

Reishauer's RZ150 Speeds Up Production

Bob Sakuta, president and owner of Delta Research in Livonia, MI, runs one of the world's most highly advanced gear manufacturing cells.

"We're making these gears with total automation," Sakuta says. "They come out of the cell without a person ever touching them."

The cell includes the complete manufacturing process: hobbing, grinding, roll testing, deburring, rustproofing, washing and turning.

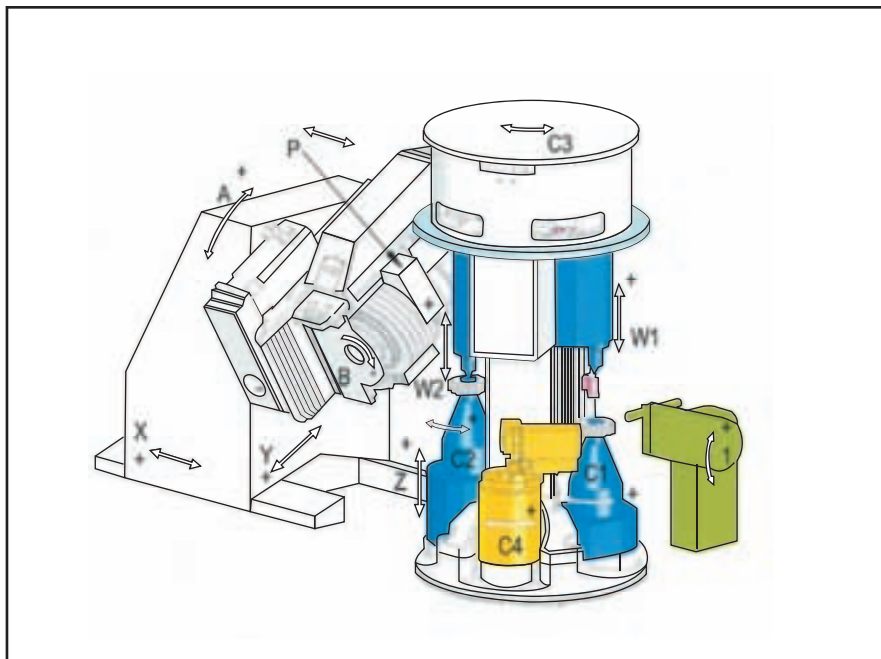
The cell produces left- and right-hand versions of a helical gear for automotive use—at the rate of 750,000 pieces per year. The company runs the cell for one manned shift during the day and, on average, 1.5 unmanned shifts after hours. Its high-tech features include the ability to contact an operator on call during the unmanned shifts.

At the heart of the cell is the RZ150, the newest model gear grinding machine from Reishauer, which was designed from the ground up to reduce cycle time while maintaining the highest levels of quality.

The RZ150 comes equipped with some features that make it especially well suited for high-level production. The most obvious of those features is the machine's dual-spindle design.

"As we're grinding one part, the second spindle is being loaded," says Sakuta. "You have almost no load time. That's the biggest advantage."

"The double spindle is, for us, revolutionary," says Laslo Ferez, senior project engineer at the Vehcom Manufacturing division of Linamar Corp. in Guelph, Ontario. His company uses the RZ150 to grind transfer shafts for a Big Three customer. "With other machines, you have just one spindle, and you're losing time in the loading and unloading. So here, there's no additional cycle time required for loading and unloading."



The dual-spindle design of the Reishauer RZ150 allows one part to be loaded (C1) while another is being ground (C2), reducing cycle time.

For most workpieces, the part changeover time is about four seconds, says Dennis Richmond, vice president of Reishauer Corp. of Elgin, IL. He adds that the machine shaves cycle time in other areas as well.

For example, while one part is being ground, the next workpiece is pre-synchronized to the thread in the grinding wheel. This helps minimize idle time during the grinding portion of the cycle, Richmond says. And in a high-production environment, every bit of cycle time is precious.

