

Time-Saving Tools

By Joseph L. Hazelton,
Contributing Editor

Parts manufacturers can choose from various multifunction tools to reduce cycle times and free up tool positions in their machine tools.

Structure Medical Inc. needed to increase production of a part by 25 percent, from 800 to 1,000 every 20 hours.

The Naples, Fla.-based medical parts manufacturer had been producing the titanium parts on a dedicated Swiss-style machine. To meet its customer's greater demand, Structure Medical had dedicated a second Swiss-style machine for about 4 weeks to manufacture the additional 200 parts needed per day.

The second machine tool had to be dedicated to that job because of setup requirements for the bar feeder, guide bushings, pickup collets and cutting tools and dialing in the machine. "It's not like you can just flip a switch," said John Cross, Structure Medical's manufacturing manager.

But dedicating a second machine meant moving its jobs to other machines, adjusting those jobs' part programs and setting up the cutting tools. "It was a mad rescheduling of the machines," Cross said. "The programmers were not happy. The setup guys got a lot of overtime."

Consequently, Structure Medical looked into multifunction tools and found the Multi-V from Magafor, Turners Falls, Mass. The tool allows the

Multifunction tools often must be custom-made, like this one, which consists of three pairs of boring and chamfering inserts for making three concentric holes. Besides specials, though, many toolmakers offer one or more lines of multifunction tools for machining several types of part features with a single tool.



medical parts manufacturer to spot drill, deburr and chamfer with one tool rather than with the three single-purpose tools it had been using. "It seemed like a natural fit for the particular job we were doing on the Swiss," Cross said.

The switch reduced cycle time for a medical part by 30 percent, from 90 seconds to 63 seconds. Now a Swiss-style machine can produce the needed 1,000 parts in 20 hours.

Greater Productivity

Multifunction tools increase productivity by reducing noncutting time.

A machine tool may take several seconds to pull a single-purpose tool from a workpiece, switch to the next single-purpose tool and position it so machining can resume. A multifunction tool would eliminate that tool-change time.

Multifunction tools can boost productivity by making more tool positions available in a machine tool, like in a lathe's turret. More available positions are especially beneficial when parts require a large number of features. Using only single-purpose tools, a machine may not have enough positions to completely machine a part, forcing an operator to manually change one or more tools to complete the part or move it to another machine for the remaining operations.

Increasing productivity via a multi-



Sandvik Coromant

One type of multifunction tool features a tool body made to accommodate two or more different types of inserts. This Sandvik Coromant 880 tool body has two pockets, one at the body's free end for a drilling insert and the other on the body's taper for a chamfering insert.

function tool requires research from parts manufacturers, though. "The key issue to whether a multifunctional tool makes sense is the part features," said Rudy Stricker, marketing manager for Ceratizit (Reutte) Austria GmbH, which makes multifunction tools. However, multifunction tools are available to machine various combinations of features and may

range from simple to complex, from an indexable tool with pockets for holding two different single-purpose inserts to a solid tool capable of two or more metal-cutting operations.

Tool Bodies

Multifunction tools are often specials. For example, Tool Fabrication Corp., Milwaukee, designed and manufactured a tool to finish bore and chamfer three concentric holes in one pass. The tool body has six pockets: three for boring inserts and three for chamfering inserts. Each boring insert works with a particular chamfering insert, so the tool consists of three pairs of inserts.

Multifunction tools may also be modified standards and need only certain specifications to complete the design, such as Sandvik Coromant Co.'s Corodrill 880, which was introduced in October as a multifunction tool. Besides drilling, the 880 can be made to chamfer and/or counterbore.

The tool is part of the Fair Lawn, N.J.-based toolmaker's Tailor Made program. The toolmaker changes the basic tool body design to suit an end user's hole configuration, which includes the hole's diameter and length, the counterbore's diameter and length and the chamfer's size. "They are made to specific hole requirements," said Curtis Cole, a Sandvik Coromant drilling product specialist.

