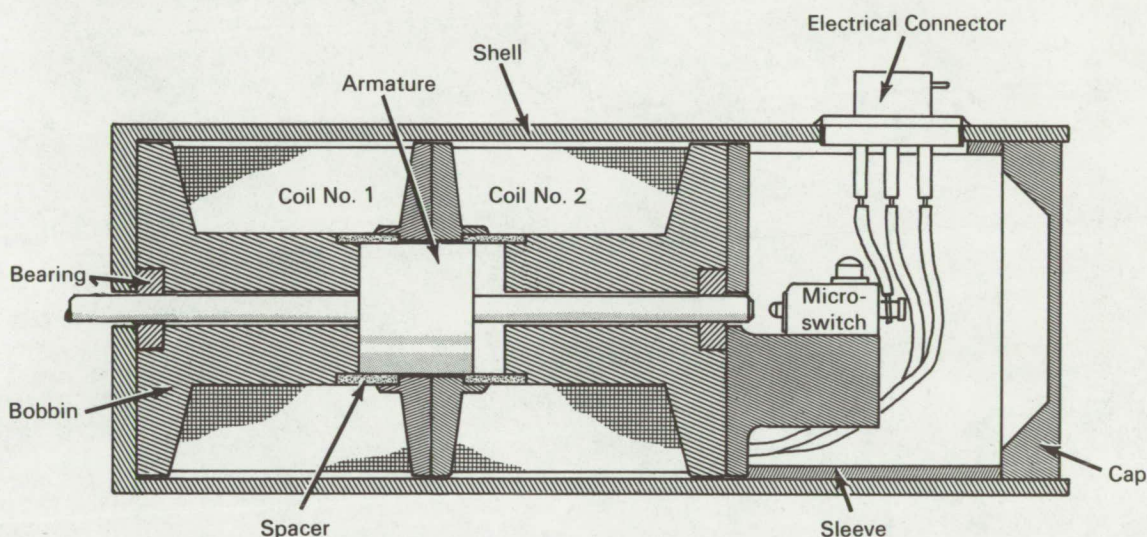


NASA TECH BRIEF



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Residual Magnetism Holds Solenoid Armature in Desired Position



The problem:

To design a holding solenoid that will hold its armature in a desired position without the continuous application of electrical power or mechanical locking devices.

The solution:

A solenoid that utilizes residual magnetism to hold the armature in the desired position after excitation current is removed from the coil.

How it's done:

The solenoid consists of two coils with insulated copper windings; a bobbin, an armature, and a shell made of a material having the desired residual properties (for example, alloy ASTM A-353); brass bobbin spacers; polytetrafluoroethylene bearings; and a sleeve, cap, and switch bracket made of aluminum

or stainless steel. A microswitch may be included to monitor the position of the armature.

When excitation current is applied to coil No. 1 of the solenoid, the armature moves to the position indicated in the illustration. When the current is turned off from this coil, the residual magnetic field in the magnetic circuit (linking the bobbin, armature, and shell) will hold the armature in position as long as desired. The armature can be released from this holding position by applying current to coil No. 2 or exerting a mechanical force on the armature shaft that is greater than the residual magnetic force. When the armature is moved from its equilibrium (holding) position, the residual magnetic field essentially disappears. The armature can then be moved in either direction by applying current to the appropriate coil.

(continued overleaf)

Notes:

1. Although this solenoid consumes no electrical power in the hold position and eliminates the need for mechanical locking devices, it has a low tolerance to armature displacements from the equilibrium position. Such displacements destroy the residual magnetic field. The solenoid should therefore not be used in a vibration environment, without suitable modification.

2. Inquiries concerning this innovation may be directed to:

Technology Utilization Officer
Lewis Research Center
21000 Brookpark Road
Cleveland, Ohio 44135
Reference: B67-10038

Patent status:

No patent action is contemplated by NASA.

Source: R. P. Crawford
of General Dynamics
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Lewis Research Center
(Lewis-343)