United States Patent [19]

Remington

[11] **3,813,622**

[45] **May 28, 1974**

[54] **AXIAL MOTION MAGNETICALLY ACTUATED SWITCH**

[76] Inventor: **Richard C. Remington,** 10 Van Riper Ave., Pompton Plains, N.J. 07444

[22] Filed: **Jan. 9, 1973**

[21] Appl. No.: **322,107**

[52] **U.S. Cl.** **335/151**

[51] **Int. Cl.** **H01h 51/28**

[58] **Field of Search** 335/151, 152, 153, 154, 335/205, 206, 207, 196, 202, 259, 265

[56] **References Cited**

UNITED STATES PATENTS

2,840,661	6/1958	Ducati	335/154
2,905,784	9/1959	Ducati	335/154
3,008,019	11/1961	Scheidig	335/208
3,236,964	2/1966	Sommer	335/203 X
3,377,576	4/1968	Langberg et al.	335/196
3,525,060	8/1970	Scheidig	335/153

Primary Examiner—Roy N. Envall, Jr.

[57] **ABSTRACT**

An axial motion switch which consists of a magnetic material armature attached to an end cap of a sealed vessel by means of a spring, flexible contact wire, or the like. The other end of the sealed vessel is provided with a magnetic, internally extended end cap which forms a pair of contacts with the free end of the armature. The two end caps are electrically insulated from each other by using a vessel of insulating material, such as glass or a metal vessel suitably insulated from the end caps. When the vessel is placed in a magnetic field of correct orientation, the armature is attracted axially by mutual magnetic pole induction to the internally extending end cap and the contact therebetween causes a low electrical resistance path to exist between the end caps of the switch device.

