Dec. 19, 1967 J. B. THATCHER 3,359,515

MINIATURE RELAY

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Fig. 1

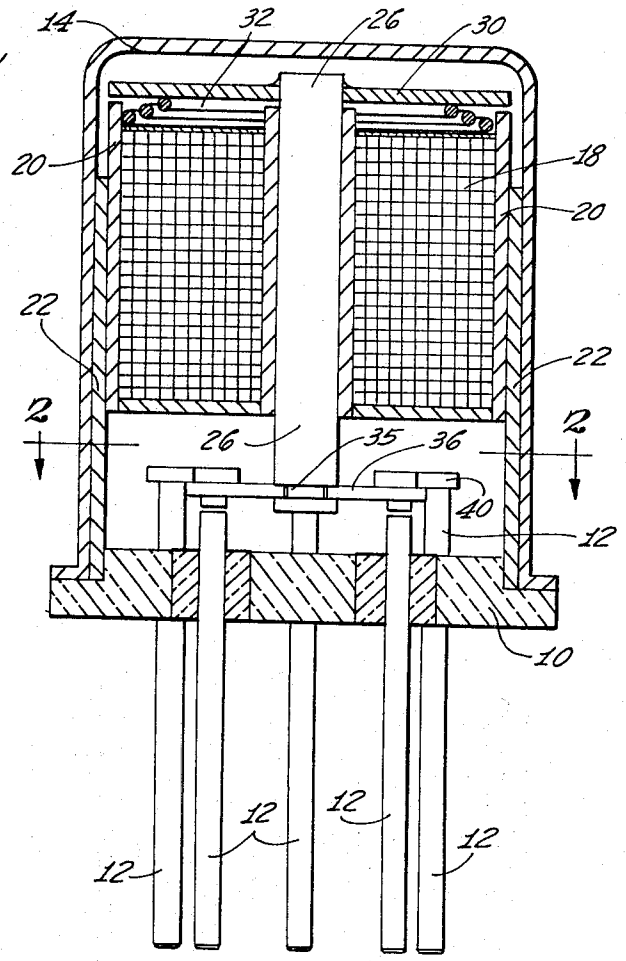
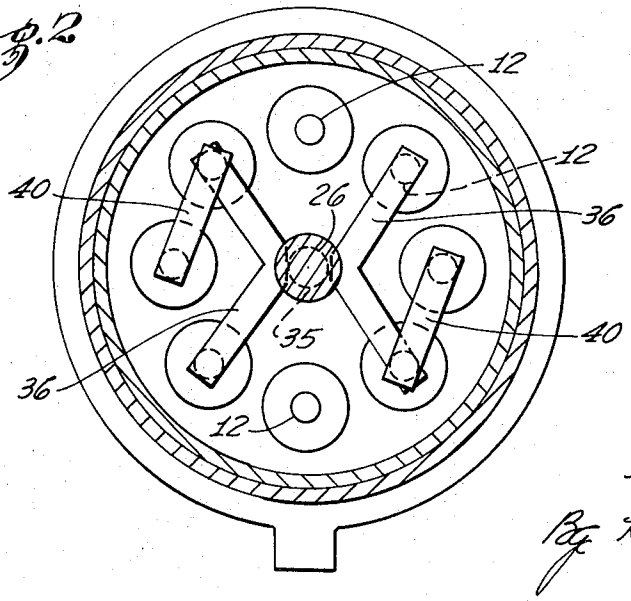


Fig. 2



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MINIATURE RELAY

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ABSTRACT OF THE DISCLOSURE

A miniature relay is described herein which includes one or more movable contact members, each of which are operated by a common armature on a lever principle. The relay is constructed so that small movement of the relay armature results in a relatively large movement of the movable contacts with respect to the fixed contacts of the relay. The relay described is of the miniature type, and is particularly adapted for operation in a gas tight envelope.

