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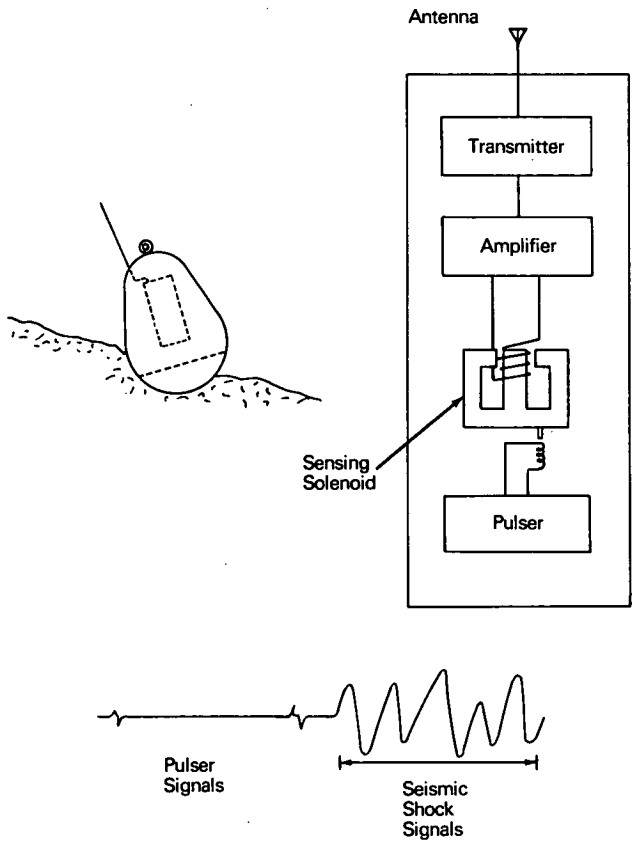
NASA TECH BRIEF

Seismometer Designed for Remote Operation in Random Orientation



The problem:

To design a portable seismometer that can be placed in normally inaccessible locations, as by lowering to the ground from a helicopter or by parachute drop from an airplane, and that will operate efficiently in other than a vertically upright position. The seismometer must be packaged with appropriate telemetry equipment in order to transmit its measurements to a receiving station.

The solution:

A seismometer that is mounted in a rugged housing that contains an amplifier, transmitter, and antenna to relay measurement data to a receiving station. The instrument incorporates automatic angular adjustment

(continued overleaf)

to minimize the effect of angular error between the seismic mass axis and local vertical.

How it's done:

The seismometer responds to local disturbances by measuring the relative movement of its housing with respect to an inertial or seismic mass, and supplying an output voltage proportional to the relative displacement. In operation, shocks to the casing, caused by slight movements of the surface the unit is resting on, cause the case to move in relation to the seismic mass. A sensing solenoid, rigidly held by the case, reacts to the change in plunger-to-coil relationship, and generates a signal. This signal is amplified and fed to a transmitter for relay to a receiving station. The seismometer also incorporates a self-monitoring system that periodically signals the device's operational readiness. This system is made up of a pulser that is timed to feed impulses at regular intervals to a solenoid whose plunger is attached to the base of the seismic mass. This causes the mass to move slightly in relation to the case and a signal is generated in the sensing solenoid. This signal is of slight amplitude and readily distinguished from any generated due to surface disturbances because of its programed repetition rate.

Notes:

1. The seismometer case, in the area of the seismic mass, may be filled with a damping fluid to withstand hard impact. Automatic means may be included to vent the damping fluid following impact.
2. Electronic components in the seismometer package are protected from impact damage by standard potting techniques.
3. This seismometer may be dropped into bores in the earth or lowered to rest on the bottom of a body of water. The only modification required in such cases would be that necessary to maintain electronic system effectiveness.

Patent status:

Title to this invention has been waived under the provisions of the National Aeronautics and Space Act (42 U.S.C. 2457 (f)) to California Institute of Technology, Pasadena, California, 91109.

Source: Francis E. Lehner, et al of
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