Another key advantage of the machine is its small footprint, Richmond says. The machine itself, not including the coolant system, takes up just 54 square feet of shop floor space. For companies that use a central coolant system, such as Vehcom Manufacturing, that means the RZ150 takes up "about as much space as a small milling machine," Ferez says.

But even when the machine is equipped with a material handling system and coolant/filtration system, the footprint is just 15 x 20 feet.



The RZ150 takes up just 54 square feet of floor space.

The RZ150 can grind parts with the following specifications:

- OD of 20–150 mm
- Gear face width up to 50 mm
- Shafts up to 350 mm (with the optional tailstock)
- Pitch rating of 1–3 module
- Helix angles to +/- 40°
- Grinding wheel diameter 206–275 mm
- Grinding wheel width up to 125 mm

Like all Reishauer machines, the RZ150 uses the continuous generation method of grinding (similar to hobbing in

principle) and employs a threaded wheel. To maximize the productivity, many manufacturers use a multi-start grinding wheel on the machine. The machine at Delta Research is equipped with five-start grinding wheels, for example.

The machine's dressing unit is located on the turret assembly, rotating along with the two work spindles. Alignment of the dressing tools to the thread on the grinding wheel is facilitated by the use of acoustic sensing devices and is completely automatic, Richmond says. This automatic alignment helps assure fast and accurate positioning, eliminates the possibility of damage to the tool and helps extend the life of the diamond tool, he adds.

The machine's automatic stock-dividing sensor ensures a precise mesh for the subsequent grinding operation. Located outside the working area near the second spindle's loading position, this sensor determines the required tooth width and tooth gap for all teeth to be ground and determines the corresponding angular position for best fit of workpiece in relation to the grinding worm thread, Richmond says. Also, the system provides an added safety feature. Because it counts the teeth and determines whether the tooth widths are in the right range, the machine knows if an incorrect workpiece has been loaded and can reject that part.

The RZ150 includes 12 numerical-controlled axes, most of which are equipped with absolute encoders. This results in fewer reference movements at

machine startup, Richmond says. The encoders also tie in with the machine's Siemens 840 D CNC control system, which continuously monitors NC axes to prevent potentially dangerous movement in the case of hardware or software failure.

Another special control feature is the electronic gearboxes. Developed by

Reishauer, these devices synchronize the independent work spindle axes to the corresponding master axis. The EGB module runs on its own computer system, but it is embedded in the Siemens control system.

The RZ150's machine interface allows the entering of all necessary data from a gear blueprint. A wide range of

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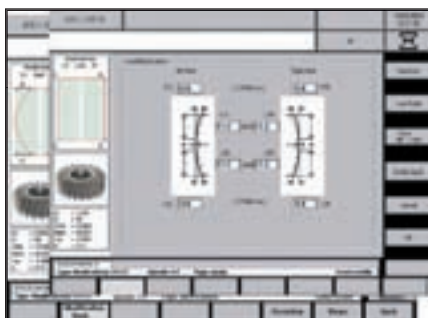
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Users can enter gear parameters via the RZ150's interface.

modifications is possible via the data input screen, and separate screens are available for tooth modifications and tooth corrections. Small deviations to the gear flank form can be corrected via program input without changing the original gear modification data. When the data has been entered, a graphic representation appears on the screen, which allows

the operator to visually check whether the input data is correct. This allows the operator to evaluate the topology of a gear flank, Richmond says.

With all these features, though, "It takes a high-level skilled operator to make this thing sing," Sakuta says.

But, he adds, this is not a problem at Delta Research. Even a highly skilled

employee is worth the price when considering that it takes just three operators to run the cell and produce 750,000 parts per year.

Also, Sakuta says, the maintenance staff has to pay special attention to the machine's paper bag filtration system. Because of the high volume of gears being ground, the system can fill up quickly with sludge and therefore has to be monitored.

