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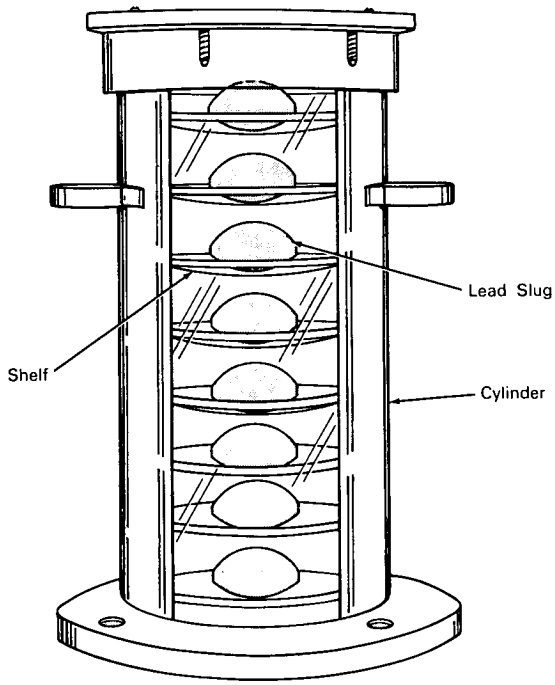
NASA TECH BRIEF

This NASA Tech Brief is issued by the Technology Utilization Division to acquaint industry with the technical content of an innovation derived from the space program.

Viscous-Pendulum Damper Suppresses Structural Vibrations



The problem: The suppression of response of structures to vibratory forces by addition of damping has in the past been difficult to achieve in a controlled manner. Previous methods have involved variation of tension in joints of the structure, wiring the structure to a dash/pot damper, and, in certain applications, coating the structure with an energy-absorbing material. All of these methods have exhibited deficiencies in applications where precise regulation of damping is of importance.

The solution: A viscous-pendulum damper that provides a simple means of varying the damping of structures subjected to horizontal vibrations.

How it's done: The viscous-pendulum damper (VPD) consists of a cylindrical container enclosing an assembly of round trays on which round, loaf-shaped lead slugs rest. When assembled, the VPD is filled with a viscous liquid such as silicone oil or glycerin and attached, with axis vertical, to the structure. The trays have symmetrically concave upper surfaces so that the slugs are free to move in any horizontal direction but are caused by gravity to always seek the center (or lowest) point in each tray. Because the radius of curvature of the trays determines the natural pendulum frequency of the damper slugs, the device may be arranged for either tuned or untuned operation. For tuned operation, the pendulum frequency of

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the VPD is approximately the same as that of the natural mode to be damped in the primary structure. For untuned operation, the VPD pendulum frequency is quite low relative to natural frequencies of the primary structure. The damping efficiency for tuned operation is much higher than for untuned operation; however, when more than one vibration mode in the primary structure is to be damped and the disturbing force consists of a continuous spectrum rather than discrete frequencies, untuned operation is preferred. The amount of damping imposed on the primary structure may be readily varied by changing either the total number of slugs used or the viscosity of the damping fluid.

Notes:

1. The VPD would be useful for reduction of wind-induced vibrations on erected structures such as gantries, smokestacks, electric transmission towers, drilling rigs, or any tall structures exposed to such forces.
2. Inquiries concerning this invention may be directed to:

   Technology Utilization Officer
   Langley Research Center
   Langley Station
   Hampton, Virginia, 23365
   Reference: B64-10272

Patent status: NASA encourages the immediate commercial use of this invention. Inquiries about obtaining rights for its commercial use may be made to NASA Headquarters, Washington, D.C., 20546.

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