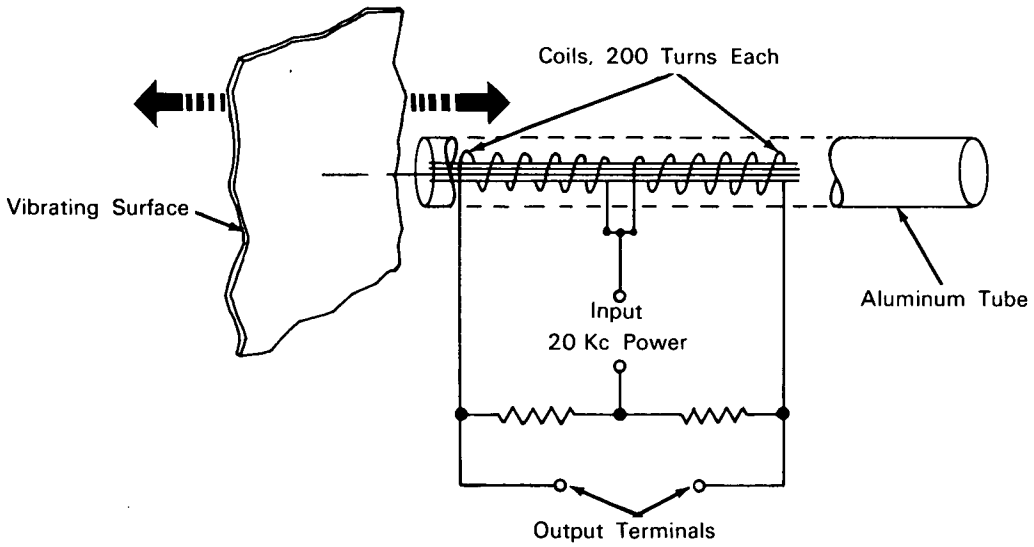
NASA TECH BRIEF

Transducer Senses Displacements of Panels Subjected to Vibration



The problem: Measuring the surface displacements of nonferrous metal panels subjected to vibration or flutter such as produced by high-velocity winds. The transducer to be used for the measurements must not be placed in physical contact with any portion of the test panel.

The solution: An inductive vibration sensor, 0.25 inch in diameter by 2 inches in length, that can be positioned 0.02 to 0.7 inch from the surface of a nonferrous metal panel.

How it's done: The sensor employs a simple circuit consisting of two counter-wound coils on a common core enclosed in an aluminum tube. A bridge circuit is formed by the addition of two resistors of equal value. Electrical power is supplied to the unit by a commercially available 20 kc signal generator. The input and output leads must be individually shielded. The coil at the sensing end, placed in proximity to the test surface, varies in inductance as the surface vibrates. The opposite coil is not affected and serves as a stable reference. The device has a flat frequency response of 1 kc and produces a voltage output which varies approximately as the inverse square of the distance of the sensing end of the coil from the panel surface. Because of the nonlinear characteristic of the sensor, a calibration curve is needed for each position relative to the surface where a null point is established. The device can detect a displacement of 0.00002 inch when it is positioned at 0.05 to 0.1 inch from a surface. When the

(continued overleaf)

device is positioned at a distance of 0.5 to 0.7 inch from the surface, its detection capability decreases to 0.002 inch.

Notes:

1. The sensor can best measure surface displacements in a flat plate of nonferrous metal that is a moderately good electrical conductor and more than 0.005-inch thick. It can also be used to a limited extent for ferrous metals and surfaces of unsymmetrical configuration.
2. Inquiries concerning this innovation may be directed to:

   Technology Utilization Officer
   Ames Research Center
   Moffett Field, California, 93523
   Reference: B65-10085

Patent status: NASA encourages commercial use of this innovation. No patent action is contemplated.

Source: Richard O. Pea
(ARC-37)