But what matters most to these manufacturers is the reduced cycle times and high throughput that this machine allows.

At Vehcom Manufacturing, the grinding cycle time on the RZ150 is 25–30 seconds. "The machine is very, very fast," says Ferenz.

Sakuta's parts are also being ground in less than 30 seconds. "There was nothing like it at the time for the throughput. If you had shown me this gear five years ago and said, can you grind the teeth in 30 seconds, I would have laughed at you. Today, this machine spits these things out, one right after the other."

The speed is essential to Delta Research. Its customer wants even more parts next year. Sakuta already has another RZ150 on order.

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Balzers Introduces Self-Supporting Diamond-Like Carbon Coatings

Balzers AG has created a new PVD coating system designed to permit greater load bearing capacity than its conventional diamond-like carbon coatings.

The coatings are suitable for engine components, high-pressure pump parts and other highly loaded tribological applications. They can also be applied to components made of softer materials that are used in food processing machinery, for medical components and in the aerospace industry.

Balzers developed the coatings to be self-supporting, so they could be used on materials that aren't self-supporting and that tend to have an "egg-shell" effect. These materials have low hardnesses and lack adequate support when placed under high surface pressure. They include metal alloys, stainless steel, and lightweight materials.

"We are able to coat softer substrate material," says Raphael Mertens, Balzers' project manager-R&D for coated components in Liechtenstein.

According to Balzers, its STAR coatings include a hard, tough, metal-based layer of chromium nitride, providing sur-



face hardness and support (load bearing capacity) for the superposed carbon coating. The company adds that the layer also improves the fatigue and corrosion resistance of its parts—and provides good wear resistance under emergency running conditions.

Balzers describes the new coatings as having "superior tribological arrange-

ments," so it calls them STAR coatings. The coatings, BALINIT DLC STAR and C STAR are both modified diamond-like carbon coatings with enhanced load bearing capacity. Also, a special DLC-R coating was designed for superior running-in performance.

DLC-R's extra feature comes from a film of softer carbon. According to

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Balzers, the film doesn't affect a coated part's wear resistance, but it eliminates wear on the mating part, especially during the running-in phase.

DLC STAR was designed for heavy-duty valve train components, piston assembly parts and sliding bearings that run against hard surfaces.

The STAR coatings, each with more than two functional layers, can be applied directly onto bronze, steel, case-hardened steel or nitrided steel. Moreover, Mertens says the layers can be applied in one step in a Balzers' coating chamber. Gears wouldn't have to be removed from the chamber during vacuum processing. They wouldn't be exposed to outside air, where they might oxidize, damaging the coating.

"We think, especially for gears, this is a very important thing," Mertens says.

Also, the C STAR coating was tested for scuffing resistance at the Technical University of Munich by the Gear Research Centre (FZG). Mertens describes the test conditions and results. The test was conducted on an A-type gear using an FZG test rig and, for comparison, included runs for an uncoated gear and a gear with a regular carbon coating. All the test gears were made of 20MnCr5, case-hardened to 60-62 HRC, and were run with RL 144, a Coordinating European Council reference oil, a mineral oil with no additives.

The runs were conducted with a pinion speed of 2,250 rpm, a pitch-line velocity of 8.3 m/s, an oil temperature of 90°C, and with torques ranging from 3.3 Nm to 714.2 Nm. The test was designed to run the gears through stage 14, with each stage lasting 15 minutes.

The uncoated gear failed in stage 6. The regular carbon-coated gear lasted through stage 12, then started to scuff in stage 13. Mertens says the gear coated with C STAR didn't fail, and it was run through stage 14: "This coating didn't show any scuffing."

Balzers has applied the STAR coatings to the gears of gear manufacturing

and automotive companies. The cost to apply a STAR coating to a gear varies depending on its type and size, but Mertens estimates the cost at \$10-\$50 for common gear geometries in low quantities.

The coatings can be applied at five Balzers sites in Germany, Japan, Liechtenstein, the United States and the United Kingdom.