More than a shoulder mill

WHEN IS A MILLING TOOL not just a milling tool? When it can also perform ramping and helical interpolation. That's the case for the V590 series of 90° square shoulder endmills and facemills from Valenite LLC, Madison Heights, Mich., which provide ramping and helical interpolation in addition to shoulder and endmilling. Cutter diameters range from 0.375" to 6", and the tools accept 7mm, 10mm, 13mm and 16mm parallelogram-style inserts. Different insert grades allow the through-coolant tools to machine steel, stainless steel, cast irons, high-temperature alloys, aluminum and nonferrous materials.

"It's a versatile, general-purpose tool," said Jeff Eckhout, product specialist, milling and rotary tools for Valenite. "There is a small tooth on the end of the

insert that provides up to 13° ramping capability and makes it useful for helical interpolation. There are different ways of opening up a cavity, but one efficient way is to keep ramping back and forth across the workpiece and open up a cavity until you've reached your length, width and depth requirements. With this tool, you can follow that with helical interpolation to open up holes."

The number of inserts per tool depends on insert size. For example, each tool typically accepts two to four 16mm inserts and as many as five 10mm or 13mm inserts.

Machine shops are using the V590 in a variety of high-production manufacturing applications in addition to die and mold and general machining. Valenite recently introduced high-feed 10mm and 13mm

Valenite V590 square shoulder mill with 10mm inserts. The tool provides ramping and helical interpolation in addition to shoulder milling and endmilling.

inserts for the V590, which turn the tool into a high-feed milling cutter.

The V590 can be used in several different machine tools. For example, a 40-taper, 15-hp machine would typically run the tools with the 7mm, 10mm and 13 mm inserts, while a 50-taper, 50-hp machine would typically run tools with 16mm inserts to facilitate deeper DOCs and higher metal-removal rates.

The V590 also offers a range of corner radius options from 0.016" to 0.252" in several increments. —Alan Rooks



Valenite

"They're not off-the-shelf tools."

A more complicated multifunction tool body is KM63UT from Kennametal Inc., Latrobe, Pa. Developed for mill/turn centers, the body features four locations for KM25 quick-change tool heads, each with a pocket for an insert, and can be used with static and rotating tools. The heads allow machinists to replace a pocket for one type and size of insert with a pocket for another type and size.

The body and head arrangement can be useful if an insert's pocket wears out or is damaged. If the pocket were integral with the body, a parts manufacturer would have to discard the body or continue to use it but without some of its multifunctionality. "You don't have to buy the whole, big body all over again. You're just replacing low-cost, smaller, quick-change heads," said Curtis Rellick, global product manager for Kennametal's tooling systems division.

Complicated Inserts

Ceratizit's EcoCut is an example of a multifunction tool with a complicated insert rather than a complicated tool

body. The EcoCut insert can drill, bore, face and OD turn.

Ingersoll Cutting Tools, Rockford, Ill., also makes an insert that can drill, bore, face and OD turn. The T-Cap insert performs its four operations via two adjacent cutting edges. Their locations are evident when looking at a worn T-Cap insert. "You're going to have quite a bit of wear across the front edge of the insert from the drilling and boring and external turning, and then you're going to have some wear on the adjacent side of your insert from your face turning," said Ed Woksa, Ingersoll's marketing manager for holemaking products and the Taegu line, which includes the T-Cap.

Woksa contrasted this wear to that of a single-purpose insert. "It's probably going to have all of the wear in one location because that insert is typically doing one thing and doing it over and over and over," he said.

Woksa added that the T-Cap insert has a high helix cutting edge for freer machining compared with many single-purpose ISO inserts and is suited to Swiss-style machining of small parts or

shallow features on conventional CNC lathes.

Solid Tools

A third type of multifunction tool is a solid tool made to perform multiple operations, such as the Thriller tool, which can drill, thread and chamfer in one pass. Made by Emuge Corp., West Boylston, Mass., the micrograin-carbide tool has a TiCN coating. With a Mosys (modular system) toolholder, a Thriller can also spot face or counterbore because the toolholder accepts an interchangeable, bolt-on, solid-carbide facemilling head or a solid-carbide counterboring head.