The present invention relates to electric switching devices; and it relates more particularly to an improved miniature relay which is adapted for operation in a gas-tight envelope which may, for example, contain a pressurized inert gas so as to inhibit contact arcing.

The miniature relay to be described is particularly adapted for multiple-contact, double-throw operation. A particular feature of the relay is that it may include one or more movable contact members which are operated by a common armature on a lever principle. The operation is such that a small movement of the relay armature results in a relatively large movement of the movable contacts.

The above-mentioned feature permits the magnetic components of the relay to operate with relatively small gaps in the magnetic circuit, and yet achieve relatively large movement of the movable contacts, so that contact spacing can be relatively large.

This means that a relatively small magnetic field can be used to operate the relay and yet achieve relatively large contact spacing. The relay, therefore, can exhibit maximum voltage switching capabilities and yet require minimum operating power.

Another feature of the improved miniature relay of the invention is that it requires a minimum number of moving parts; and it requires no journaled, or relatively expensive components.

A principal objective of the invention, therefore, is to provide an improved relay with multiple-contact, double-throw capabilities; which relay can be constructed readily and inexpensively, requires relatively few and simple parts, and yet operates with a high degree of efficiency and is capable of switching relatively high voltages.

Another object of the invention is to provide such an improved relay which is small in size, light in weight, and rugged in its construction.

Yet another object of the invention is to provide such an improved miniature relay which is capable of withstanding relatively intense shocks and vibrations.

A still further object of the invention is to provide such an improved relay which is reliable in operation over long periods of time and throughout wide temperature ranges.

Other objects, features and advantages of the invention will become apparent from a consideration of the following description, when the description is taken in conjunction with the acccompanying drawing, in which:

FIGURE 1 shows a side sectional view of one embodiment of the invention; and

FIGURE 2 is a cross sectional view taken substantially along the line 2—2 of FIGURE 1.

The improved relay of the present invention, as illustrated in the drawing, includes a base, or header 10. The header 10 may be formed of a ceramic material, or it may be metal. A plurality of rigid terminal pins 12 extend through the base 10.

When the base 10 is composed of a conductive material, appropriate insulating bushings are provided for each of the terminal pins.

As shown in FIGURE 1, the terminal pins extend beyond the upper side of the base 10 and into the interior of the relay. The relay itself is enclosed, for example, by a casing, or envelope, 14. The casing 14 may be affixed to the base 10 by welding, bonding, or by any other appropriate means.

As indicated above, the interior of the casing 14 may be filled, for example, by a pressurized inert gas, such as argon, helium or neon. Such an inert gas inhibits arcing of the contacts within the relay, and prolongs contact life.

An electric coil 18 is supported within the casing 10, the coil being enclosed in a magnetic housing 20. The housing 20 and enclosed coil may be supported on the base by means, for example, of a tubular support member 22. The tubular support member may be secured to the base 10 in any appropriate manner. The magnetic housing 20 may be welded, or otherwise affixed, to the tubular support member.

An insulated rod 26 is slidable within the coil 18. The rod 26 extends perpendicular to the plane of the base 10, and it moves in a direction perpendicular to the base between a first position and a second position.

A disc 30 of magnetic material is secured to the upper end of the rod 26. The disc 30 extends parallel to the base 10, and over the coil 18. As shown in FIGURE 1, the upper end of the magnetic housing 20 is open, and the magnetic disc 30 extends over the open upper end of the housing.

A coil spring 32 is interposed between the disc 30 and the top of the coil 18, so that the disc is normally biased away from the upper edge of the magnetic housing 20. Appropriate stop means (not shown) is provided to limit the upper movement of the rod 26 and disc 30.

It will be appreciated that the rod 26 forms the armature for the relay unit. When the coil 18 is de-energized, the spring 32 biases the disc 30 away from the upper edge of the magnetic housing, so that a small gap appears in the magnetic circuit. However, when the coil 18 is energized, the resulting magnetization of the magnetic housing 20 draws the disc 30 down against the upper edge of the housing, so as to close the housing. When this occurs, the armature 26 moves down to its lower position.