1 Claim, 3 Drawing Figures

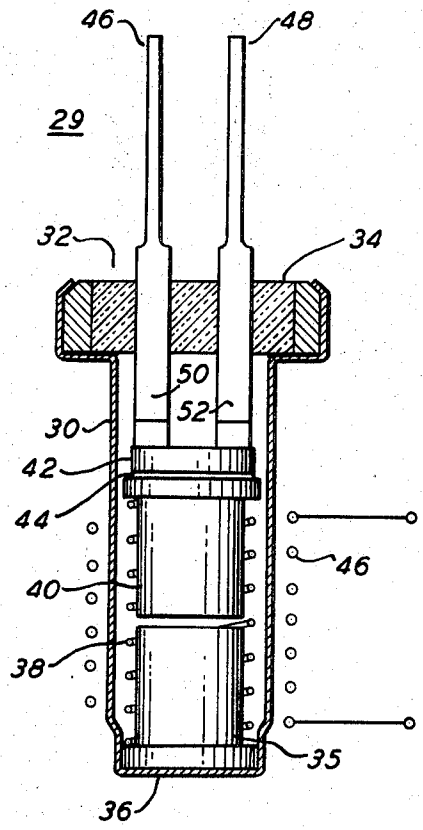


FIG. 1

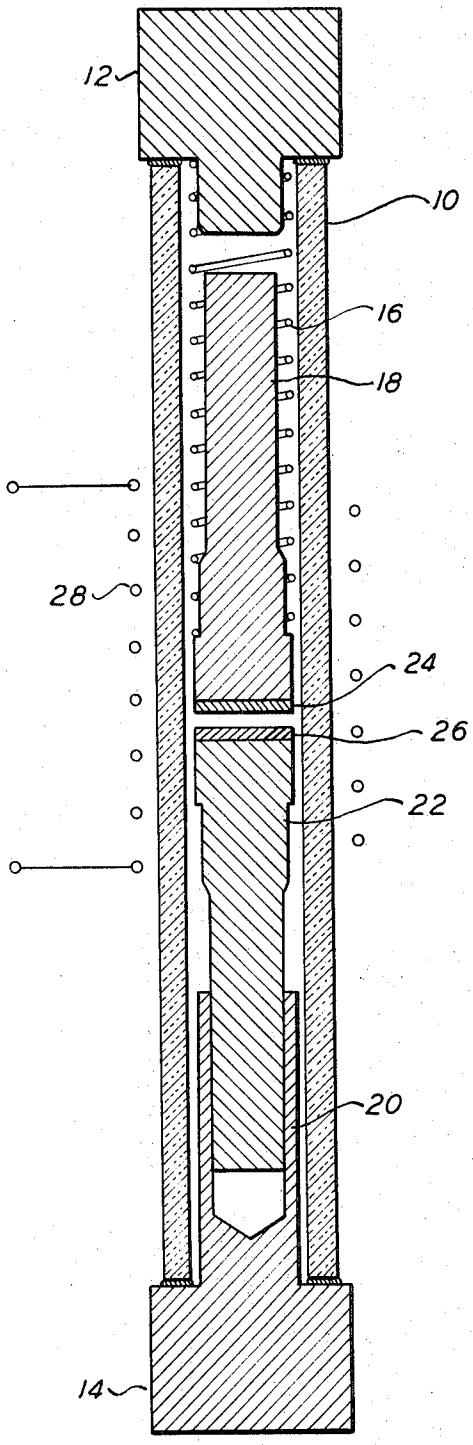


FIG. 2

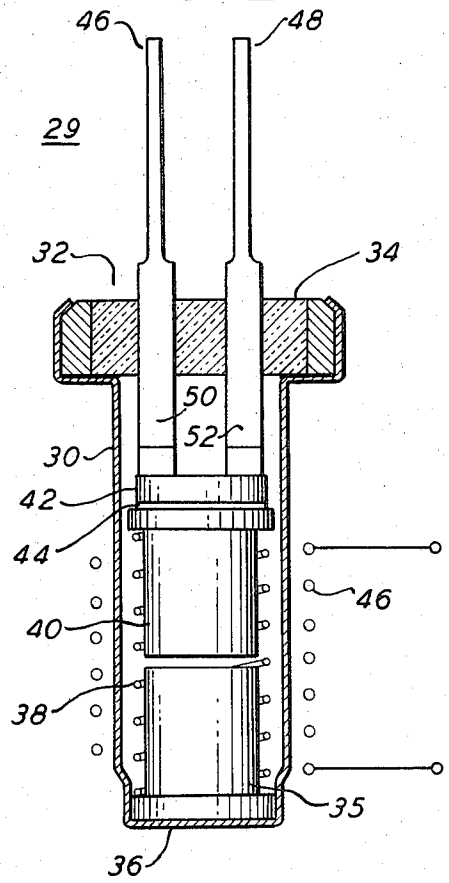
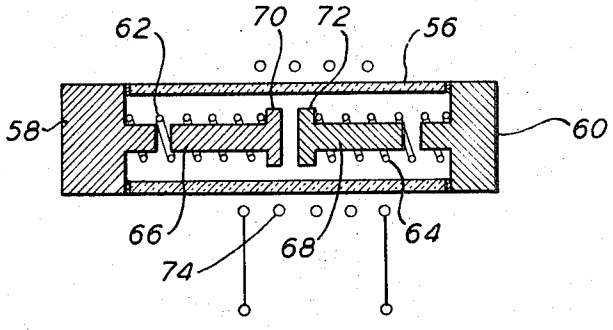


FIG. 3



AXIAL MOTION MAGNETICALLY ACTUATED SWITCH

BACKGROUND OF THE INVENTION

1. Field of the Invention

The present invention relates generally to a circuit closing device and more particularly to a circuit closing device in which the circuit closing elements themselves are of magnetic material enclosed in a hermetically sealed vessel so that when placed in a magnetic field of proper orientation the contacts are subject to induced magnetic forces of opposite polarity and wherein at least one of said circuit closing elements is axially actuated to close the circuit.

2. Description of the Prior Art

The present circuit closing device relates to switching devices for controlling electrical circuits such as a reed type switch wherein two paddle shaped reeds sealed in a glass tube containing inert gas overlaped each other and are spaced slightly apart. When the device is placed in a magnetic fidld of propdr pol[r orientation, the two reeds are brought into contact by magnetic attraction and close an electrical circuit. The motion of the reeds is in a direction that parallels the diameter of the glass tube. Although this type of switch is particularly useful for controlling electrical circuits, it is relatively expensive to manufacture in that generally the reed type switch must be manufactured by hand or, if by automatic machines, on a "one at a time" basis. In addition, the physical configuration and resulting close tolerances of the reed switch make the unit too expensive for many applications.

SUMMARY OF THE INVENTION

It is, therefore, an object of the present invention to provide a circuit closing device of the above type which can be fabricated or manufactured at reduced cost while maintaining the effectiveness and durability of the switch as well as reliability in operation. It is a futher object of the present invention to provide a low cost circuit closing device with hermetically sealed contacts wherein at least one of said contacts is magnetically actuated in an axial motion to make contact and close the circuit. Toward the fulfillment of these objects, the circuit closing device of the present invention comprises a switch structure that eliminates the complicated mechanical and magnetic structures of the prior art with a structure comprising a simple pair of magnetic contacts which perform both the magnetic and electrical functions necessary to an electromagnetic circuit closing device. The utilization of magnetic material for the contacts eliminates the utilization of magnetic armatures so that the contacts are directly actuated by the magnetic field.

BRIEF DESCRIPTION OF THE DRAWINGS

Reference is now made to the accompanying drawings for a better understanding of the nature and objects of the present invention. The drawing illustrates the best mode presently contemplated for carrying out the objects of the invention and are not to be construed as restrictions or limitations on its scope.