According to Emuge, the Thriller is best suited for CNC machine tools that can perform helical interpolation, have a minimum spindle speed of 5,000 rpm and an internal coolant supply capable of least 221 psi.

At S&C Electric Co., Chicago, the Thriller replaced three tools: a spot drill, drill and tap that machined aluminum workpieces for the company's high-voltage electrical products, which are used in electrical substations and other

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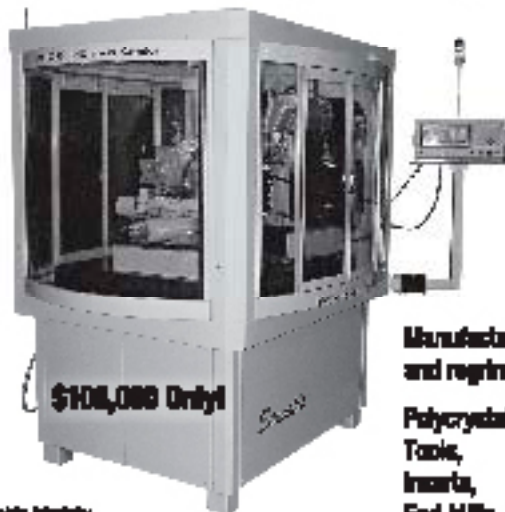
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S&C purchased the multifunction tool when it bought a new machine tool, making sure the machine had the options needed to apply the tool. S&C had been using a horizontal milling machine and single-purpose tools in conjunction with a 120-tool magazine to manufacture 14 part numbers. That machine tool had a maximum spindle speed of 5,000 rpm; the new one has a maximum spindle speed of 10,000 rpm. S&C usually runs its Thriller tools at 8,000 rpm. Also, the previous machine tool had a maximum coolant pressure of 100 psi, the new one has a maximum coolant pressure of 1,000 psi. S&C applies coolant at 500 psi for the Thriller tools. S&C also installed a finer filter in its coolant system to ensure that the tools' 0.3mm-dia. through-coolant holes wouldn't become clogged.

The multifunction tool was decisive in S&C's purchase of the new machine tool. "We justified the cost with these tools," said Terry Noonan, S&C's CNC senior supervisor. Once in production, the new milling machine and tools performed better than expected, reducing

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cycle time by 65 percent instead of the company's estimated 35 percent, according to Steve Chadwell, an S&C associate engineer.

S&C will use the spare machine time and four pallets to manufacture parts that it currently outsources. "We're just now getting ready to build fixtures for

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four other pallets,” Chadwell said. He added that insourcing will allow S&C to more effectively control its inventory. “When we order from the outside, we have to give them large orders to get a good price.”

Another solid multifunction tool is Magafor’s Multi-V. The tool can perform eight functions: centering-spotting, V-grooving, engraving, side milling, drilling, circular interpolation, chamfering and longitudinal chamfering. It can be used on lathes, Swiss-style machines and vertical machining centers.

Part of the tool’s multifunctionality results from web thinning, a grinding operation that maximizes a drill’s sharpness. Via web thinning, the Multi-V’s drill point can have a width as small as 10 percent of the drill diameter. That width prevents the drill from walking, said Robert Savage, Magafor’s president, adding that “the web thinning is important when engraving because you allow the point to be able to penetrate below the surface.”

Iscar Metals Inc., Arlington, Texas, makes a TiAlN-coated, micrograin-carbide tool that’s capable of nine oper-



Iscar Metals

A third type of multifunction tool is a solid tool. This Picco MFT tool from Iscar Metals can drill, bore, turn, face turn, internal profile, internal and external chamfer, and make internal and external 60° threads.

ations: drilling, boring, turning, face turning, internal profiling, internal and external chamfering, and internal and ex-

ternal 60° threading. This tool, the Picco MFT, is suited for Swiss-style lathes because of its ability to drill diameters as small as 0.157”.

