Gordon New Wins Gear Clock

Gordon New, managing director of operations for Ronson Gears of Australia, was the grand prize winner in *Gear Technology*'s drawing held in October at Gear Expo 2001 in Detroit. New won a one-of-a-kind gear clock sculpture, custom made for the event.

The drawing was part of *Gear Technology*'s booth promotion at Gear Expo. The emphasis of the booth was "Marketing in the Gear Industry." Individuals had the opportunity to consult with our staff about the advertising and promotional opportunities available to companies in the gear industry or companies wanting to reach the gear industry.

Visitors to the booth entered the contest by dropping their business cards in a box. The drawing was held Tuesday, October 9.

In addition to the custom-made original clock, *The Gear Industry Home Page*™ and *powertransmission.com*™ held drawings for smaller worm-and-wheel clocks. The winners of those drawings were:

- John R. Arbisi, Ingersoll Contract Manufacturing Co.;
- Gerard J. Connell, Cloyes Gear & Products Inc.;
- Jeff Coursey, Nachi Machining Technology Co.;
- Alexander J. Gunow, Midwest Thermal-Vac;
- George T. Shturtz, Metal Powder Products Co.; and
- Paul Wandler, L&H Welding & Machine Co.

Congratulations to all of the winners, and thank you to all who came to Gear Expo and visited us. Those who are interested in a marketing consultation, but who didn't have the chance to come to the show, can call us at (847) 437-6604.

Circle 300

Grinding by Broaching

The parts: internal gears with small diameters and heat-treat distortion. The problem: how to grind the distortion from the teeth? A solution: grind by broaching.

Fässler AG has a modified broaching process that provides the surface roughness of ground gears where grinding isn't possible because of space problems, like in internal gears with small diameters.

The process uses a diamond-coated short broach and multiple, up-and-down strokes to remove heat-treat distortion from broached, hardened workpieces.

Located in Dübendorf, Switzerland, Fässler has offered the process since the mid-1990s. While not new, the diamond-coated short broach appears unique as a finishing tool for internal gears. According to Martin Gerber, a Fässler salesman, only his company makes such a broach. The broach operates in the company's HS-100 hard broaching machine.

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 Response Card.

Bülent Yesilalp, Fässler's sales director, describes the short broach process as simple and reliable, and as a low cost solution for high volume production.

In this process, the internal gear lies on the broaching machine's deposit table and is held in place by a hold-down bar. The gear isn't rigidly clamped, so the broach can move it according to the gear's center.

With a mounting flange, the short broach has a centering zone to position the gear with the profile and check the allowable runout, a tapered zone to remove stock, and a ground cylindrical zone to calibrate, or flatten, the profile.

In a normal broaching machine, driven by a hydraulic cylinder, the broach is pulled down through a gear blank in one stroke.

In the HS-100, the broach is pushed up and pulled down through an internal gear's opening. When the broach exits up or down, chips are rinsed from between the broach and gear by the deposit table's ring nozzle. Designed to finish gears, the broach can remove only 25–40 microns of stock.

Also, the short broach process avoids a problem with the long broach process:

Gordon New of Ronson Gears (left) and *Gear Technology* publisher Michael Goldstein hold the gear clock that New won in the *Gear Technology* drawing at Gear Expo 2001.

elastic deformation.

Fässler has produced diamond-coated long broaches for more than 20 years. Such long broaches could be made for finishing internal gears. But, the broach's single, long stroke expands its workpieces, which later shrink.

The short broach process uses multiple, short strokes, so elastic deformation in a gear from one stroke can shrink and be removed during the next stroke.

"We have no expansion in the workpiece," Gerber says. "That was the reason to change to this short broach process."

Thus, the short broach grinds heat-treat distortion from internal gears, giving them their proper profile, within their tolerance range. The broach provides such accuracy whether it's new or old.

Fässler Corp.'s multiple-stroke short broaches, like this one, can finish-broach internal gears with small diameters and heat-treat distortion. A gear's major diameter can be as small as 20 mm.

When new, the broach's dimensions are their largest, so its finished gears will have dimensions at the lower, smaller end of their tolerance range.

As the broach is used, its diamond grit will wear away. The broach's dimensions will become smaller, so its gear's dimensions will move toward the upper, larger end of their tolerance range.

When the broach is smallest in size, and needs to be replated, gear dimensions will be at the upper end of their tolerance range. The change in the broach's size is the tolerance range of its internal-gear workpiece.

The workpiece's dimensions can range from 30–250 mm for its outside diameter, 20–80 mm for its internal-gear diameter, 3–100 mm for its height and 3–55 mm for its gear-profile height.

Each diamond-coated short broach has a lifetime of 200–300 meters of broaching length and a cycle time of

A short broach sticks out of the HS–100 deposit table and ring nozzle, below the machine tool's hold-down bar. The broach uses multiple up-and-down strokes to provide internal gears with the surface roughness of ground gears.

The short broach centers a gear with its upper set of teeth, then removes stock and flattens the gear's profile with the lower set of teeth.

20–40 seconds to finish an internal gear.

Assuming a gear height of 20 mm, each broach can finish-broach the flank and major diameter of 10,000–15,000 gears. Also, each gear would have a cycle time of 30 seconds and cost about 30 cents to finish. The 30 cents per gear includes the cost of replating the broach during its lifetime. Each new broach costs $6,000–$15,000, depending on its size.

The broach's lifetime is defined by its stroke length: The longer the stroke, the greater the stress on the broach's diamond coating and the shorter the broach's lifetime. That lifetime also can be shortened by work parameters set by the machine operator.

At its smallest size, the broach must have its coating removed, then be replated and reground with a new coating of metallically attached industrial-diamond grit. The broach can be replated three times before it must be discarded. Replating can be done by companies other than Fässler.

Besides removing heat-treat distortion, the broach removes an internal gear's helix, pitch and taper errors. Gerber and Yesilalp add that the broach increases the gear's contact ratio with lower peak stresses and lengthens the gear's lifetime.

According to Yesilalp, the short broach process can simplify assembly of gears and shafts. He explains that the process creates gears with correct dimensions—gears don't even need to be measured—so gears and shafts don't have to be built in pairs.

He adds that the process can reduce heat treatment costs for some applications by eliminating over-pinion heat treatment.

And, Fässler's short broach process isn't limited to internal gear shapes. The process also can finish-broach single and multiple keyways, polygons and other spline profiles.

Circle 301

Tell Us What You Think . . .

If you found this column of interest and/or useful, please **circle 302.**
If you did not care for this column, **circle 303.**