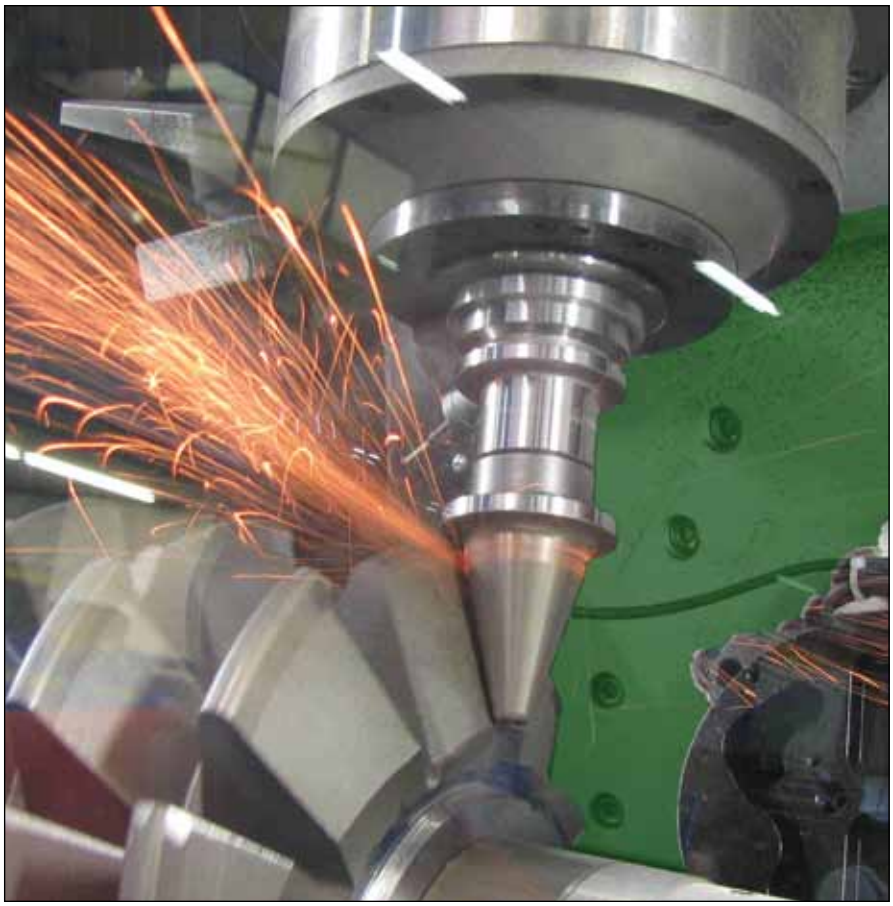
Profiling Grinding Technology

CORVUS CPP 1100 BOASTS SHORTER SET-UP TIME, MORE MACHINE INTEGRATION



The Corvus CPP 1100 was created to meet the demand for large or coarse pitch hob manufacturing (courtesy of Schneeberger).

In the mid 1980s, Schneeberger played a leading role in the development and construction of the first CNC-controlled profile grinders. Today, the company remains on the forefront of grinding technology with its latest entry, the Corvus CPP 1100 mm profile grinding machine. Created to meet the demand for large or coarse-pitch hob manufacturing, the Corvus CPP 1100 is designed to accept up to 20" diameter coarse-pitch hobs with maximum cutting depth. Form grinding is achieved by profile dressing the wheel to the correct configuration and grinding the axial and radial relief with the profiled wheel. This process is better known as pencil grinding, where the grinding wheel has the form of a large pencil to allow the cutting edge to be relieved with the slanted spindle head. The powerful direct drive grinding spindle offers 30 hp (45 hp at 150 percent duty cycle) to meet the requirement of the large contact area the formed grinding wheel has to grind. "In the past, the customers have used old CAM-driven machines and were grinding dry," says Rolf Herrmann, general manager at Schneeberger. "The new CNC machine has a much shorter set-up time, grinds more efficiently using coolant and, with the wheel changer, offers all operations necessary to grind the tool in one set-up including roughing, pre-grinding and finish grinding. Also, dressing the finishing wheel to the required form is part of the integrated manufacturing process."

