

Leading the Pack

Automation, accuracy and software are at the forefront of tool and cutter grinder developments.

When asked about the market for CNC tool and cutter grinders, one OEM said, “The trend is: Don’t buy anything!”

Despite the current slump, though, toolmakers and regrind shops still grind tools. And machine builders constantly introduce products to help them work more efficiently and cost-effectively.

In pursuit of greater machine utilization and lower labor costs, automation is getting heavy emphasis. So is the development of software that enables grinding machines to perform a wider variety of operations and economically handle smaller lots and short-lead-time production schedules. Plus, more powerful machines provide the versatility needed to grind a wider range of tools.

To learn first-hand about emerging tool and cutter grinder trends, we asked machine builders to discuss some of their recent product developments.

Auto Motivated

Manufacturers of new tools have long taken advantage of “lights-out” grinding. Regrind shops can’t, though, because there’s no tool-to-tool consistency as there is with new-tool production. Regrinders *can* reap some benefits of automation, though.

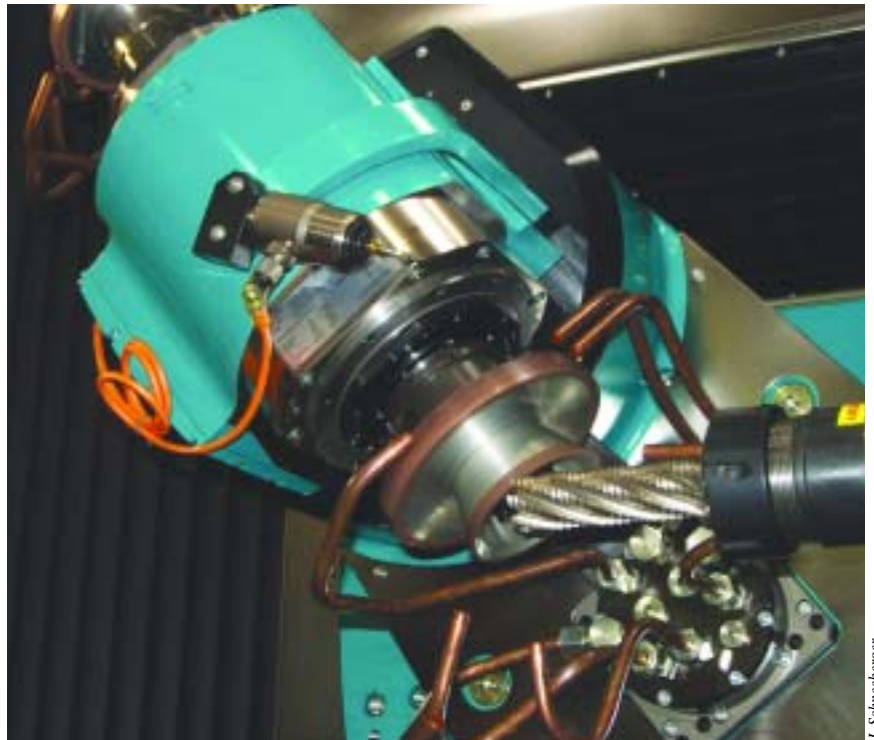
David Brigham, vice president of Schütte Corp., Jackson, Mich., said regrinders don’t necessarily desire unat-

tended grinding. Instead, they want to contain costs by enabling one operator to run multiple machines.

Schütte’s WU305 universal tool and production grinder incorporates features that allow that. Its software and loading system permit automatic regrinding, in one setup, of different styles of tools and different shank sizes. These include cylindrical and conical endmills, cor-

ner-radius and ballnose styles; step drills; and other stepped tools with different ODs, shapes and geometries.

Using SIGS (Schütte Integrated Grinding Software), the operator first enters the number, sizes and styles of tools to be reground. Next, he picks the operations to be performed, then initiates the automatic regrinding of a pallet of tools. The automated workpiece-handling sys-



J. Schmeberger

Big, heavy-duty machines let toolmakers handle a wide range of grinding tasks.

tem features an integrated pick-up loader that requires no additional floor space.

