

A Planetary System that Increases Power Density



More power at your fingertips—Turnkey Design Services is manufacturing a planetary gear system to increase power density.

A gear buyer has a motor, an actuator and a new requirement for the gears between them: More power in the same space. Or he may face the other common requirement: The same power in less space. Whichever is the case, he needs a planetary gear set that will do the trick in his low horsepower application.

Also, whichever is the case, he may find the needed gear set in a design conceived by the National Aeronautics and Space Administration and developed by it and Turnkey Design Services LLC, a small engineering firm.

As an example of more power in the same space, TDS compares its planetary set to a similar, conventional set. Both have gearhead diameters of 23 mm. The TDS set has a reduction ratio of 222:1, the other a ratio of 246:1. The TDS set, however, can sustain a maximum torque of 1.2 Nm to the other set's 0.7—that's a 71% increase in maximum continuous torque.

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Moreover, the TDS set does its work in two stages; the other set uses four. Not surprisingly, the TDS set weighs less than its counterpart, 35 grams compared to 100.

The greater power and fewer parts—and the consequent reduced weight—result from the planetary set's design. The heart of that design is the elimination of a separate bearing and the incorporating of a cylindrical roller on the sun gear and each planetary gear. These rollers provide the same function as a bearing would. They also allow the TDS set to achieve greater load sharing between its gears, thereby increasing load carrying capacity, says president & engineering manager Rob Kennedy.

He adds that the gear-bearing product can achieve several gear ratios in the same space by swapping out several gears. These ratios include 3.8:1, 28:1, 43:1 and 1,298:1. TDS is already in the midst of proving this ability to a Chicago manufacturer of electric gear motors.

TDS is manufacturing three prototype sets, each with the same diametral and axial envelopes, 3" and 2.6" respectively, but each with a different ratio, 38:1, 55:1 and 346:1. Based on TDS's detailed drawings, these ratios can be achieved by replacing the first stage gears (sun, planets and ring) without replacing the second stage ones, Kennedy says.

TDS is looking to use the planetary set for speed reducing in conjunction with electric and hydraulic motors that drive actuators, pumps, compressors and gearboxes.

Kennedy says TDS intends to market the gear-bearing product to the automotive and aerospace industries and describes several possible applications in both industries. The planetary set could be used to open and close sliding doors on vans, to open and close lift gates on SUVs and to move power seats back and forth in automobiles. In aerospace, the assembly could be used to open and close bay doors of cargo and fighter aircraft and to extend and retract aircraft wing flaps.

NASA conceived and initially developed the gear-bearing product and later licensed TDS to look into its commercial uses and to manufacture it. TDS itself is a custom-product design firm that specializes in hydraulic and pneumatic products and applications and in turbomachinery.

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