Onboard dressing, tool support, hydraulic tailstock, probing and more useful application solutions can be offered or are standard with the machine. To utilize full production capability and have the ability to rough grind and finish grind as well as maintain a useful wheel diameter, the machine is equipped with an automatic eight-station wheel loading system. The new wheel is loaded—including the correct coolant nozzle manifold—for best grinding and coolant conditions. For rough stock removal, the CBN-plated grinding wheels can be employed while finishing is done with vitrified wheels. The Schneeberger software *Quinto5* rounds out the latest in hob manufacturing capability. "The software offers a very graphical programming environment geared to the hob grinding application for the Corvus C500 face grinder, Gemini GHP hob profiler or the Gemini DMR hob sharpener," Herrmann says. "All machines use Fanuc 310 control technology with linear motor drive systems for the axis drives."

Schneeberger offers a range of machines for the cutting tool industry including the Corvus C500 face grinder for coarse-pitch hobs up to 70 hp, max wheel and tool size up to 20" including integrated dressing, O.D. grinding spindle, gap eliminator for dressing and fully-automated balancing of the wheel. The Gemini GHP is specifically designed for profiling

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smaller hobs as well as spiral hobs with extreme helix. Other applications Schneeberger machines are known for include bevel gear cutters, stick blade grinding, sharpening or manufacturing with a large geometry database. Schneeberger offers other small and large machines for spline grinding, manufacturing of any cutting tools as well as tool room machines for re-sharpening. In the near future, the company will be offering CNC capability for bevel gear tooling. Also, stick blades of all forms can be ground and offered to the market.

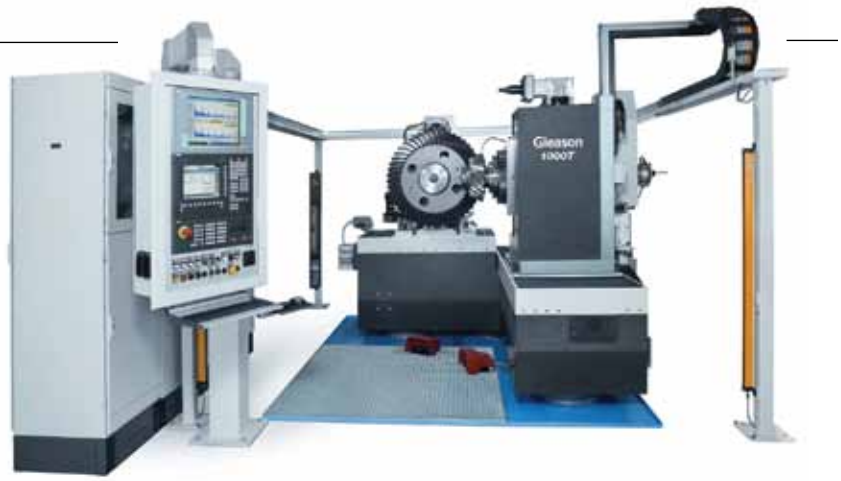
Schneeberger's catalog includes CNC grinders Corvus, Gemini, Sirius, Norma and the new Aries5 with capacities of up to 26 kW. The Schneeberger concept conforms to a movable or fixed column construction, depending on the machine design and application—the grinding heads with double spindle are rotatable up to 370 degrees. All CNC machines can be equipped with options for measuring and inspection or with loading robots. The Aries line is an alternative to the five-axis technique for regrinding. A simple control takes care of the helical interpolation whilst manual settings are assisted by an ergonomic mechanical design. Large end Machines come with strokes of up to 3,000 mm for round, spiral and flat broaches, cutter heads, splined shafts. The company also offers CNC machines for the production of exacting ground parts outside the tool domain.

"One special feature Schneeberger offers is in-process quality control with automatic compensation inside the machine, a feature using a camera set-up checking profile accuracy and adjusting dressing cycles to compensate for thermal shifts or wheel wear," Herrmann says. Thanks to this new machine technology, Schneeberger has dramatically improved set-up times, accuracies and surface finish for their customers as well as the manufacturing time for a hob. "We have gotten excellent response on the machine's design, rigidity, capability and ease of operation."