Richard Sullivan, Iscar’s national manager for machine tool builders, described the tool as “a very complex design,” but added that “once you understand the tool, the use is very simple.”

Tool Life

Parts manufacturers can expect to change their multifunction tools more frequently than the corresponding single-purpose tools because contact time will be longer than that of any one corresponding single-purpose tool. For example, an EcoCut tool may need to drill and bore a hole and then face turn the workpiece. “This could—let’s say—take, overall, 30 to 35 seconds,” Stricker said. “With four different tools, the contact time for every single tool is only—let’s say—5 or 10 seconds.”

A parts manufacturer will therefore have to balance the time spent on more frequent tool changes against the time saved via reduced cycle time and greater availability of tool positions. Also, an

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end user may be able to reduce the frequency of tool changes by having a spare multifunction tool available in a turret or tool storage magazine for use after the first one reaches the end of its life.

Magafor's Savage echoed Stricker's comment. The Multi-V performs its different functions via different dynamics or positions, not different cutting edges. "If you're V-grooving, you're moving in a longitudinal direction, whereas if you're drilling, you're moving in a vertical direction," Savage said. "Even though it's cutting on the same surface, it's a different dynamic."

Because the Multi-V is using the same cutting edge for multiple functions, that edge will have more contact time than a corresponding single-purpose tool. "With this in mind," Savage said, "tool life is not usually sacrificed."

Ingersoll's Woksa added that another measure of an insert's life is the number of cubic inches of workpiece material removed. By this measure, a multifunction tool may be more efficient at removing material because more of the insert's surface area is used.

Tool Costs

Besides reducing cycle time, a parts manufacturer can save money because a multifunction tool can cost less than the total cost of corresponding single-purpose tools. Woksa estimated that a 20mm-dia., solid-carbide drill costs about \$250; a 3/4"-dia. boring bar is \$150, plus 10 inserts are \$108; and a holder for OD turning costs \$85, plus 10 inserts cost \$100, for a total of \$693. A 20mm-dia. T-Cap kit, which includes one tool body and 10 inserts, costs \$330.

Multifunction tools can also save money by reducing cycle time. Iscar's Sullivan noted: "When you bring prices down on a cutting tool by 10 percent, what's your end effect on the bottom line? It's actually negligible. But when you bring down cycle time on a Swiss machine by 10 percent, now you're putting money in your pocket."

Also, reducing cycle time means freeing up machine time for additional parts or jobs. The freed-up machine time can reduce what Sullivan calls "opportunity cost." He asked, "If your machine's tied up doing a series of parts and you don't have any more machine time and can't take on another job, what's that cost?"

A parts manufacturer will have to spend some time, though, to learn whether one or more of its jobs would benefit from using multifunction tools. "You just need the right situation for these to make sense," Sullivan said, "and I think they do in many different situations." CTE

About the Author: Joseph L. Hazelton is a contributing editor for Cutting Tool Engineering. He has 7 years of experience as a reporter and editor of metalworking publications.

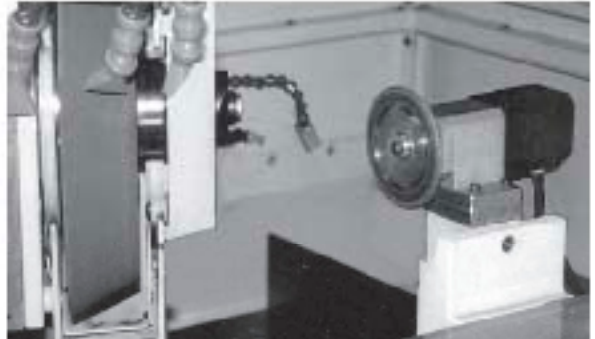
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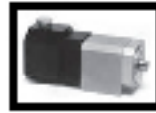
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