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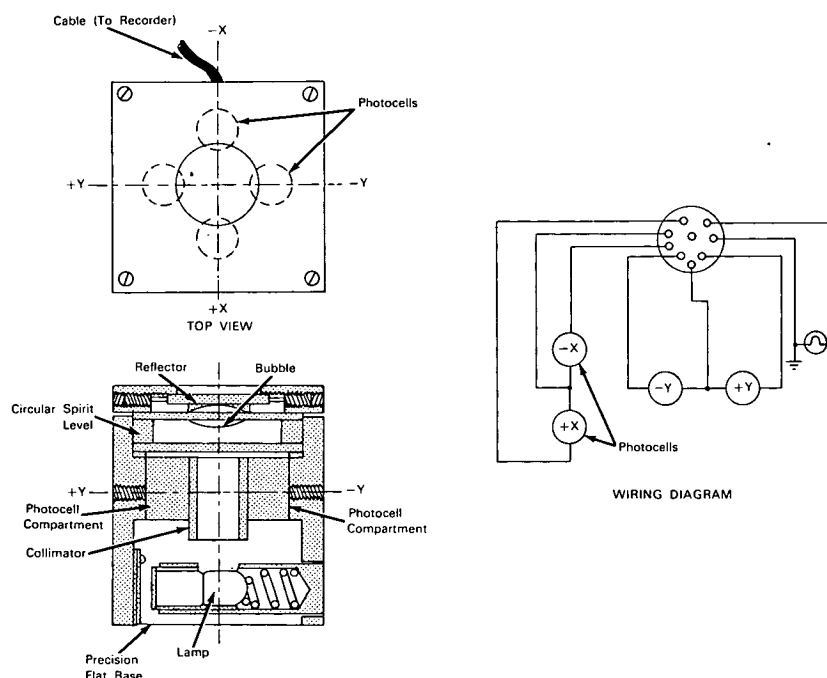
Brief 65-10067

NASA TECH BRIEF



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Sensitive Level Sensor Made With Spirit Level, Gives Electrical Output



The problem: Devising a sensitive two-axis level sensor that will provide an electrical indication of the deviation of the level of a flat surface within ± 15 seconds of arc.

The solution: A sensor incorporating a circular spirit level, a small electrical lamp, and two pairs of photocells connected in a bridge circuit. The sensor is packaged in a $1\text{-}1/4 \times 1\text{-}1/4 \times 1\text{-}1/2$ -inch steel container having a precision flat base which is placed on a horizontal surface to be leveled.

How it's done: The four photocells are mounted at the extremities of two orthogonal reference axes (+x, -x; +y, -y) lying in a plane parallel to the base of the

container. Each pair of oppositely mounted photocells (one pair on the x-x axis and the other pair on the y-y axis) is connected as a half-bridge circuit. The small lamp near the base of the sensor is symmetrically mounted between the photocells. Light from this lamp passes up through a collimator to the circular spirit level and a concave reflector which are symmetrically mounted above the photocells. The bubble in the spirit level and the concave reflector constitute a lens system which reflects light from the lamp to the photocells.

In making a measurement, the base of the sensor is set on a horizontal precision flat surface to be leveled. When the bubble is centered, indicating a level condition, the photocell bridge is balanced and there is

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no electrical output. When the test surface deviates from level by more than ± 15 seconds of arc, the bubble is displaced and different amounts of light are reflected to each of the photocells. As a result, the bridge is unbalanced and puts out a dc error voltage.

Notes:

1. The sensitivity of the device is basically dependent on the geometry of the spirit level.
2. This sensor can be easily converted into an automatic leveling system by incorporating conventional position servos.
3. This device should have application for remote leveling of machinery, automatic leveling of force-measuring instruments, leveling of surveying instruments, and leveling of vehicles in static test orientations.

4. Inquiries concerning this invention may be directed to:

Technology Utilization Officer
Langley Research Center
Langley Station
Hampton, Virginia, 23365
Reference: B65-10067

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: E. L. Bryant
(Langley-49)