For more information:
J. Schneeberger Corp.
Contact: Rolf Herrmann
1380 Gateway Dr. #8
Elgin, IL 60124
Phone: (847) 888-3498
Fax: (847) 888-3665
www.schneeeberger-us.com

Gleason

INTRODUCES ROLL TESTING AND SINGLE-FLANK TESTING OF BEVEL GEARS



Now roll testing and single-flank testing of bevel, angular bevel and parallel-axis gears with diameters up to 2,500 mm can be completed much faster with the introduction of the Gleason 1000T, 1600T, 2000T and 2500T Universal Gear Testers. The new series of Gleason six-axis fully CNC Universal Gear Testers can perform the full range of pattern checking and single-flank (SFT) motion transmission error testing on any bevel gear set with the widest possible range of angles. Unlike competitive products, the Gleason Universal Testers are equipped with a CNC-controlled

pivoting gearhead that can swing from 0 to 180 degrees, thus enabling it to precisely mesh pinion and ring gears of varying angles and types, and even cylindrical gears—both parallel axis and off-angle.

In addition, the new design also makes day-to-day operations such as setup, manual or full automatic operation and "jogging" much simpler and more intuitive—despite the added complexity of testing an angular gear set. The Gleason testers enable the operator to relate to the machine through virtual gear set axes that are easier to understand and work with, rather than typical machine axes that can be difficult to translate into angular motions. Siemens 840D or Fanuc 31i CNC controller and intuitive Windows-based Gleason inspection software not only support this unique virtual capability, but also make more routine functions like manual roll checks, cycle set-up and V & H testing that much easier for the operator.

The Gleason Universal Testers also are designed and built for rugged, dependable operation and the day-to-day rigors of the production floor. They feature, for example, a particularly rigid and thermally stable granite machine base frame, and an advanced light curtain to protect the integrity of the work zone. They also combine an extremely compact size with a particularly large and accessible test area. Load/unload is manual, so the open test area and long axis travels make it easier for the operator to quickly load and unload gears of any size and geometry.

First of the new series, a 1000T, is already in production at Sauter Bachman, a Netstal, Switzerland based leader in the production of high quality gears and gearboxes for aircraft, automotive, railway and textile industry applications. The 1000T, 1600T, 2000T and 2500T (for workpiece diameters ranging from 1,000 mm, 1,600 mm, 2,000 mm and 2,500 mm respectively) help complete the Gleason family of highly popular testers that also includes the 360T, a similar universal tester for gears up to 420 mm in diameter, and the 600HTT Turbo Tester, for bevel gears up to 600 mm in diameter.

For more information:
Gleason Corporation
1000 University Avenue
Rochester, NY 14692-2970
Phone: (585) 473-1000
Fax: (585) 461-4348
www.gleason.com

MAG

INTRODUCES VTC WITH GEAR CUTTING CAPABILITY

The first technology advancement for large vertical turning centers (VTCs) resulting from MAG's recent acquisition of Modul, a gear manufacturing equipment specialist in Germany, introduces integrated gear cutting capability on a VTC 2500H for workpieces up to 2,700 mm diameter.

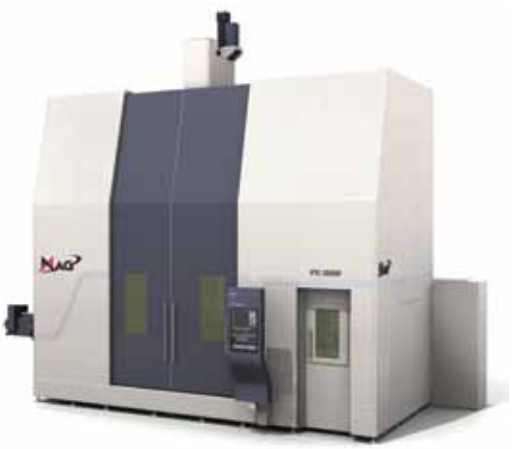
The new multi-axis machine combines gear hobbing and milling capabilities with the VTC's wide range of turning, milling, drilling, threading and contouring capabilities. It can turn blanks and subsequently cut gear teeth, all in one setup. The machine's ability to execute rough turning of the outside diameter and gear cutting on the inside diameter in one setup results in higher quality gears. It also eliminates a separate gear cutting machine and reduces labor, part transfers, setups, work-in-process and plant footprint/overhead.

