In Search of a Competitive Advantage

Grinding/Abrasive Technology Continues to Impress in 2014

Matthew Jaster, Senior Editor

The grinding/abrasives market is rapidly changing, thanks to new technology, more flexibility and an attempt to lower customer costs. Productivity is at an all-time high in this market, and it's only going to improve with further R&D. By the time IMTS 2014 rolls around this September, the gear market will have lots of new toys and gadgets to offer potential customers. If you haven't upgraded any grinding/abrasives equipment in the last five years, now might be a good time to consider the investment.

Kapp Technologies

BILL MILLER DISCUSSES LATEST GRINDING TECHNOLOGY

Kapp and Niles offer the industry's widest range of machines and tools for profile and threaded wheel gear grinding, says Bill Miller, vice president sales at Kapp Technologies.

In the heavy duty truck transmission market, the focus is on flexibility. Automation with robotics is becoming more prevalent, according to Miller. "As non-grinding time becomes a more significant proportion of total production time, automatic loading is essential for high-output. Our KX 260 and KX 500 machines are designed so that customers can easily integrate robots on site.

The automotive industry requires all grinding machines be able to grind a variety of gears, to reach maximum efficiency and flexibility. Our compact KX 100 Dynamic offers this efficiency with its automated work arbor change and semi-automatic wheel change. A full change-over, including inspection, is accomplished in only 20 minutes."

Customers that rebuild gearboxes continue to look for design improvements in order to differentiate their service, according to Miller. "Integrated software simulates modifications, and high-speed measurement verifies the grindability of a part prior to grinding. These are two improvements which significantly add to the quality of the rebuild. Tools are also available for superfinishing as a post process in the grinding machine."

The aerospace market is also benefitting, as they replace 30-year-old Kapp grinders with the latest models. For expanded options, CBN tooling compatibility is offered not only on Kapp V-Series machines but also on Niles ZE Series and ZP Series machines. And modern software shortens the learning curve dramatically for all grinding processes, while still enabling customers to program special grinding cycles."

He adds that all market segments continue the trend towards dressable tools when economics are favorable. "Kapp diamond dressing tools allow our customers to count on us for turn-key support. We're extending the lifetime of the tools and lowering the costs for our customers. This is key to our business," Miller says.

Finally, "multifunctional machines" continue to gain attention. These machines are designed either as a single unit, where datum surfaces and diameters are finished in sequence with the gear teeth in one clamping, or as multiple machines tightly integrated to function as one. The incentive to invest in this technology, however, is still tempered by uncertainty in the market.

Miller believes that increased competition in this area helps. "Multifunctional machines are a higher price and in order to prove to the market their multiple benefits, technical expertise on both ends is critical," Miller says. "We're going to gain some traction in this area during the next growth period as more and more customers begin to see the advantages of these machines. A lot of our competition is following us on these developments, which can only make the market more attractive."

For more information:
Kapp Technologies
Phone: (303) 447-1130
www.kapp-niles.com

Drake Manufacturing

INTRODUCES JOB SHOP THREAD, WORM AND GEAR MACHINE

Drake Manufacturing Services Co. recently introduced its latest machine solution designed for a multifunctional machining platform. With its internal thread, external thread, and profile gear grinding capability, Drake's Ultimate Job Shop Thread, Worm & Gear Machine (Model GS:JS) offers the versatility required in a job shop environment for half the cost of three separate machines. This universal, 4-axis CNC machine was developed for grinding internal and external threads, as well as profile grinding gears.

Features include a cast polymer base for thermal stability and dynamic stiffness, linear motors on linear ways for high acceleration and contouring capability, fewer mechanical parts, and low-maintenance operation, a high accuracy workhead—0.002° index accuracy, power helix for quick changeovers and ±90° helix/lead angles and Drake Part Smart menus for changeovers in as little

as 15 minutes with simple entry of new part parameters.

Stig Mowatt-Larssen, Drake's R&D Manager, stated, "This machine is ideal for production of small batches in a cost-efficient manner. Our product development team fine-tuned this machine with a gear & thread job shop in Japan, grinding everything from fine pitch pinions against a shoulder with a 25 mm diameter wheel to ball nuts to lead screws. The JIS Class 0 pinions measured great, and the customer appreciated no wheel run-out into the adjacent bearing journal."