IN THE DRAWINGS

FIG. 1 is a sectional view of an axial motion switch in accordance with a preferred embodiment of the invention;

FIG. 2 is a sectional view of another example of an axial travel switch which is normally closed;

FIG. 3 is a sectional view of a further clarification of the form of the invention.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

Referring to FIG. 1, 10 is a glass vessel in which non-magnetic end caps 12 and 14 have been sealed at opposite ends. To the end cap 12 is secured a spring or flexible contact wire 16 which supports an armature 18 at its free end, non-magnetic end cap 14 is provided with an internally extending flange 20 in which is supported a pole 22 of magnetic material. Armature 18 is provided with suitable noble metal in contact area 24 as is pole 22 at its contact surface 26. The envelope 10 may contain any suitable inert gas or any other appropriate non-corrosive gas.

The armature 18 and the pole 22 are appropriately mounted within the envelope so that they may close an electric circuit with the contact of surfaces 24 and 26. An energizing coil 28 connected to a suitable source of current is provided surrounding the envelope so when appropriately energized electro-magnetic lines of force act on the armature 18 and pole 22 to have them attract to each other and contact at 24 and 26 to thereby close an electric circuit between the end caps 12 and 14.

In brief, the axial motion switch 10 when exposed to a magnetic field generated by the energizing coil 28 subjects the armature 18 and pole 22 to induced magnetic forces of opposite polarity and the armature 18 overcomes the retractile force of the spring 16 and moves axially to make contact with the pole 22. When the magnetic field is removed, the spring 16 returns to its original position and the continuity from the end cap 12 and the end cap 14 is open. In the preferred embodiment, the coil 28 is energized with an appropriate amount of d.c. current to cause the armature 18 to overcome the retractile force of the spring 16; if desired, the energizing coil may be replaced by a bar or toroidal magnets which would serve a similar purpose.

FIG. 2 shows a switch device 29 with an envelope 30 having an opened end 32 provided with a glass header 34 suitably mounted therein to provide an hermetic seal between the glass header and the envelope 30. A pole 35 is attached or fixed to a base 36 on which is secured a coil spring 38. An armature 40 is mounted on the free end of the coil spring so that the armature is axially spaced from the pole 35 to provide a predetermined contact gap therebetween. Fixed to the armature 40 is a bridging contact 42 which is insulated from the armature by a suitable insulation spacer 44, a pair of connectors 46 and 48 are mounted in the glass header 34 so that their respective end portions 50 and 52 are in contact with the bridging contact 42. The ends of the connectors are provided with a suitable plating of nickel, welded tungston, or silver cadmium oxide as required by the particular application of the switch device 29.

An energizing coil 54 is provided so that when the coil is energized with a suitable d.c. current the armature 40 and the pole 35 are subjected to induced magnetic forces of opposite polarity and the armature overcomes the retractile force of the spring 38 to come in contact with the pole 35. In this manner, the bridging

contact **42** attached to the armature **40** no longer contacts the connector ends **50** and **52** so that the circuit between the connectors **46** and **48** is opened. When the switch device **29** is no longer magnetically actuated, the armature **40** will become subject to the spring force and move away from the pole **35** and the bridging contact **42** closes the circuit between the connectors **46** and **48.**

FIG. **3** shows an envelope **56** provided with end caps **58** and **60** which are fabricated of non-magnetic material. The end caps **58** and **60** are provided with flange portions integral therewith on which are mounted springs **62** and **64,** respectively. An armature device **66** is mounted on the spring **62** secure to the end cap **58** and another armature device **68** is mounted on spring **64** attached or mounted on end cap **60.** The armatures **66** and **68** are provided with contact ends **70** and **72,** respectively. An energizing coil **74** is suitably mounted adjacent the envelope **56** so that when energized, the armatures **66** and **68** are subject to induced magnetic forces of opposite polarity and the armatures overcome the retractile force of their respective springs **66** and **68** and move toward each other to make contact. Where larger contact gaps or immunity from shock and vibration are required in an axial motion switch, the double armature device of FIG. **3** is ideally suited so that under the forces of shock or vibration, the armature **66** and **68** will move in phase and eliminate the possibility of any contact problems.

While the present invention has been described in preferred embodiments, it will be obvious to those skilled in the art that various modifications can be made therein within the scope of the invention and it is intended that the appended claims cover all such modifications.

What is claimed is:

1. A circuit closing device operable by magnetic forces, comprising a metal envelope having an opened end, a glass header mounted within said opened end to provide a hermetic seal between said glass header and said envelope, a pole mounted within and secured to the base of said envelope, a coil spring secured at one end to said pole, an armature mounted on the free end of said coil spring and axially spaced from said pole, an insulation spacer mounted on one end of said armature opposite the end axially spaced from said pole, a bridging contact mounted on said insulation spacer, a pair of connectors mounted in said glass header and having connector ends within said envelope in contact with said bridging contact, an energizing coil provided surrounding said envelope and connected to a source of current so when energized said armature overcomes the retractile force of said spring to contact said pole and axially displace said bridging contact from said connector ends to open the circuit between said pair of connectors.

* * * * *