Gear production capabilities include hobbing, form milling (of external and internal gears), turn-milling of gear teeth with carbide end mills, and chamfering/deburring. This system is suitable for the part making requirements of the wind and power generation industries, mining equipment, marine and other heavy machinery. The hobbing module is fully integrated into the VTC to allow turning, milling and hobbing or form milling of internal and external geared slewing rings. Two different heads are available with 36 or 46 kW power. They can hob modules up to 24.0 mm or form-mill teeth up to module 28.0 mm on parts with a maximum face width of 600 mm.

The functionality of the gear manufacturing software is fully integrated into the turning center's control with one common HMI, so programming gear cutting operations is simple and intuitive. Features include workshop-oriented dialog for input of all geometric and technical parameters for the workpiece and hob.

In addition to gear cutting, MAG's VTCs can perform standard and hard turning, as well as live-spindle machining, contouring and part probing operations on multiple sides and the full diameter of a part. Customer-driven features include use of standard modular tooling, such as KM 80 and Coromant Capto solutions, as well as automatic tool changers; green design with minimal hydraulics; minimal or flat-floor foundation requirements for many models; and innovative chip management and removal that minimizes operator intervention. A full machine enclosure meets CE specifications and ensures a dry floor environment.

MAG offers horizontal turning centers, inverted-spindle VTCs and vertical twin-table turning centers equipped for integrated gear processing, along with a full range of gear cutting tools, including solid hobs and milling cutters, heavy-duty hobs, inserted-blade hobs and milling cutters, as well as carbide end mills. In addition, MAG produces a line of dedicated gear production machines and related technology at its facility in Chemnitz, Germany.

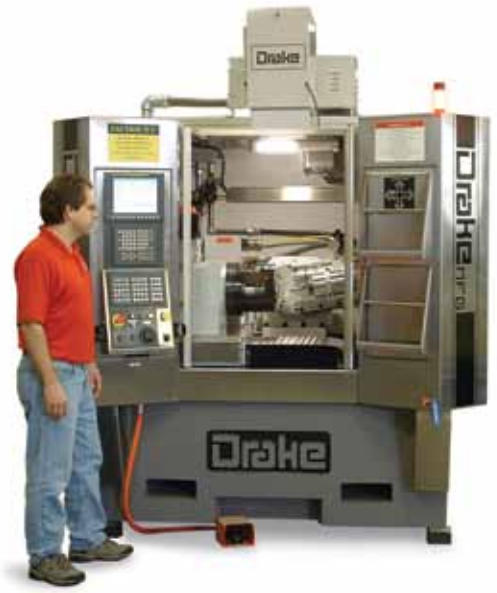


For more information:
MAG IAS, LLC.
3940 Olympic Blvd. Ste 500
Erlanger, KY 41018
Phone: (859) 534-4600
www.mag-ias.com

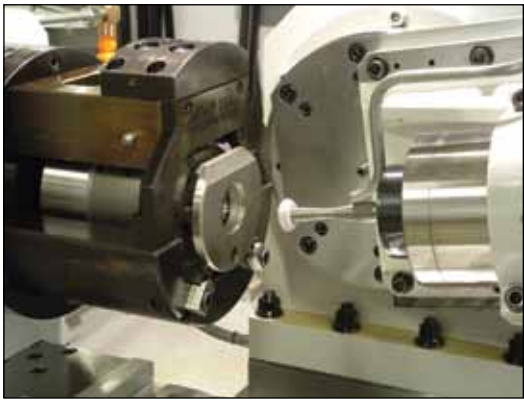
Drake Manufacturing

ENJOYS EXPORT SURGE WITH THREAD GRINDER

Drake Manufacturing Services Co. is enjoying a surge in exports to Chinese manufacturers, with orders



