Vector Gears

Take a herringbone gear, modify the usual V of the herringbone tooth into a smooth and gracefully rounded "U", add a little twist, and you have the gear that Flowdata Corporation is banking on being the state-of-the-art impeller for flow-metering and control—the Vector gear.

"We do a lot of work in the FDA-compliant industries—food, beverages and pharmaceuticals," said Dave Foran, Flowdata president. "We also sell to chemical, petrochemical and automotive markets. Because all of our products are based on impellers, our design engineers are very gear oriented."

Flowdata's products use pairs of gear-like impellers to measure fluids moving through various sized pipes and under various pressures. Previous designs were, however, limited in flow regardless of the applied pressure. The Vector impeller doubles the flow rate by incorporating large pockets between the gear teeth.

The teeth mesh so well that Flowdata engineers have been able to eliminate the external synchronizing gearboxes usually needed for these applications. This means that the functions the same regardless of the viscosity of the liquid the unit is metering.

A further benefit of this alignment accuracy is that it prevents gear abrasion, uneven wear and the passage of unmetered fluids.

Finally, the Vector's design eliminates the axial forces that push apart conventional paired gears when they are under pressure.

Although the Vector was designed by Flowdata, the actual machining of the gear was done by BPS Industries of Baltimore, MD. Creating the gear required a highly advanced 5-axis CNC machine tool working from a 3D solid modeling system. Flowdata used Parametric Technologies' Pro/Engineer to create the solid model, and BPS used the same system along with Pro/MFG to program their CNC machine tools and cut the metal.

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Welcome to* Revolutions, *the column that brings you the latest, most up-to-date and easy-to-read information about the people and technology of the gear industry.* Revolutions *welcomes your submissions. Please send them to* Gear Technology, *P.O. Box 1426, Elk Grove Village, IL 60009, fax (847) 437-6618 or e-mail* people@geartechnology.com. *If you'd like more information about any of the articles that appear, please circle the appropriate number on the Reader Service Card.

Above: A pair of Vector gears. Courtesy of Flowdata Corporation.

World's Slipperiest Solid

The *Guinness Book of World Records* lists a patented dry-film lubricant from General Magnaplate Corp. as the material with the lowest coefficient of friction (static and dynamic) of any solid.

HI-T-LUBE was invented in the 1950s for use in fighter aircraft. The lubricant was further developed for NASA in the 1960s to be applied to the mating surfaces of critical moving parts in space vehicles. Parts treated with HI-T-LUBE can operate in extreme temperatures (-360°F to +1000°F), vacuum and high radiation environments, maintaining a coefficient of friction of 0.03 while withstanding compression loads in excess of 150,000 psi.

HI-T-LUBE is made up of five layers of metals and alloys that are electrodeposited and permanently bonded to the substrate metal. It can be applied to steel, stainless steel, copper, copper alloys or aluminum. Typical applications include gears, rollers, bearings, pistons, engines and other moving parts.

The 1998 edition of *The Guinness Book* features an interview with HI-T-LUBE inventor Dr. Charles P. Covino, who describes how sometimes luck is better than design. "I put five materials together and composited them into a lubricant. And it worked the first time," Covino said.

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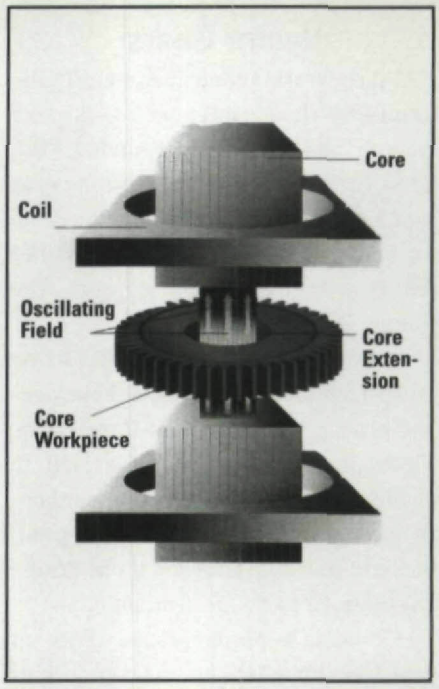
Gears and sprockets are protected against wear, sticking, and galling by General Magnaplate's Hi-T-Lube® synergistic coating.

Uniform Magnetic Heating

A new patented heat treating process that produces a rapid and uniform through-heating of metal components of varying shapes and mass may replace induction heating or furnace processing for some applications.

Both uniform magnetic heating and induction heating use coils to set up a linking of magnetic fields in the workpiece. Induction heating systems place the workpiece inside a heating coil. Eddy currents are generated on the surface of the component, creating a heating pattern on the outside that radiates or conducts inward toward the core.

Uniform magnetic heating uses two coils that are permanently fixed around the ends of a C-shaped laminated core. Because flux energy passes between the ends of the core in a linear fashion, the energy is evenly distributed throughout the entire part. The result is a through-heating that doesn't rely on thermal conductivity to transmit heat from the surface to the center of the part.



How uniform magnetic heating works. Courtesy of Mitsubishi International Corporation.

Another benefit of uniform magnetic heating is that the same coils can run a wide variety of parts. The system's PLC can be programmed for a predetermined frequency level or voltage gain to automatically achieve the optimum power output and heating rates regardless of part size, shape or material.

Uniform magnetic heating is patented by the U.K.-based CoreFlux Systems International, Ltd., and is distributed worldwide by Mitsubishi International Corporation.

The CoreFlux process has been used successfully in lower temperature range applications such as the preheating of transmission gears for laser welding; tempering transmission couplings and drive shafts; shrink-fitting rotors, gears and bearings; and stress relieving of wheel hubs, gears and castings. Company officials expect to receive similar benefits in high-temperature applications such as through hardening of gears and bearings.

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New Technology Helps Find Alloys of the Future

The Marshall Space Flight Center in Huntsville, Alabama has a containerless processing facility that will help materials researchers determine how atoms are arranged in molten mixtures, which could lead to the discovery of new, stronger and lighter alloys and metallic-electronic crystals with never-before-seen properties.

Called the Electrostatic Levitator or ESL (pictured above), the new machine was donated to Marshall's Microgravity Research Program by Space Systems Loral of Palo Alto, California. The ESL uses static electricity to levitate metal samples, which are then melted with a laser. This allows measurements of various thermal and physical properties including surface tension, viscosity, heat capacity, undercooling nucleation—how far below freezing a molten sample will stay liquid—and solidification rates without the metal touching the test container. Such contact could alter the test results, contaminate the alloy mixture, or damage the test container itself.

"The levitator provides important thermophysical property measurements," said Dr. Jan Rogers of Marshall's Space Sciences Laboratory. "By using hands-off measurements, we get an unhindered look at the effects different processing temperatures have on experimental samples. The internal structure of materials—like metals, alloys, oxides and semiconductors—are greatly influenced by heating and cooling rates. The levitator is helping us learn what structures and what unique material capabilities may result from manipulating various metal-alloy samples."

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