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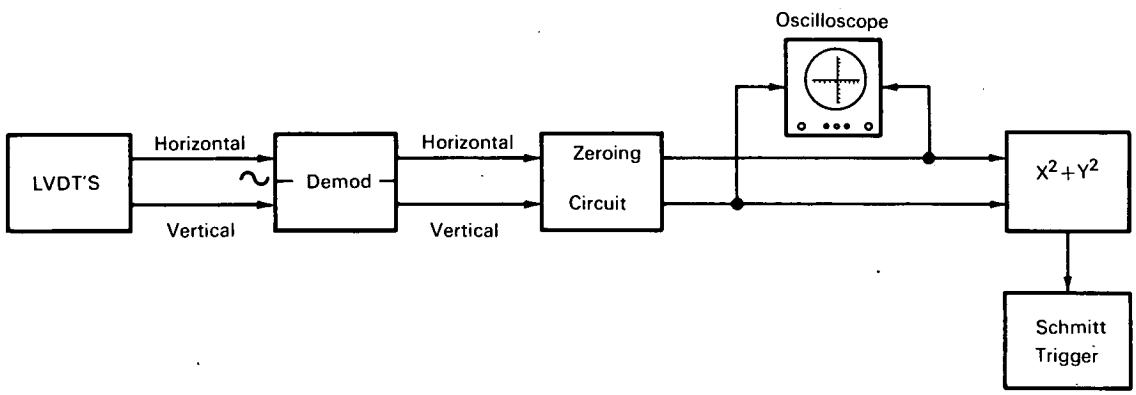
Electronic Skewing Circuit Monitors Exact Position of Object Underwater



The problem:

A long cylindrical capsule is remotely positioned underwater into a cylindrical tube of slightly larger inside diameter than the capsule. The capsule must be guided through a seal and into a tube so that it does not make contact with the tube wall. A device is necessary to remotely monitor the capsule to determine its exact radial position; also it is necessary to automatically stop the positioning if the capsule becomes misaligned.

The solution:

A linear variable differential transformer (LVDT) electronic skewing circuit that detects movement of the capsule from a reference point and provides a continuous signal that is monitored on an oscilloscope.

How it's done:

Two linear variable differential transformers mounted at the insertion end of the tube are used with demodulators to provide X and Y position signals, the voltages of which are proportional to the change in distance from a predetermined reference point. The horizontal and vertical signals are produced as the capsule moves radially from the reference. These signals are fed through a zeroing circuit to the X and Y inputs of an oscilloscope. The vector result of the horizontal and vertical components of the capsule movement then appears on the scope face as a dot which shows the exact position of the capsule within the reactor. The zeroing circuit is used merely to establish the reference position of the dot during calibration.

A standard analog four-quadrant root-mean-squared circuit combines the X and Y signals to produce the vector output if needed. A Schmitt trigger device is activated if movement of the capsule varies by more than a predetermined amount. The trigger output shuts off the drive system until the reason for the variation can be determined and a correction made.

Notes:

1. The system provides x^2 and y^2 which is compared against r^2. The Schmitt alarm is set to trigger at a value slightly less than r^2 of the tube.

(continued overleaf)

2. This technique provides a variety of remote measuring capabilities in addition to the underwater application.
3. A radial positioning accuracy of 0.005 inch has been achieved for a capsule whose O.D. was 8.5 inches ±.02 and a tube whose I.D. was 9.00 inches.
4. Inquiries concerning this innovation may be directed to:

   Technology Utilization Officer
   AEC–NASA Space Nuclear Propulsion Office
   U.S. Atomic Energy Commission
   Washington, D.C. 20545
   Reference: B67-10629

Patent status:

No patent action is contemplated by AEC or NASA.

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under contract to
AEC–NASA Space Nuclear Propulsion Office

(NUC-10146)