in hand for more than 25 machines. This latest machine is a GS:TI-LM 200, a four-axis internal thread grinder with a 200 mm maximum grinding length and 350 mm swing over the table. It was tooled and programmed to grind recirculating ball nuts used in the power steering systems of heavy-duty commercial trucks. It is the second machine delivered to this customer, and more than doubles their production capacity. The steering nut weighs over nine kg and is manually loaded into a custom workholding fixture. Robot loading is also available. Cycle time for the internal thread grinding process is approximately two-minutes. The GS:TI-LM 200 is equipped with linear motors for maintenance-free operation. No ball screws and 0.05



micron scales mean accurate leads and helical path. A CNC rotary diamond dressing unit mounted on the workhead can generate wheel forms either by contouring or plunge dressing with a form roll. The wheel spindle is equipped with a power helix that can grind lead angles of +/– 12 degrees. The machine also has a safe shutdown feature that prevents crashes in the event of a plant power loss. Each Drake machine is delivered with *Part Smart* programs. The operator needs only to input part specific variables into the control to run parts. No customer programming is required and the customer can change from one part to another in minutes.

For more information:
Drake Manufacturing
4371 North Leavitt Road
Warren, OH 44485
Phone: (330) 847-7291
www.drakemfg.com

Contour Automatic Series

ENABLES HIGH-SPEED, IN-LINE INSPECTION

The new opticline CA614 noncontact shaft measuring system is designed for fast, easy, economical and robust submicron measurement of all contour features on complex shaft-type parts up to 600 mm in length, 140 mm diameter. The stroke is driven by a motorized tailstock, freely positionable over the full holding range, permitting easy, fast, and precise workpiece loading and holding. The value of the Contour Automatic series has been proven in automotive and aerospace applications, including carrier shafts in aircraft engines, drive parts in helicopters, and various rotor parts. In these instances, the system inspects length, geometry (angles, radii, etc.), form (roundness, run-out) and diameter in rapid cycles. Ease of operation and programming, plus the system's unique flexibility to measure any num-

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ber of different part variations with little or no changeover, delivers maximum return on investment to manufacturers.

Depending on the measurements required, standard measuring functions can be quickly combined into one optimized measuring run. Examples of combined dynamic functions include: size, roundness, run-out, minimum size, maximum size, etc. and can be computed based on a single contour record. The measurement system monitors itself for negative ambient influences, providing automatic active temperature compensation before every measuring run. Contour Automatic hardware and software are optimized for use in production environments to provide maximum reliability over long periods of time. The optical sensor operates in an environment that protects it from part wear and collision, while delivering short cycle times, accuracies into sub-microns, and computed measurement results within a few seconds. Once a new part is loaded into the system, a simple scan is performed that within seconds commits the part to memory. User-friendly software then allows the user to intuitively create new measuring programs within minutes based on the preliminary scan.

The creation of part measuring programs, data display, and further processing of the measurement results takes place through an easy to understand graphical user interface (GUI). The user interface also provides the capability to customize inspection reports for satisfying plant and customer demands. In operation, the part is loaded into position then automatically scanned optoelectronically utilizing the silhouette principle. The workpiece contour can be evaluated quickly

and precisely utilizing the high resolution associated with each measured datum (statically or dynamically). A flexible, pneumatic driving fixture provides defined workpiece driving and easy workpiece handling.

For more information:
Hommel-Etamic America Corp.
1505 West Hamlin Road
Rochester Hills, MI 48309
Phone: (248) 853-5888
Fax: (248) 853-1505
www.jenoptik.com

Techniks Boring Tools

Maximize Productivity

Pinzbohr High Precision Modular Boring Tools from Techniks offer accuracy, rigidity and repeatability. All Pinzbohr boring tools are built with the quality, reliability and ease-of-use features machinists need to maximize productivity. Innovative features include the AccuSET dial for easy insert adjustments in increments of .0001". The SpeedSET feature enables synchronized setting of roughing heads without having to adjust individual slides, or having slides slip out of position during adjustment. The SafetySET feature prevents the operator from accidentally damaging the lock screw by over-tightening. The offset-center tapered lock screw coupling system provides maximum tightening force between the tool and the toolholder, while still allowing heads to be changed in spindle. Minimum boring size is .315". Maximum boring size is 19.685". Also available are the popular BohrSTAR kits, sized in ranges from .2362" up to 8.2677".