Balzers created the STAR coatings at the request of customers, mainly automotive racing customers. Appropriately, the company introduced the STAR coatings at a motorsport show, Autosport International, in January in the U.K. Three months later, Balzers introduced the coatings to the U.S. market.

For more information:

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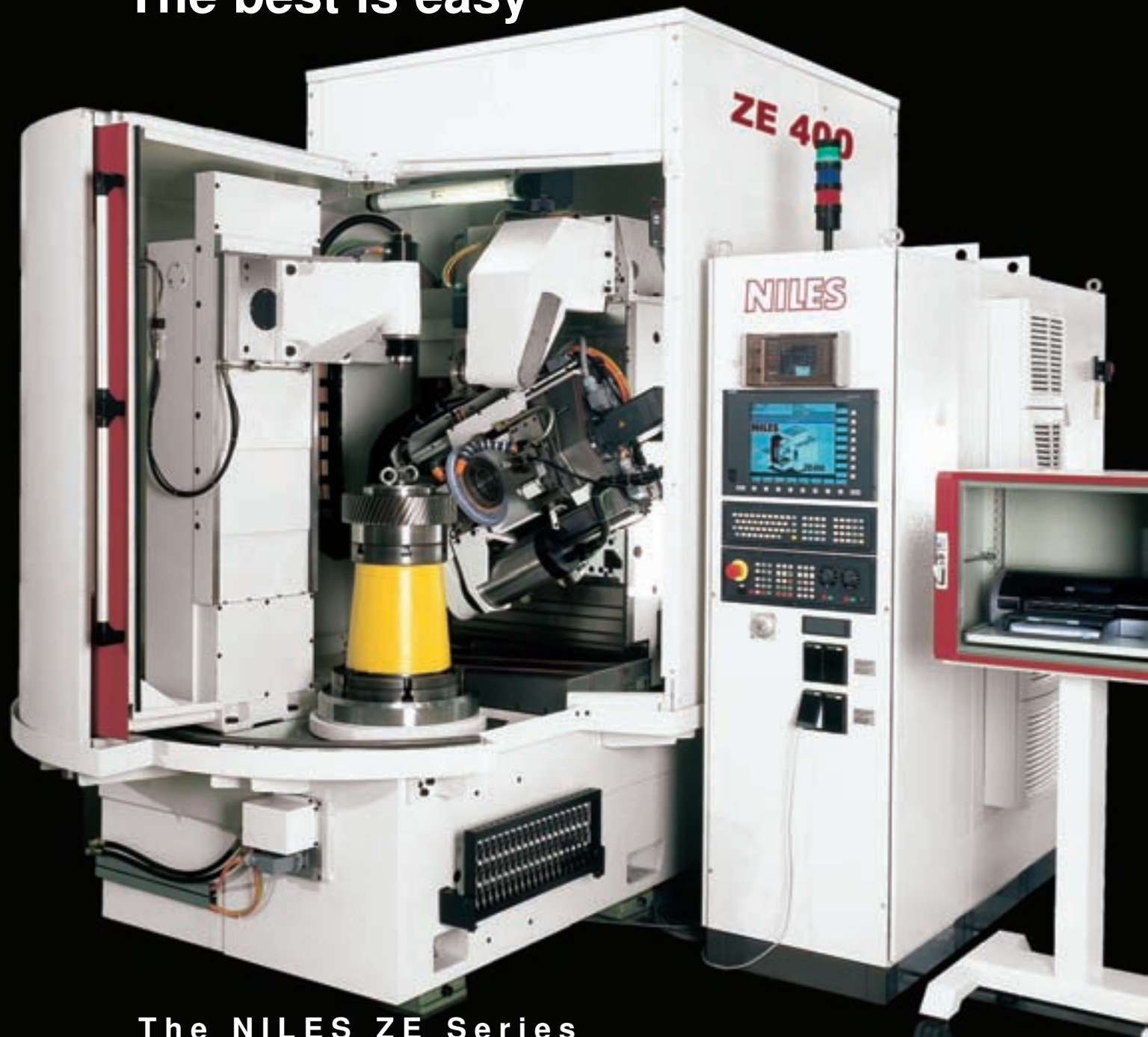
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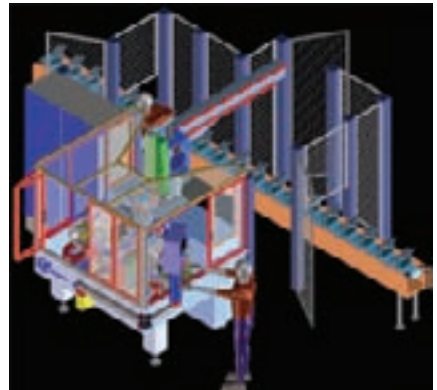
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New Process Monitoring System from Marposs