Pneumatically controlled drives, directed by the machine's CNC, govern loader movement. Wide variations of workpiece sizes are handled by interchangeable gripper fingers and bushings sized to hold different-diameter tools.

Precise Control

Cycle time reduction is the top priority for many manufacturers. But for others, such as makers of high-precision cutting tools and medical components, part quality is paramount.

Rollomatic Inc.'s applications and service engineer, Brian McKahan, said improvements in grinder technology enable recently developed machines to hold extremely tight tolerances and impart excellent finishes. Among them is the company's 6-axis GrindSmart

620XS grinder for manufacturing medium- to micro-size (0.625"- to 0.004"-dia.) rotary tools. Rollomatic, Mundelein, Ill., reports that the 620XS can hold 1- to 2- μ m concentricity on the OD of a 1mm-dia. ball-nose endmill.

Greater machine rigidity and advanced software contribute to the accuracy, McKahan said, as does precise control of machine motion. The machine's X, Y and Z axes have linear glass scales, while a rotary glass scale is fitted to the A-axis grinding head. The glass scales boast a resolution of 100 nanometers (1 nanometer is 1-billionth of a meter), eliminating the effects of temperature changes on ballscrews, linear guide rails and other transmission elements. Direct-drive AC motors coupled directly to the



The 620SX is for smaller, high-precision tools.

ballscrews enhance dynamic behavior, and the rotary axes have a backlash-free drive system.

A hydraulic, movable and programmable steady rest features a fine-adjustment capability that minimizes deflection and boosts quality. The machine's centering and workholding capabilities enable it to grind extended-length tools with length-to-diameter ratios as high as 100:1.

Prepping blanks best done on dedicated equipment

Today's software lets a CNC flute grinder perform nearly any operation on a tool, including cylindrical plunge grinding to prepare blanks for fluting.

But Rollomatic's applications engineer, Brian McKahan, said a flute grinder isn't really designed for plunging. "When grinding adverse forms, such as concave radiuses, it's difficult to keep tight tolerances and good roundness on a flute grinder. The work head is not designed for it. And, you can't run at a high enough rpm to get the best finish."

Specialized blank-preparation grinders are the answer. He said Rollomatic's RPG plunge grinder is designed for preparing blanks for precision cutting tools and punches. It performs both roughing and finishing. And its automatic loader allows unattended, economical operation.

Dan Lenk, director of sales for New Unison Corp., Ferndale, Mich., agreed that processing blanks on a tool and cutter grinder adds time. But, he added, it can minimize workpiece handling. "Put in a blank and out comes a complete tool," he said.

New Unison offers CNC tool and cutter grinders that can prepare blanks and pro-

duce a finished tool, and builds DedTru blank-preparation machines.

Toby Roll, sales manager at Tru Tech Systems, Mt. Clemens, Mich., said using a tool and cutter grinder to prepare blanks "is like hauling 3,000 lbs. of dirt with a Cadillac. Maybe you can do it, but you'd be a lot better off to do it with a nice dump truck."

Tru Tech's blank-preparation grinder, he said, "is not as big or fancy as a lot of the really advanced cutter grinders, but it is the most accurate machine available for prepping blanks. We guarantee our standard unit to rotate a tool within 0.000030" roundness."

Shops that employ both kinds of machines, he said, can improve productivity. The same operator who runs the cutter grinder can run the blank-preparation machine simultaneously. "Our machine is under \$100,000, while CNC cutter grinders may be \$300,000 to \$400,000." The result is, he continued, "You've got an expensive machine doing what it's made to do, and you've got our machine spinning down blanks much faster than the cutter grinder could ever do it."

—B. Kennedy

Flex Time

According to Tim Hallman, COO of Saacke LLC, Ladson, S.C., shops want to automate as many of their grinding processes as possible. "Flexibility is the name of the game, whether the production run is long or short."

