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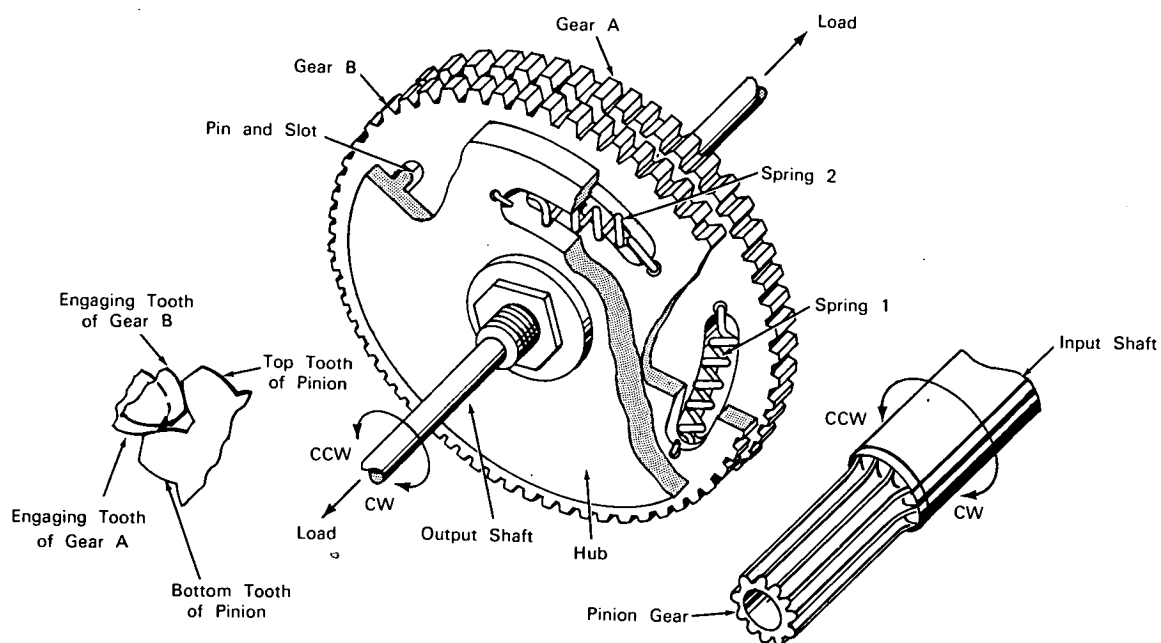
Brief 65-10148

# NASA TECH BRIEF



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## Bidirectional Step Torque Filter Eliminates Backlash



**The problem:** To maintain a constant output torque, free of backlash components, from a pulsating input torque.

**The solution:** Two elastic elements (springs) connecting a hub and two spur gears absorb torque differentials and provide the desired antibacklash characteristics between input and output shafts. The system performs equally well in either direction of rotation.

**How it's done:** The hub is securely attached to the output shaft and the two spur gears turn freely on the shaft. Spring 1 connects gear A to gear B and spring 2 connects gear B to the hub. The input shaft pinion engages both spur gears. Spring 1 forces the engaging

tooth of gear A against the bottom tooth of the pinion and the engaging tooth of gear B against the top tooth of the pinion. This arrangement prevents backlash between the input and output shafts and spring 1 also serves as a torque filter between the two spur gears. When the input shaft is rotated clockwise, its pulsating torque is transferred directly to gear A, which then drives gear B through spring 1. The torque pulsations are filtered by the spring since the pinion does not directly drive gear B in this direction of rotation and gear B is free to rotate slightly with respect to the pinion. The hub and output shaft are then driven counter-clockwise with a smooth, constant torque by a pin in the hub that engages a slot in gear B. When the input

(continued overleaf)

shaft is rotated counterclockwise, it drives gear B directly. In this condition, gear B drives the hub and output shaft clockwise through spring 2, which filters out the pulsations in the input torque.

**Notes:**

1. This system is capable of filtering small angular displacements to less than 1 arc minute (essentially zero).
2. This device should be of interest to manufacturers of precise control systems.
3. Possible configurations and filter materials are limited only by the application desired.

4. Inquiries concerning this invention may be directed to:

Technology Utilization Officer  
Goddard Space Flight Center  
Greenbelt, Maryland, 20771  
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**Patent status:** NASA encourages the immediate use of this invention. It is owned by NASA and inquiries about obtaining royalty-free rights for its commercial use may be made to NASA, Code AGP, Washington, D.C., 20546.

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