

# GOT A GEAR QUESTION?

## Ask the Expert!

Welcome back to *Gear Technology's* Ask the Expert—our popular regular feature intended to help designers, specifiers, quality assurance and inspection personnel in addressing some of the more complex, troublesome gearing challenges that never cease to materialize—whether on the drafting table or the shop floor. Simply email your question—along with your name, job title and company name (if you wish to remain anonymous, no problem)—to: [jmcguinn@geartechnology.com](mailto:jmcguinn@geartechnology.com); or submit your question by visiting [geartechnology.com](http://geartechnology.com).

## QUESTION

### Gleason Machine Set-Up

We have a Gleason 116 and we want to cut a 4/49 ring and pinion set. We have cut the ring with a 6" cutter diameter on a Gleason 22. No formate type, but we are not able to develop the pinion with a 6" cutter.

The 116 Bevel and Hypoid Gear Generator (Fig. 1) is a mechanical machine that was designed for cutting gears and pinions from five teeth to 99 teeth with a limiting ratio of 10:1. In some cases—where the number of teeth is small, the ratio high and face width long—the total amount of cradle roll and work roll becomes very large. The large work roll can't be handled by the mechanical drivetrain of the No. 116 machine. For these conditions there was a special version of the No. 116 machine with special features that was renamed the No. 121 High-Reduction Hypoid Gear Generator (Fig. 2). The No. 121 machine was capable of cutting one-tooth pinions and virtually any desired ratio. The No. 121 machine modifications consisted of one additional source of motion in



Figure 1 Gleason No. 116 bevel and hypoid gear generator.



**Figure 2 Gleason No. 121 high-reduction hypoid gear generator.** the drivetrain. This was a separate motor which drives the cradle and work spindle, while the standard main motor drives the cutter and the feed cam. The added motor drive is a variable speed unit which permits fast return after the relatively long generating roll required for pinion teeth under five teeth with a high ratio. The No. 116 and No. 121 are no longer offered by Gleason, but a Gleason Phoenix machine (Fig. 3) is ideally suited for cutting these types of gear sets.

The gear set in question— $4 \times 49$  with a ratio of 12.25:1—would require approximately  $31^\circ$  of cradle roll and  $368^\circ$  of work roll to generate the pinion tooth form. Therefore, this gear set would be considered beyond the capacity of a standard No. 116 machine.



Figure 3 Gleason Phoenix 280C universal bevel gear cutting machine.

The pinion development procedure for low teeth numbers and high ratios is somewhat different than a normal hypoid or spiral bevel gear set. The following cutting changes were developed by experienced operators and can be used to develop a left-hand pinion.

**Topping or flanking changes:**

- *Machine offset:* Down, flanks—both sides
- *Machine offset:* Up, tops—both sides

**Toe or heel changes:**

- *Eccentric angle:* Plus, towards heel—both sides
- *Eccentric angle:* Minus, towards toe—both sides

From the basic data mentioned in the question, there is no reason why a 6.00" diameter cutter could not be used for this design. However, this could be better determined by a bevel gear application engineer after knowing all the required gear design data, such as pressure angle, spiral angle, face width, etc.

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