A new tool and process monitoring system from Marposs is designed to provide continuous monitoring of metalworking processes through several different types of sensors that enable control of various machine functions, thus allowing cycle optimization as well a reduction of



scrap and machine downtime.

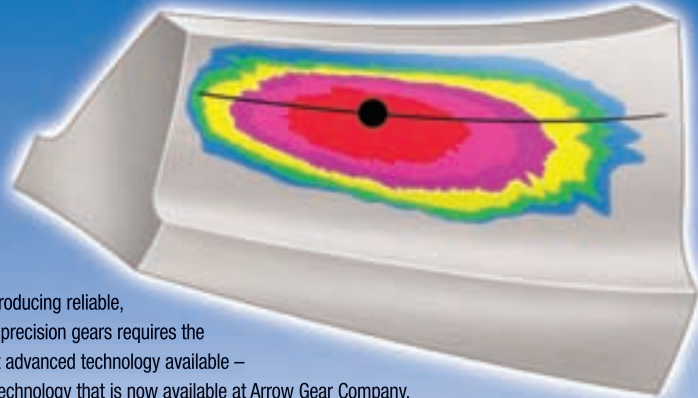
According to the company's press release, five products are utilized for monitoring. A vibration monitor analyzes vibrations in rotating devices, such as machine tool spindles, to permit the highest possible tool revolutions.

A force monitor is included for the direct and reliable identification and control of the strain and forces acting on the tool to optimize the cutting parameters and production cycles. A power monitor exists for controlling the variations in the cutting process through continuous and absolute surveillance of power absorbed by the machine's axis or spindles. A displacement monitor measures distances in high resolution using wear-free, non-contact sensors for applications such as automatic compensation for thermal drift. Temperature monitors sense temperatures in critical machine tool sub-systems such as near-moving components, like axes, gears and spindles.

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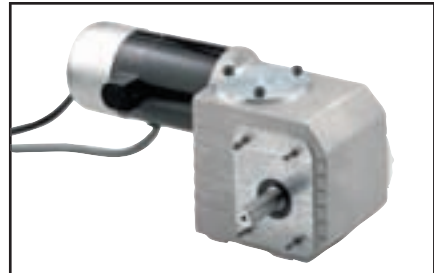
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New Double Reduction Gearmotors from Bodine

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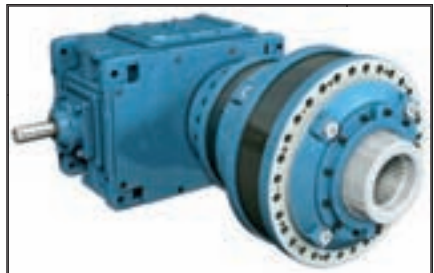
Gearmotors are available with the company's 30R AC, 24A DC and 22B brushless DC motors. The double reduction design provides gear ratios from 80:1 up to 3,600:1, allowing a relatively small motor to produce up to 150 lb.-in. of torque, according to the company's press release. Gearheads are offered with



outputs ranging from 0.5–3.1 rpm. The 3RD models are unvented with bronze and hardened steel worm gears, and gearmotors carry various built-to-order shaft options including single, double or hollow-shaft configurations.