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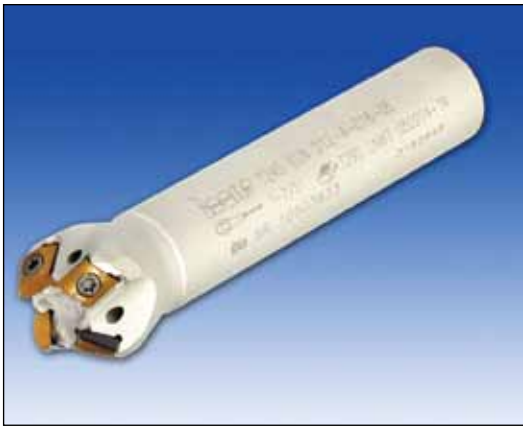
For more information:
Techniks Inc.
9930 East 56th Street
Indianapolis, IN 46236
Phone: (800) 597-3921
www.techniksusa.com

End Mills

IMPROVE CHAMFERING PERFORMANCE



A new family of Iscar end mills extend the benefits of tangential Sumomill inserts to chamfering, countersinking and face milling. Featuring the proprietary Sumo Tec coating treatment, Iscar's Sumomill creates a fundamentally stronger cutting platform, which leads to longer edge life and elimination of fracture failures at higher cutting rates, even in unfavorable conditions. Sumomill tangential end mills, all four-flute in 12 mm diameters, come in 30, 45 and 60 degree geometries. In face milling applications they can run at very high table feeds due to their small diameter and high flute density. The proprietary Sumo Tec surface treatment produces a much smoother, more lubricious surface on the insert, with fewer thermal stresses and stress factors than would be found in an untreated plain PVD or CVD coating. This leads to cooler cutting (heat is a key enemy of machining inserts), less friction and much reduced risk of insert rupture. On average, SumoTec coated tools have proven to literally double throughput and reliably extend insert life by 40 percent versus identical but untreated inserts, according to the company.

For more information:
Iscar Metals Inc.
300 Westway Place
Arlington, TX76018
Phone: (817) 258-3200
www.iscar.com

BIG Kaiser

INTRODUCES TWIN CUTTER BORING SYSTEM

BIG Kaiser's 319 SW series is an exceptionally rigid, new style, twin cutter rough boring system. These corrosion-resistant boring heads offer a unique feature—by simply reversing the insert holders, users can switch between balanced and stepped cutting. The Kaiser 319 SW series will replace the older 314 RW series. By not introducing additional components or having to manually adjust insert height for different roughing methods, the 319 series reduces setup time and eliminates the need for a pre-setter due to fixed tool heights and a diameter scale on the tool. "These tools are fully compatible with our existing KAB and CKN modular systems and offer much larger variety, versatility and capability to our rough boring program." says Jack Burley, BIG Kaiser vice president of sales and engineering. "Although the current 314 series will be phased out, our customers will maintain the same roughing methods from one head using the 319 program, but now with greater ease of setup and higher performance."

The tools, with a diameter range .787"–8.000", utilize standard carbide inserts (CC, SC, and SP) and provide coolant-through direct to the cutting edge to improve chip evacuation and lengthen tool life.

For more information:
BIG Kaiser
641 Fargo Avenue
Elk Grove Village, IL 60007
Phone: (847) 228-7660
www.bigkaiser.com

NUM Gear Shaping Software

ACCELERATES WIND TURBINE GEAR PRODUCTION

Advanced gear shaping software and motion control hardware from NUM has been used to bring an old

manually-controlled gear shaper machine up to modern day control standards. The five-axis Stanko machine is now controlled by a NUM Axium Power CNC system, using electronic gearbox techniques to synchronize the rotary cutter, gear blank and stroking axes. It also incorporates an innovative programmable replacement for the stroking axis, which reduces product changeover time from hours to minutes—significantly improving productivity. The gear shaper was bought by DePe Gear Company, which specializes in the design, manufacture and refurbishment of gears and gearboxes for a diverse range of industrial and commercial applications, including the steel processing, rail, mining, quarrying and aeronautical industries. The company operates a considerable number of gear cutting, shaping and grinding machines at its Stoke-on-Trent manufacturing facility and is no stranger to NUM as three of its current gear cutting machines are equipped with NUM Axium CNC systems and *NUMgear* software.

