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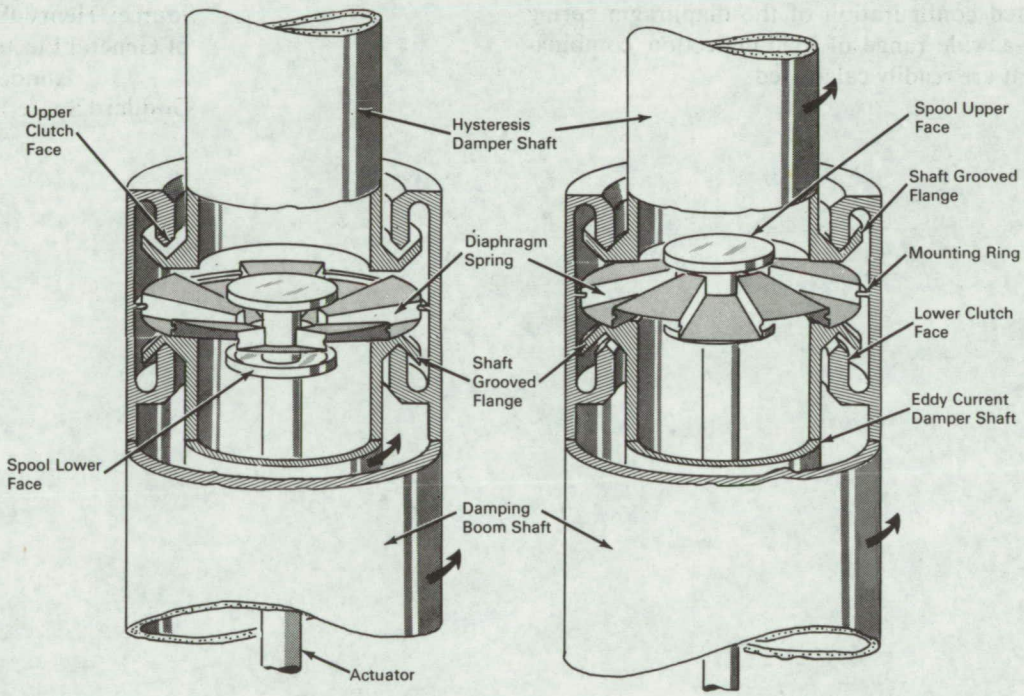
NASA TECH BRIEF

Diaphragm Spring Gives Clutch Over-Center Toggle Effect



The problem:

A requirement existed to alternately couple an eddy-current damper and a hysteresis damper to a single damping boom shaft to test the relative merits of the two dampers. Because of the miniscule damping forces involved it was required that the inoperative damper be completely isolated from the damping boom shaft during test of the other damper.

The solution:

A diaphragm spring clutch mechanism (solenoid actuated) which, when engaged in either direction, is essentially floating and completely free from the actuator and disengaged components.

How it's done:

The diaphragm spring has two stable positions and operates as an over-center toggle. In the left figure, the spring is deflected through center on its mounting ring by the actuator spool upper face so that the spring exerts force on the eddy-current damper shaft thus engaging the lower shaft grooved flange with the lower clutch face of the damping boom shaft. This drives the damping boom shaft with no restraining

(continued overleaf)

external force present since the hysteresis damper shaft is completely disengaged and the actuator spool area is clear due to the over center "throw" of the diaphragm spring.

In transferring torque to the damping boom shaft from the hysteresis damper shaft, the actuator is moved upward so that its spool lower face contacts the diaphragm spring, driving it flat and then over center so it assumes a conical shape as shown in the right figure. This exerts force on the hysteresis damper shaft by engaging the upper shaft grooved flange with the upper clutch face of the damping boom shaft. Thus, the hysteresis damping effect alone is imposed on the damping boom shaft as the eddy-current damper shaft and actuator spool area are completely disengaged.

Notes:

1. The fluted configuration of the diaphragm spring permits a wide range of load-deflection combinations that are readily calculated.
2. The beryllium copper spring is made in a flat (on-center) position and is deflected at assembly in one direction or another since the diameter of the mounting ring is smaller than the free diameter of the flat spring.
3. The V-grooves of the two damper flanges and mating surfaces of the damping boom shaft ensure that the parts will repeatedly engage in a concentric manner and with parallel faces.
4. Inquiries concerning this innovation may be directed to:

   Technology Utilization Officer
   Goddard Space Flight Center
   Greenbelt, Maryland 20771
   Reference: B66-10297

Patent status:

No patent action is contemplated by NASA.

Source: Henry W. Rosenberg
of General Electric Company
under contract to
Goddard Space Flight Center
(GSFC-499)