"We worked with this high-quality prototype shop to upgrade our *Gear Smart* software to include simpler form modification menus and the ability to more simply 'dial-in' the tooth form for a first-good-part that is so important for job shops" said Rick Sanders, systems engineering manager and chief software architect. The 390 mm diameter by 1 meter length machine was delivered to a short-run custom gage and prototype job shop in central Japan.

For more information:
Drake Manufacturing Services Co.
Phone: (330) 847-7291
www.drakemfg.com

Norton Abrasives

NEW ABRASIVES BOND TECHNOLOGY BENEFITS GEAR GRINDING

Norton Abrasives has developed and launched Norton Vitrium3, the next generation of bonded abrasives products, engineered for maximum performance and cost savings in precision grinding. An entirely new abrasives platform, Norton Vitrium3 features a patent-pending bond technology developed by the Saint-Gobain Abrasives R&D team. This bond features an exclusive chemistry that promotes excellent grain adhesion, resulting in improved product versatility across a wide range of applications. Substantial performance improvements with Norton Vitrium3 are now attainable in all Norton abrasive grains, from proprietary Norton Quantum ceramic alumina to conventional aluminum oxide.

Norton Vitrium3 has three major features and benefits over standard vitrified bonds including a stronger bond construction to meet higher wheel speeds, an improved holding power utilizing less bond-to-abrasive ratio for an improved cut rate and significantly less burn, while reducing power consumption and grinding forces on the part. An increased porosity eliminates burn or other part damage.

Products including gears, camshafts, crankshafts and bearings are using materials that are more difficult to grind. The primary products for all of these precision grinding applications are vitrified grinding wheels and segments.

A substantial amount of work has been done over the last 20 years on the cutting tool portion of the wheel, the abrasive grain. In 1990, Norton Abrasives introduced the first ceramic alumina abrasive, Norton SG. This new grain offered much higher performance in all areas of precision grinding as a result of a combination of the hardness of each ceramic alumina grain and the new science of "controlled micro-fracturing."

The vitrified or glass bond is the material that holds or bonds the abrasive grain together. The heavier the bond-to-grain ratio, the harder or stronger the wheel is and the more pressure needed to break down the bond to release new abrasive grain for cutting. The correct balancing of bond-to-grain ratio is necessary to provide enough holding power for the grain to perform the required cutting stops and starts without burning or damaging the work. For some materials or in some wide contact areas, artificial media is introduced into the matrix, which burns out during firing to leave a large, porous structure, which promotes better coolant flow, retards the dulling of the grain and reduces burn.

This bond platform features an exclusive chemistry that delivers an entirely new grain adhesion science, resulting in improved product versatility across a wide range of precision grinding applications. The chemistry of holding the abrasive grain in the bond matrix for the precise amount of time is referred to as "grain adhesion science." Norton Vitirum3 is a new product formulation that substantially increases the module of elasticity or strength of the bond. This allows for less bonding material to be used to provide the same holding power on the individual abrasive grain.

In a large gear grinding application example for the wind energy market, Vitrium3 enabled a 67% reduction in dress comp. per part and a 13% reduction in total cycle time. The Vitrium3 wheel was single rib, 16 × 2 × 5 inches (Baseline Spec: 60-G, Vitrium3 Specs: 3TGP60-G12VS3GB). The application was "Involute Pinion - Grind Teeth" with a steel part diameter of 8 inches and width of 19 inches, 60 HRc. The wheel speed was 1,443 rpm with stock removal at .04 inch and a 32 Ra surface finish.

For more information:
Norton Abrasives
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MTB-Burri

OFFERS FLEXIBLE AND COST EFFECTIVE GRINDING SOLUTIONS

MTB–Burri is offering manufacturers flexible and cost effective solutions in the grinding world that were only available in Europe until now. With MTB's engineering expertise, service support, and operational facilities, Burri is being launched and embraced with high interest. Installations of Burri grinders and dressing machines have been in operation for 20 years and are in many prominent, well-known companies throughout the world. Industries include automotive, machine tools, agriculture and other market sectors. Only as recently as 2013 has the first grinder been installed in the United States.

Burri CNC Continuous Generating Gear Grinders are built on the mechanical basis of the Reishauer type AZO/AZA/RZ 301/RZ 361/RZ 362/RZS platforms. Operators, engineers and companies accustomed to Reishauer grinders will find that the Burri grinders utilize adaptable clamping mechanisms so all tooling can be interchanged, reducing additional investment in tooling. The machine is equipped with a B&R controls system, high performance Ethernet network, compact I/O system, modular drives with energy recovery system, digital absolute precise encoders, and CNC control on all axes, and an attached electrical cabinet.

