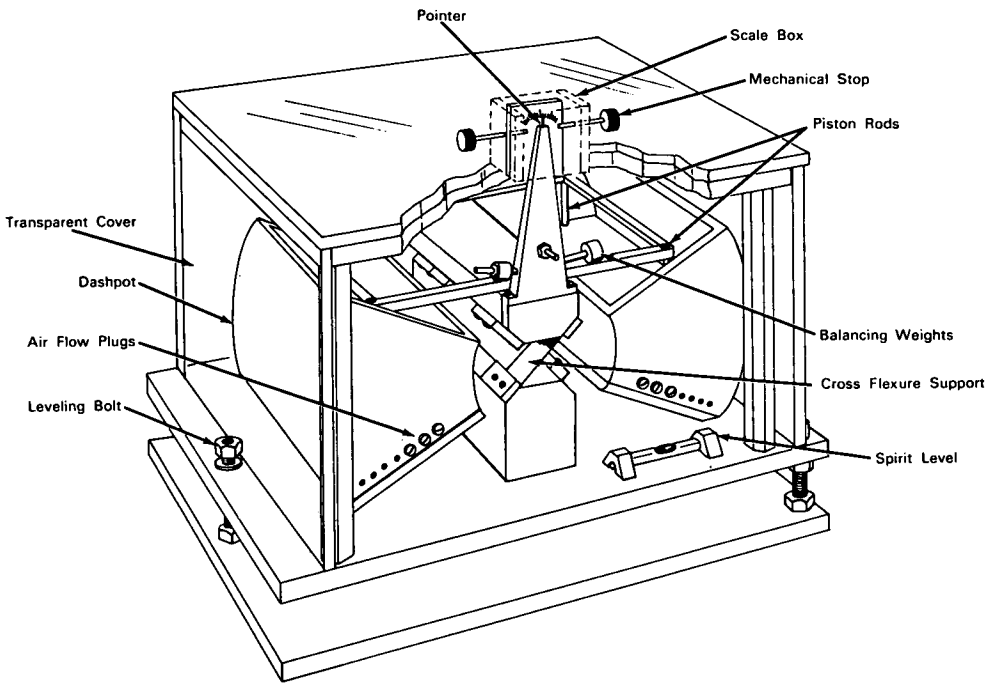
NASA TECH BRIEF

Seismic Transducer Measures Small Horizontal Displacements



The problem: Measuring small horizontal displacements (0.05-inch to 0.5-inch) occurring in a frequency range of less than 1 cps to 3 cps on buildings and other structures subjected to vibration where no fixed reference point is available. The acceleration corresponding to a sinsusoidal frequency of 1 cps and a peak displacement of ±0.25 inch (0.5 inch peak-to-peak) is 0.0125 g. Accelerometers capable of measuring such low accelerations are not readily available. In addition, the acceleration measurements would have to be integrated twice by suitable instrumentation (e.g., an integrating accelerometer) to derive the displacement. The double integration would introduce errors in the displacement measurements involving the complex waves commonly associated with building vibrations.

The solution: A pendular seismic transducer mounted on a 10-inch × 12-inch base plate. The transducer is enclosed in a transparent plastic case to prevent air currents from disturbing the balance of the pendulum.

How it's done: The transducer is essentially an inverted A-shaped pendulum mounted on cross flexure supports (cardan hinges). Horizontal arms extending from the base of the pendulum are bolted

(continued overleaf)

to pistons which move in a push-pull manner inside two air dashpots to damp the oscillation of the pendulum. An indicator scale on the top plate of the case allows direct reading of the instantaneous displacement of the apex of the pendulum from its center position. The relative motion of the pendulum and base, corresponding to displacements produced by mechanical vibrations, is measured by a sensitive rotary differential transformer mounted near the pendulum pivot on the rear side (not shown in the illustration). The transformer is connected to a galvanometer circuit to permit remote reading of the transducer output. All adjustments and calibration of the instrument are made in the laboratory except leveling, which must be done in the field. The pendulum is astaticized by adjusting the position of a pair of screw-mounted balancing weights. Adjustment for optimum damping of the pendulum is made by plugging an appropriate number of holes in the dashpot walls.

Note:

Inquiries concerning this invention may be directed to:

Technology Utilization Officer
Marshall Space Flight Center
Huntsville, Alabama, 35812
Reference: B65-10029

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

Source: Thomas L. Greenwood
(M-FS-81)