circular tools, which can have clearance problems and are sometimes specials. The dovetail toolholder F&F designed holds a stick tool, which provides better clearance and can be produced in-house with a wire EDM.

Although producing screw-machined parts is the company's primary business, "some customers know us for making special tooling," Duffy said. "We've made facing tools for big turning centers that nobody else could make. We've made some through-coolant broaching tools that nobody else has made. If someone can dream it up, we can build it."

That being said, lately, F&F is focused on becoming ISO 13485 certified so it can court more medical business. Amongst other requirements, certification requires a written procedure for every process and that every process is performed the same way every time. "That has not held us up from doing medical

From band instruments to bone screws

Elmer Fisher and his son Frank established Elkhart, Ind.-based F&F Screw Machine Products in 1959. Being located in the "band instrument capital of the world," the shop initially produced parts almost exclusively for band instruments.

Frank eventually took over the business and the shop took on new work to keep its three employees busy.

Current co-owner Blake Slack began working part-time at F&F in 1970 after starting his career elsewhere. "I started in a screw machine shop when I was 15 years old," Slack said. "I went to school during the day and worked nights. One thing let to another and I started to buy into the business in 1972."

In 1975, F&F built an addition, doubling the shop's size to 3,600 sq. ft.

Slack added: "Roger [Duffy] came along in 1986 and just clicked with the business. The next thing you know he's part owner. Now we're 50/50."

A Brown & Sharpe single-spindle screw machine retrofitted with ServoCam technology, which turns the critical turret-slide axis into a CNC ballscrew drive.

By the mid '80s, the shop had grown to 5,400 sq. ft. Frank Fisher retired in 1986, shortly after Duffy started.

The shop's business continued to grow and F&F broke ground for a new building in May 1996. Before the end of the year, F&F's 40 employees moved into their new 20,000-sq.-ft. facility. That same year, F&F purchased its first CNC machine—a Tsugami 7-axis Swiss-style machine. Now, it has seven CNC Swiss-style machines, in addition to three CNC 2-axis slant-bed lathes, five vertical machining centers, two wire EDMs and 60 cam-driven, single-spindle screw machines.

The shop has retrofitted 12 screw machines with the ServoCam technology from AMT Machine Systems Ltd., Columbus, Ohio. ServoCam turns the critical turret-slide axis into a CNC ballscrew drive.

F&F also plans to get bigger by adding equipment that complements what it already has. "We're good at screw machining, machining and wire EDMing," Duffy said. "We'll stay with what we're good at and just grow it."

But the shop will need extra space to accomplish that. "We're out of room now, but there is room to expand," he said. "We could probably double our facility, an idea we're entertaining." And F&F has achieved this growth via repeat business and word of mouth. "We've never had a salesman," Duffy noted.

F&F stills produces some musical instrument parts, but has diversified into an array of industries. "We're a job shop," Duffy said. "It comes in; we set it up and knock it down. Turnaround is the name of the game, because nobody has lead times anymore." *—A. Richter*

work," Duffy said, "but before we get into it heavily, we want to have that behind us."

In the meantime, F&F will continue screw machining parts, making tooling and thread whirling screws when appropriate. "Right now," Duffy said, "whirling has become such a buzz word in the medical industry that people feel like they have to whirl and that's not necessarily true. Sometimes, single-pointing is as good or better." That would be the case when a short thread length is required or when a part is needed "yesterday," and F&F is able to produce an insert for single-turning a bit faster than one for whirling. △

Contact F&F Screw Machine Products at www.ffscrewmachine.com or (574) 293-0362.