A notch 35 is formed adjacent the lower end of the armature 26. A V-shaped elongated resilient movable contact strip 36 is secured to one of the terminal pins 12, so that the particular terminal pin forms a common contact for the relay. The movable contact 36 has an intermediate portion which is engaged in the notch 35 in the armature 26. The resilient movable contact 36 also has a free end which spans over the top of a second one of the terminal pins 12 and is normally spaced from the upper end of that pin.

When the coil 18 is energized, so as to move the armature 26 to its lower position, the armature moves the movable contact 36 downwardly, so that its free end contacts the last-mentioned terminal pin 12. Therefore, the first-mentioned terminal pin is selectively connected to the last-mentioned pin by the movable contact, when the relay is energized and de-energized.

An elongated fixed contact 40 may be affixed to a third terminal pin 12, and this latter fixed contact extends over the top of the free end of the movable contact 36 and

is normally engaged thereby. The movable contact **36** is caused to dis-engage the fixed contact **40** when the relay is energized and the contact **36** is caused to engage the aforesaid second terminal pin **12**.

Therefore, a single-pole, double throw action is achieved by the switching components of the relay described above. As illustrated, similar switching components may be provided on the opposite side of the relay, so that a double-pole, double-throw effect may be achieved. Likewise, other movable contacts can be arranged around the notch **35** in the armature **26**, so that a multiple-pole effect may achieved.

It will also be appreciated that the notch **35** engages each of the movable contacts **36** at an intermediate point, so that a lever effect is achieved. This means that a relatively small movement of the armature **26** results in a relatively large movement of the free end of the movable contact **36**. Thus, the gap between the magnetic disc **30** and the mangetic housing **30** may be relatively small, and yet the gaps between the movable and fixed contacts may be relatively large. Therefore, the relay can be designated to switch relatively high voltages, and to accomplish this with a minimum of magnetic force.

The invention provides, therefore, an improved miniature relay which may be constructed in a simplified and inexpensive manner. The improved relay of the present invention is small in size and light in weight. Yet it is extremely rugged in its construction, and is capable of reliable operation.

It will be appreciated that although a particular embodiment has been shown and described, modifications may be made. It is intended to cover all modifications of the invention in the appended claims.

What is claimed is:

1. An electric switching unit including: a base; means for supporting an electrical energizing coil on said base; an insulated rod slidable in said coil perpendicular to the plane of said base and forming an armature for the unit, said insulated rod having a notch formed therein adjacent the the lower end thereof; a magnetic member affixed to said rod and magnetically coupled to said coil so as to cause said rod to move in a first direction perpendicular

to the plane of said base to a first position when said coil is energized; biasing spring means for causing said rod to move in a second direction perpendicular to the plane of said base to a second position when said coil is de-energized; a plurality of rigid terminal pins extending through said base; and an elongated resilient movable contact having a V-shaped strip-like configuration affixed to one of said terminal pins and having a free end spanning a second of said terminal pins, said movable contact having an intermediate portion extending into said notch in said insulated rod and engaging said insulated rod to be moved thereby, so that the free end of said movable contact selectively contacts said second terminal pin as said rod moves between said first and second positions.

2. The switching unit defined in claim **1** in which said coil is surrounded by a magnetic housing having an open upper end, and in which said magnetic member is a disc secured to the upper end of said insulated rod and extending over the open end of said housing parallel to the plane of said base, said disc being normally spaced from the upper edge of said housing to be drawn to said upper edge and close said housing when the coil is energized.

3. The switching unit defined in claim **1** and which includes a fixed contact affixed to a third of said terminal pins and extending over the free end of said movable contact to be engaged thereby when said free end is moved out of engagement with said second terminal pins.

4. The switching unit defined in claim **1** in which said magnetic member is a disc secured to the upper end of said insulated rod and extending over said coil parallel to the plane of said base; and in which said biasing spring means is a coil spring interposed between said disc and said coil.

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