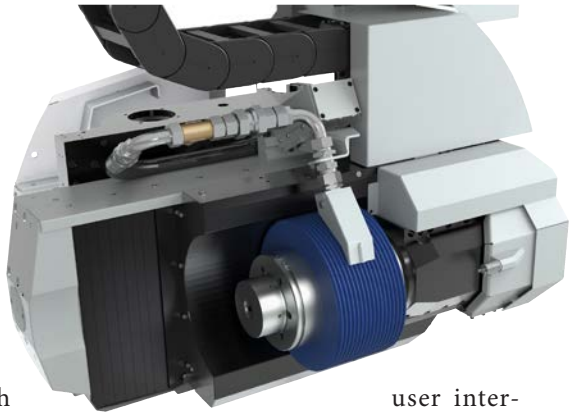
The grinding support has hardened linear guides, a synchronous motor which is directly connected to the grinding spindle and adjustable from 0 to 3,500 rpm (corresponds to a cutting speed of 63 m/sec). It's also equipped with a completely new profiling slide with ball bearing spindle, linear ball guides and linear measuring system that allows the profiling cycle to occur in both directions (forwards/backwards). The wheel guard has integrated meshing probes and a transmitter for balancing the head. Its short cone grinding spindle is engineered for installation of the balancing head for a fully-automatic balancing system for handling grinding wheels with dimensions of 350 × 104 × 160 mm.

All original Reishauer components that were liable to become maintenance problems are eliminated, such as electric clutches, indexing plunger, lead screw of the dressing slide with all change gears, and other.

For more information:
MTB-Burri
Phone: (815) 636-7502
www.machinetoolbuilders.com

Liebherr

SINGLE TABLE GEAR GRINDING MACHINE DELIVERS QUALITY



With a one-table design and a new-design grinding head, the Liebherr LGG 180 and LGG 280 machines greatly reduce grinding times for twist-free profile and generating grinding. The machines are designed to deliver consistent high large-scale production quality in automotive applications, including conical gearing. According to a Liebherr spokesman, "With this series of space-saving machines, vehicle manufacturers can develop a complete production line, in which all gearing components for a passenger vehicle transmission can be ground: planetary and sun gears, bore-type gears, as well as drive and pinion shafts with lengths up to 500 mm."

The advantage to the one-table solution is higher quality throughout the entire production. There is one clamping fixture, one geometry. Every machined part is manufactured under the same conditions for the highest reproducibility. The one-table approach provides the statistical capability and reliability in continuously producing controlled µ-range finish quality for gear noise optimization.

The new grinding head allows for rotation speeds up to 10,000 rpm and has spindle power of 35 kW. With this performance data, the head enables high cutting speeds and high feed rates. The new grinding machine can exploit the considerable potential of the innovative 3M abrasive Cubitron II. Changing the grinding arbor with HSK-C 100 tool holder is a fast and simple process. Also available is a second grinding head for featuring a small worm diameter for collision-critical parts.

The machine will enable undulations to be applied specifically to gear wheel flanks for noise optimization purposes for the first time. The ability to produce sub-µ range waviness cost-effectively gives designers a whole new range of optimization options. The touch screen user interface on the machine control permits easier, intuitive programming and machine operation and incorporates an integrated webcam. The control also can incorporate substantial additional documentation, such as fixture layouts and tool mounting instructions. The LGG machines are easily coupled with Liebherr automation solutions to create a fully automated production line for the highest quality gears in the least possible cycle times.

For more information:
Liebherr Gear Technology, Inc.
Phone: (734) 429-7225
www.liebherr.com

Gleason Corporation

SINGLE-SOURCE CUSTOM OPTIONS

Manufacturers of large gears expect modern gear-grinding machines to be able to produce excellent quality gears with considerably increased productivity and maximum process reliability at low cost. With its Titan 1200G gear grinding machine, Gleason-Pfauter has succeeded in satisfying these discerning requirements. The Titan 1200G can be individually configured to suit customer requirements and provides maximum productivity, flexibility and quality. Use of a fully-automatic tool changer facilitates entirely new machining strategies for grinding gears. The Titan includes a fully automatic tool changer, combined profile grinding, Opti-Grind and Power-Grind. The possible machining strategies allow productivity and flexibility for the user, taking into account not just the desired workpiece geometry, but also many other production and customer-specific boundary conditions.