In addition, the gearmotors can be face-mounted on the drive-shaft side, the side opposite the driveshaft, or from the bottom of the gearhead.

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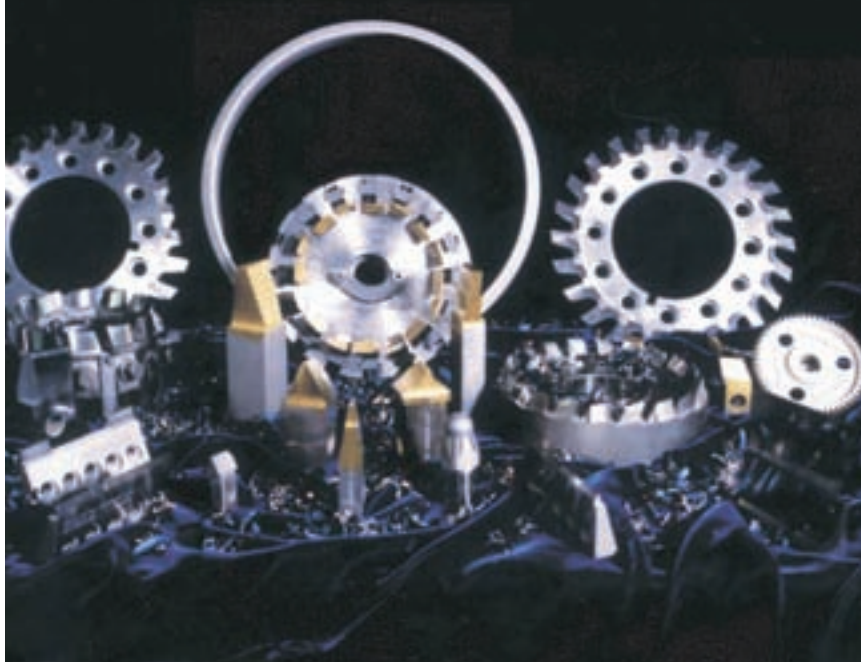
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New Tool Chuck from Hydra-Lock

The diamond OD tool chucks from Hydra-Lock Corp. increase performance without vibration and chatter.

According to the company's press release, a built-in hydraulic holder has a dampening effect that allows for quick tool changes while eliminating vibration and chatter.

The tool incorporates several diamond cutters on the outside diameter while precisely locating a diamond-chipped tool with the hydraulic chuck. All of the tool holders are precision balanced.

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New Gear Lubricant from Klüber

The Klübertop P 39-462 spray from Klüber Lubrication facilitates the adjustment of load-bearing patterns in gears and is resistant to synthetic lubricants.

According to the company's press release, the air drying inspection paint for load bearing patterns provides a contrast to the gear surfaces. Its good adhesion enables inspection in the -40° to $+200^{\circ}\text{C}$ temperature range over longer periods.

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New CNC Honing System from Micromatic Textron

The Microhone CNC tooling and abrasive system from Micromatic Textron is designed to operate as a conventional honing machine in a flexible manufacturing environment.

According to the company's press release, the Microhone was designed for use with CNC machining centers to allow the manufactured part to remain in place throughout the various tool changes.

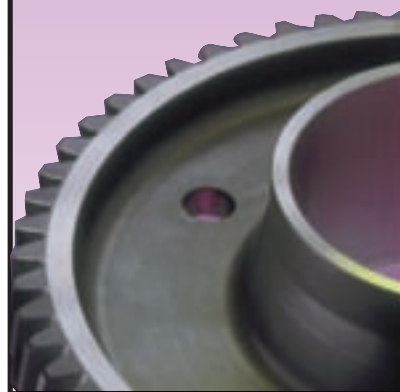
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