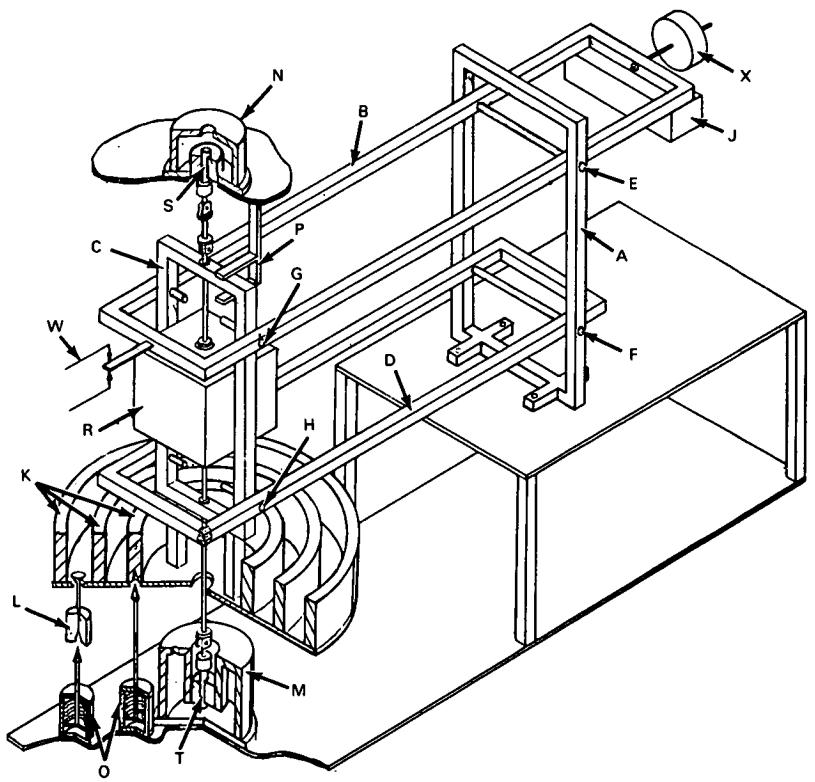
NASA TECH BRIEF

Conceptual Dead Weight Device To Provide Pressure Calibration



The problem:

To develop a pressure calibration system capable of setting accurate pressures in either absolute or gage ranges.

The solution:

A dead weight testing device, using a common force plane piston manometer to set accurate gage pressures in pounds per square inch. An additional piston gage easily adapts the device for absolute pressure calibration.

How it's done:

The basic device, shown in the figure, is a cantilever system, formed by four cast aluminum structures A, B, C, and D. Structure A, externally supported, is connected to B, C, and D by pivot devices (E, F, G, and H). Structures B, C, and D rotate in a small arc

(continued overleaf)

about the pivots in A so that a parallelogram configuration is constantly retained. A set of mechanical stops (P) limits the rotation to approximately one-half inch. Structure B, the lever arm, has a rigid weight (J) and an adjustable counterweight (X) at one end, and a zero referencing assembly (W) at the other.

Structure C contains an electric motor R which, through reduction gear trains, rotates two universal-jointed shafts. These shafts rotate precise area pistons (S and T) in the absolute pressure assembly (N) and gage pressure assembly (M). Attached to a lower extension of structure C is a circular aluminum plate, upon which dead weights K and L are placed or removed by a system of air-controlled lifting devices (O).

In operation of the device, all weights are first removed from the circular plate by the lifting devices. The tare weight or tare pressure in the system is eliminated by adjusting the counterweight until a zero reference is established.

The dead weights are then initially placed on the circular plate. This load, however, is not sensed by the system for the lower mechanical stop prevents the device from rotating with this addition.

To obtain a gage pressure reading, air pressure is applied to the gage pressure assembly. This causes an upward force on the piston gage T, which in turn exerts a force on the thrust bearing of structure C. When the force is sufficient to overcome the dead weight, structure C moves off the mechanical stop. An accurate gage pressure reading is provided at the zero reference by a servo-controlled metering of the pressure to the gage pressure assembly.

To obtain a reading in pounds per square inch absolute, a vacuum is attached to the absolute pressure assembly. The vacuum acts against piston gage S to remove the atmospheric pressure value from the dead weights. The reading is then taken from the zero reference.

Notes:

1. This unique calibration device uses the basic principles of a primary standard, is relatively maintenance free, and is accurate to 0.05%. It is capable of calibrating more than one item during a calibration sequence, is designed to reduce space requirements, and can be used with an automatic readout system.
2. This information should be of interest to manufacturers and users of pressure gages in a variety of fields.
3. Inquiries concerning this innovation may be directed to:

   Technology Utilization Officer
   Marshall Space Flight Center
   Huntsville, Alabama 35812
   Reference: B68-10264

Patent status:

No patent action is contemplated by NASA.

Source: G. Olson and G. Karcher
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