Gleason recently announced the availability of a profile grinding option for its 300TWG Threaded Wheel Grinding Machine. Gleason's 300TWG is for customers who demand the high levels of productivity and flexibility provided by the threaded wheel grinding process, especially for medium to large size batch production. Now with the addition of a profile grinding option, the machine is also well-suited to smaller batch and high-precision production, making the 300TWG a truly universal gear grinder. The combination of the two processes covers the full range of production possibilities. Dr. Antoine Tuerich, director of product management - Profile and Threaded Wheel Grinding Solutions remarked, "With the integration of the new dressable profile grinding option, the already successful 300TWG Threaded Wheel Grinding Machine becomes more flexible than ever before, allowing the configuration of this machine to meet nearly any customer requirement. Depending on the customer's application, it may be used either as a threaded wheel or a profile grinding machine. User-friendly, graphically supported software simplifies the process, yet offers a high degree of sophistication and control."

For more information:
Gleason Corporation
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www.gleason.com

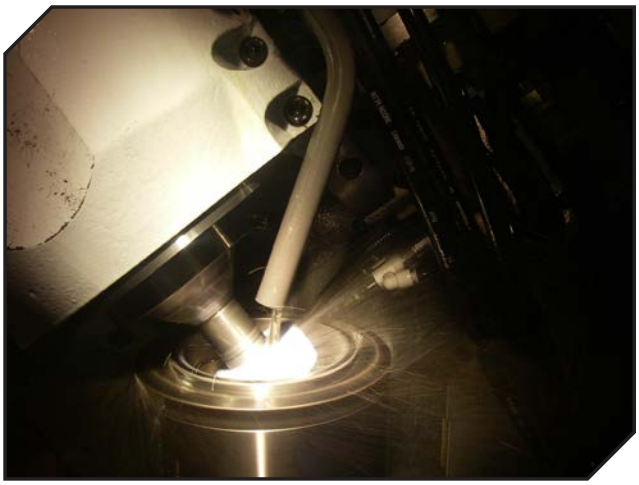
Mitsubishi Heavy Industries

OFFERS NEW PROCESSING METHOD FOR GRINDING INTERNAL, EXTERNAL AND SHOULDER TYPE GEARS

In the field of gears used for automotive transmissions and reducers in robots, after-heat treatment gear grinding has been spreading for the achievement of gear units with lower noise and higher precision. Along with the further reduction of the weight and cost of gear units, there is a growing number of workpieces that are difficult to machine such as ring gears (internal gears) in planetary gear systems and multi-shoulder type gears widely used in the automatic transmissions of vehicles and power transfer systems for hybrid cars. One of the methods for grinding internal gears is a form grinding method that grinds tooth spaces one by one. However, this method is rarely used in volume production because its machining efficiency is low. Therefore MHI developed the ZI20A, the world's first internal gear grinder for use in volume production, in 2009. Through continuous process development with Japanese automotive manufacturers and grinding wheel producers, MHI can now offer a robust and affordable process for grinding internal ring gears.

For grinding external gears, on the other hand, a continuous generation gear grinding method using a multi-threaded grinding wheel has been widely used. MHI also has the ZE series that employs such a method. This method achieves highly efficient grinding by meshing a multi-threaded grinding wheel with a diameter of 200 to 300 mm and the gear to be ground. When this method is used for grinding multi-shoulder type gears or shaft-integrated pinion gears (workpieces that turn-up at the edges), however, it is difficult to grind the tooth flank because the grinding wheel and the workpiece interfere with each other.

Thus MHI has equipped the ZI20A gear grinder with an hourglass-shaped grinding wheel and a fixture for grind-



ing external gears to develop a method allowing for the highly precise and efficient grinding of gears that were difficult to machine in the past. The main technologies used in the developed machine to allow for grinding external gears are a grinding wheel spindle that achieves rigid and stable rotation at low to high rotation speeds, the employment of an hourglass-shaped threaded grinding wheel and highly precise on-machine dressing and a control method for the amount of tooth flank modification (crowning) by adding compensation to the grinding motion.

Because a cylindrical grinding wheel interferes with the workpiece at the both edges of the grinding wheel due to its crossed-axis angle, a barrel-shaped threaded grinding wheel is required. A barrel-shaped threaded grinding wheel and the internal gear to be ground (workpiece) mesh with each other performing a generating motion to grind the internal gear. For grinding external gears, on the other hand, an hourglass-shaped threaded grinding wheel and the external gear to be ground (workpiece) mesh with each other.

