technology ■ opportunity

National Aeronautics and Space Administration
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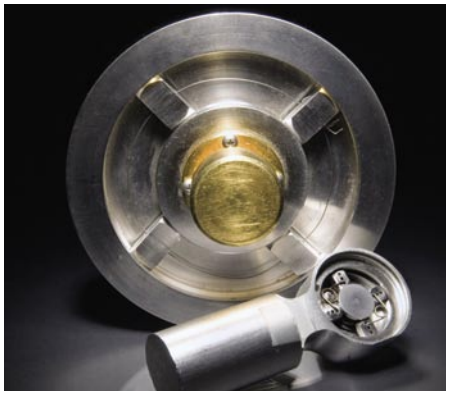
mechanical

3-D Roller Locking Sprags

Superior strength and torque at reduced size and weight



NASA Goddard Space Flight Center invites companies to license a unique three-dimensional roller locking sprag that provides a solution to torque-coupling locking brake and clutch applications that are too demanding for conventional sprag brake/clutches. The new sprag is lightweight and compact, while offering greater strength and durability. Its unique three-dimensional grooved surfaces lock several times more effectively than a standard two-dimensional sprag and can be used in any application where 2-D sprags are used.

Benefits

- **Compact**: 3-D sprags have a significantly shorter diameter and axial length than typical roller locking brakes/clutches.
- **Lightweight**: Less material mass is required to achieve a given holding torque.
- **Strong**: Grooved flange cross-sections in the 3-D roller locking sprag assembly create lower contact stresses that result in higher resistance to bending.
- **Efficient**: Locking effectiveness and torque are significantly increased over other brake/clutch devices.
- **Durable**: Reduced contact stresses and a natural lubrication path around the sprag result in reduced wear and longer life.
- **Versatile**: By varying the factors that control the locking effectiveness (e.g., angle of incline, materials and lubricants, etc.) various specifications can be achieved for differing applications.

Applications

- Over-running clutches: Used in high performance aircraft, helicopters, tilt-rotor aircraft, automotive drive trains and transmissions, forklifts, cranes, lawn and garden equipment, tools, and small engines (e.g., barring drives, multi-point drives, fan drives)
- Mechanical indexers (e.g., assembly conveyors, printing presses, product packaging)
- Backstopping (e.g., inclined conveyors, bucket elevators, fan drives, rotary pumps, etc.)

The Technology

Brakes and clutches are used in many machines with rotating parts to stop or control the degree and direction of motion. They are often are incorporated between concentric races (i.e., rotating shafts). One class of locking brake/clutch uses spherical balls or cylindrical rollers located between an inner and outer race. At least one of the races contains cam surfaces against which the balls or rollers wedge and lock to produce instantaneous torque coupling. A variation on this approach incorporates the cam shape into the roller (i.e., sprag), which rotates at a small angle to engage the sprag's cam surfaces against the concentric cylindrical surfaces of the inner and outer races. Springs are often used to preload the sprags against the race surface so that the sprags engage and disengage instantly with no backlash.

How it works

NASA's patented 3-D roller locking sprag has a tapered periphery and replaces the concentric, cylindrical surfaces of the inner and outer races of the brake/clutch with grooves, in which the 3-D sprag fits. This geometry creates four points of locking contact—two between the outer taper of the 3-D sprag and the outer grooved race, and two between the inner taper of the 3-D sprag and the inner grooved race—twice as many as with conventional, simple ball-based locking brakes/clutches.

The two additional contact points increase the locking efficiency of the device, while reducing the level of sprag-to-race contact stresses.

Why it is better

Rather than contacting the races along the full length of the roller sprags, this 3-D sprag contacts only the diametrically opposing sides of the grooved races at the four points noted above, reducing contact stress and increasing holding power.

Typical sprags also have small cam angles and large contact stresses in order generate sufficient holding torque. This results in devices with long, thick walls, which leads to heavier and bulkier sprag assemblies. Because these 3-D sprags can be produced with much shorter axial lengths, they have less mass and weight, and the assemblies they are in can be smaller and lighter.

Additionally, this 3-D roller locking sprag allows more versatility in design dependant upon the locking effectiveness needed.

Licensing and Partnering Opportunities:

This technology is part of NASA's Innovative Partnerships Program, which seeks to transfer technology into and out of NASA to benefit the space program and U.S. industry. NASA invites companies to consider licensing the 3-D Roller Locking Sprag (GSC-13617-1) technology for commercial applications or becoming a licensed supplier of 3-D roller locking sprag prototypes.

For More Information

If you are interested in more information or want to pursue transfer or prototyping of this technology (GSC-13617-1), please contact:

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More information about working with NASA Goddard's Office of Technology Transfer is available online:
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