In this particular case, DePe Gear Company purchased the Russian-built Stanko gear shaper initially for manufacturing large internal gears for the wind turbine industry, and subsequently commissioned machine tool engineering company Euro CNC to carry out the necessary refurbishment work. Euro CNC specializes in retrofitting, rebuilding and upgrading machines. This often involves equipping manual

machines with partial or full CNC systems, and the company consequently maintains a close working relationship with NUM, providing it with access to the latest CNC technology, control software, digital drives and motors. In recent years, Euro CNC has built up considerable knowledge of machine tools for gear production, and nowadays handles a wide variety of gear hobbing and shaping machines.

Euro CNC quickly ascertained that although the machine was fully mechanically serviceable, it would benefit from being equipped with new motors and drives, including high performance digital units for all axes, together with a CNC system for operational flexibility and a customized HMI to replace outmoded mechanical switchgear.

Traditionally, gear shaping machines employ a complex cam-driven 'nodding' axis arrangement to move the cutting tool up and down the gear blank as it is cut, the stroke of which needs to be synchronized to the rotation of the tool and the blank. This approach suffers from numerous disadvantages: it can involve up to three axes of movement, each subject to error, and is extremely difficult and time-consuming to set up, which does not sit well with the fast and flexible changeover requirements of modern manufacturing. Euro CNC consequently decided to develop an entirely new form of stroking axis, based on a fully programmable linear actuator. The end position, length and speed of the stroke can be freely changed under software control.

In addition to the stroking axis, the gear shaper has three rotary axes—to rotate the cutting tool and the gear blank—and to retract the cutting tool on the up stroke together with a linear positioner based on a motor and ball screw, which drives the gear blank to the cutting tool. All of these axes are controlled by NUMDrive C servo drives and NUM brushless motors.

Euro CNC chose to use a NUM Axium Power CNC system to control all five machine axes, networked to a

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NUM industrial PC and a large touch-sensitive screen. The software includes NUM's powerful *NUMgear* package, but in this instance it is used mainly to provide the electronic gearbox functions for synchronizing the cutting tool rotation, gear blank rotation and linear stroking axes. The HMI for the gear shaper machine is primarily created by a special version of NUM's PC *ProCam* software, which was jointly developed by Euro CNC and NUM's USA facility specifically for this type of application. The software combines a highly intuitive graphical user interface using common gear shaping terminology with a 'conversational' style of programming, enabling operators who are not familiar with CNC-based machines to become proficient very quickly. The refurbished Stanko gear shaper was recently installed at DePe Gear Company's Stoke-on-Trent facility and aside from a few minor initial issues has performed flawlessly.

Nigel Parker, Technical Director of DePe Gear Company, points out that, "We are using the gear shaper for a variety of internally cut gears, including spur gears for wind turbine generator gearboxes and a variety of splined gears. Although it is too early to provide quantified data, we are definitely seeing a reduction in setup and operating times. Like our other CNC machines, the most significant benefit comes from the sheer versatility of this all-digital approach, which enables us to switch freely from manufacturing one type of gear to another under software control. Machine operators no longer need to laboriously count the number of teeth being cut, but simply push the appropriate button on the menu, which helps maximize throughput."

According to Tim Clarke, Director of Euro CNC, "We have worked with NUM for about five years now, and have found their CNC products to be extremely reliable. We also benefit from excellent technical support from their U.K. facility, and have recently experienced a similar level of backing from NUM USA. So far, we have installed *PC ProCam* on some 25 machines—mostly gear hobbers rather than gear shapers—and have been delighted with the positive feedback from customers."

For more information:

DePe Gear Company Limited
Grove Road Industrial Estate
Unit 1
Fenton
Stoke-on-Trent
Staffordshire
United Kingdom ST4 4LG
Phone: +(44) 1782-594114
www.depe.co.uk

Euro CNC Limited
Station Road Industrial Estate
Bromyard
Herefordshire HR74HP
Phone: + (44) 01885-488514
www.eurocnc.co.uk

NUM Corporation
603 East Diehl Road Suite 115
Naperville, IL 60563
Phone: (630) 505-7722
www.num.com

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