For both internal and external gear grinding, higher grinding speed is required to improve grindability (i.e., lower grinding resistance and higher grinding ratio). The grinding speed is dependent on synchronous rotation between the grinding wheel spindle and the workpiece and the sliding of the tooth flank due to crossed-axis angle. Therefore sliding velocity (grinding speed) can be enhanced by increasing the rotation speed of the grinding wheel spindle and the workpiece and enlarging the crossed-axis angle. The developed grinding method is achieved due to the development of a grinding wheel spindle and a work-holding table spindle that can synchronously rotate at higher speeds, the design of an hourglass-shaped threaded grinding wheel dependent on a crossed-axis angle and the creation of its dressing method.

MHI has developed a method allowing for the highly precise and efficient grinding of external gears that were difficult to machine using conventional gear grinding methods with a threaded grinding wheel. This was achieved simply by attaching a grinding wheel and a fixture for external gear grinding to the ZI20A gear grinder, which was initially exclusive to internal gear grinding, MHI has enabled the machine to perform external gear grinding and enhanced its versatility. The company will continually meet the needs of customers by working on the further improvement of accuracy and efficiency of machining, as well as tool life.

For more information:
Mitsubishi Heavy Industries America
Phone: (248) 669-6136
www.mitsubishigearcenter.com

Star SU

ESTABLISHED CONCEPTS HIGHLIGHT THE G 250

Star SU LLC offers the Samputensili G 250 generating grinding machine based on the established concepts of the best-selling Samputensili S 250/400 G machine, which have been further enhanced and improved. The result is an innovative, compact and extremely flexible gear grinding machine. The Samputensili G 250 has been especially developed for very low cycle times and for top-quality and efficient mass production of gears with outside diameters up to 250 mm and shafts with lengths up to 550 mm. Moreover, the machine features dual work spindles that eliminate non-productive times almost completely. Particular attention has been paid to the state-of-the-art solutions that allow a fast tool change, e.g. from hobbing to grinding, guaranteeing process versatility. The machine can equally use form and worm grinding wheels, both in ceramic and in CBN electroplated. Simple design concepts in terms of tooling and dressing technology, fast automation and amazing user-friendliness are the strengths behind this unique machine.

For more information:
Star SU
Phone: (847) 649-1450
www.star-su.com

Reishauer

RZ 260 HANDLES HIGHER LOADS AND FORCES

Reishauer AG based the RZ 260 on its successful RZ 150 series. The machine was developed for the high demands of the continuous generating gear grinding process. The machine boasts the Reishauer Generating Module, LNS Low Noise Shifting technology and Twist Control Grinding technology that customers have come to expect from Reishauer machines. The RZ 260 can be fitted with one or two work spindles. A single spindle is efficient if investment and tooling costs must be minimized. When grinding gears with space limitations or small lot sizes the customer may consider the changeable profile grinding spindle that enables the use

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www.beavermatic.com | sales@beavermatic.com

of a small plated or dressable wheel to grind gears with the discontinuous profile method. Both versions of the RZ 260 can be equipped with a fixed or CNC-controlled axis for swiveling the dressing tool. This offers a significant increase in flexibility.

For more information:
Reishauer Corporation
Phone: (847) 888-3828
www.reishauer-us.com

Klingelnberg

VIPER SERIES FOCUSES ON EFFICIENCY AND PRODUCTIVITY

The adaptable gear grinding machine Viper 500 is designed for component diameters up to 500 mm and is optimally suited for both the smallest and the largest batch sizes. It is available in three different configurations, depending on individual requirements: profile grinding, small grinding wheels and multiple-wheel technology (Viper 500 K), and generation grinding (Viper 500 W). Particularly for users with frequent product changes, the flexible machine concept ensures an even more dynamic and efficient production process. The Viper 500 W configuration allows both profile grinding and continuous generation grinding on the same machine – with minimal retooling time. To change the grinding technology, just swap out the grinding wheel, the grinding wheel flank and the dressing wheel. On all three variants, the optional internal gear

grinding arm allows retooling from external to internal gearing in less than 15 minutes.

At the same time, the special machine axis arrangement provides the basis for maximum precision, continuous quality, and tremendous flexibility. Thanks to its innovative design, the machine is powerful, easy to clean, and extremely energy efficient. And last but not least, the proprietary GearPro software guarantees routine operation for the attendant, even when the applications are complex.

For more information:
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