Much of his recent work has involved specifying systems for automatic loading and unloading of tools and wheels that allow unmanned or minimally attended grinding.

Saacke's recently introduced UW ID CNC grinding center is designed around key elements of automation. Standard features include a four-position grinding-wheel changer. As a wheel package changes out, so, simultaneously and automatically, do the coolant nozzles.

Saacke credits the UW ID's high level of automation to its integrated, automatic tool-changing system. The grinder's pick-up loader accommodates 30 to 168 blanks, depending on size.

Other options include the ability to change collets with the tools, as well as add a palleting system. It expands capacity to 1,000-plus tools per setup.

Hallman said Numroto software, from NUM Corp., oversees all the au-



The UW ID grinder swaps out wheels and nozzles automatically.

tomation systems, and includes a “virtual machining” feature that permits off-machine programming and dramatically reduces setup times.

Custom Fit

All the major grinder manufacturers produce good machines, according to ANCA Inc. Vice President Russell Riddiford. What distinguishes top-level machines from the rest of the pack, though, is the machine software’s power and versatility—two increasingly important attributes.

One reason for the growing importance of software is the dwindling number of skilled operators who can manually grind complex tools. Secondly, it is difficult to manually grind tools that can be operated at the speeds possible with today’s machine tools while meeting these machines’ accuracy requirements.

Manual grinding compromises edge quality and consistency, compared to CNC grinding, said Riddiford. The reason why has to do with a fundamental difference between the processes. Manual grinding involves supporting the tool on a finger and grinding into the edge, an action that generates a burr. With a CNC grinder, conversely, no supporting finger is needed, and the grinding motion is away from the edge, leaving it burr-free.

To provide sufficient precision and accommodate both sophisticated and entry-level operators, ANCA, Farmington Hills, Mich., recently introduced the iGrind application software. The Win-

dows-based system can be customized to match the skills and demands of users. It enables them to access predefined databases of tool geometries or create their own.

The software instantly verifies any parameter change on a 3-D model. Simple, drag-and-drop editing commands permit changes in the order operations are performed. To avoid confusion, the system keeps color-coded records of any parameter changes. Customized cycles can be named, stored and altered.

Here’s the Beef

Rolf Herrmann, general manager of J. Schneeberger Corp., Elgin, Ill., said tool grinders are looking for versatility and the ability to produce as many different types of tools as possible.

“Eighty percent of customers want to handle a wide range of tools,” he said. Doing that requires heavier, more rigid machines with more horsepower. “They want more beef. They say, ‘I don’t want to fall short if an order for a big tool comes in.’”

The trend extends from the largest machines down to the smallest units, Herrmann said. Schneeberger’s Norma CFG machine is designed for the tool-room. Despite a relatively small footprint (64”x78”), it weighs in at 12,000 lbs. and features a 10-hp (continuous) HSK-50 spindle and accommodates up to six grinding wheels. The machine, which handles round tools up to ¾” in diameter, also can be configured for

The following companies contributed to this report:

Agathon Machine Tools Inc.
(914) 347-6750
www.agathonusa.com

ANCA Inc.
(248) 477-5588
www.anca.com

New Unison Corp.
(248) 544-9500
www.unisoncorp.com

Northern Tool Sales & Service Co.
(586) 756-1990
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Rollomatic Inc.
(866) 713-6398
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Saacke LLC
(843) 329-8876
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J. Schneeberger Corp.
(847) 888-3498
www.schneeberger-us.com

Schütte Corp.
(517) 782-2938
www.schuttetgm.com

Tru Tech Systems Inc.
(877) TRU-TECH
www.trutechsys.com

Walter Grinders Inc.
(540) 898-3700
www.walter-ag.com

form grinding and insert production.

At the other end of the size spectrum are Schneeberger’s largest machines, those in the Corvus line. The heaviest models weigh more than 20 tons and feature direct-drive spindles with 13-, 20- or 34-hp motors. An optional X-axis travel of 118” permits grinding of oversized parts. Users also can add a 6th axis, permitting them to entirely grind broaches in one chucking.

Sharp Idea

A major cost center when grinding is the time lost dressing wheels. An in-



Agathon's EcoDress process electrochemically dresses wheels, reportedly reducing cycle time by up to two-thirds.

process sharpening method designed to reduce these costs is available from Agathon Machine Tools Inc., Hawthorne, N.Y.

The company's sales manager for machinery, Roland Merk, said the company developed its electrochemical method, called EcoDress, primarily for grinding hard materials. Carbide is one such material.

With the EcoDress process, electric power is sent through a metal-bond wheel. The action triggers an electrochemical reaction with the grinding coolant, which dissolves the bond. This continually exposes new grits.

Conventional dressing with silicon-carbide wheels achieves grain protrusion of 15 to 25 percent of grain diameter. In-process electro-erosion, or electrolytic, dressing achieves 45 to 60 percent exposure. Agathon reports that the EcoDress process exposes nearly 100 percent of the grain. This creates large voids between the grains that enhance coolant penetration. The result is cooler-running wheels and higher material-removal rates.

Agathon says the EcoDress process can reduce cycle time by 66 percent and boost wheel life 30 percent. The process also enables hard tool materials—carbide through polycrystalline diamond—to be ground with the same wheel.

Application of the EcoDress process currently is limited to Agathon's 350 COMBI CNC periphery grinding machines for indexable inserts. Merk said, though, that the company is considering licensing the technology for other grinding applications.

Adaptive Behavior

Optimizing grinding parameters when producing a complex tool shape usually involves compromises. For example, heavy material removal may dictate feed rates that are slower and less productive than those for lighter cuts or when the wheel is "grinding air," as it enters or exits the workpiece.

To maximize machine utilization and wheel life, Walter Grinders Inc., Fredericksburg, Va., offers an adaptive-control feature on its Helitronic Power CNC tool and cutter grinder. The system reads the load on the grinding wheel and adjusts the feed rate to maintain maximum load throughout the grinding process. Because the wheel experiences a constant load and doesn't exceed its maximum, wheels last longer and unmanned operation can be extended. Use of the system also minimizes transition marks on tools, because it gradually changes feed rates as the grinding operation progresses from one feature to the next.

Walter says its adaptive control reduced the time needed to manufacture a 1"-dia. endmill from 11 minutes to 9.

Walter also offers a machine that adapts to the tool material being ground. Its Helitronic Power + Diamond machine grinds carbide and HSS tools and, employing electrical discharge grinding, processes PCD tools. Users can quickly switch the double-spindle grinder from carbide and HSS tools to EDGing diamond tools. Or, they can perform both operations in the same setup. This permits eroding the primary clearance on a tool's PCD surface, then grinding required clearances in its carbide body. The machine's adaptability, Walter says, gives users a way to enter the PCD tool market without purchasing a dedicated machine.

Invest in Technology

There's no "best" tool and cutter grinder for every job or operator.

"If you've been around tool and cutter grinders long enough, you know that every builder has its idiosyncrasies," said the vice president of Warren, Mich.-based Northern Tool Sales & Service Co., Paul Schulte. "One does endmills better, and another is better for other tools."

He added that the needs of users change. He recalled when he bought his shop, in 1986: The former owner was "doing everything manually. And if you look back at the late '80s early '90s, there was a huge revolution in the machine tool control. We've been right in the middle of that wave. We went from drawing things on drafting boards to AutoCAD, in-house networks and bar coding off the shop floor."

Schulte said shops should examine their processes before they introduce new technology. But, he feels it's critical to keep upgrading one's technology. "I tell my guys, this is something that you have to evolve with. You have to stand back and figure out where should you put your money.

"We've spent a lot of capital for a little company. You have to make a decision. If you're in the business, *be* in the business," said Schulte.