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2,833,882

SHOCKPROOF RELAY

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FIG. 1

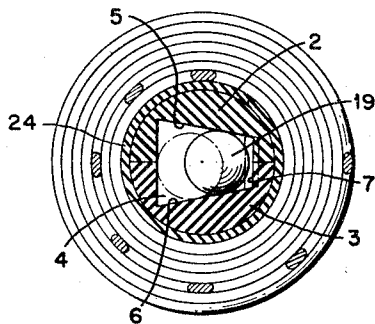
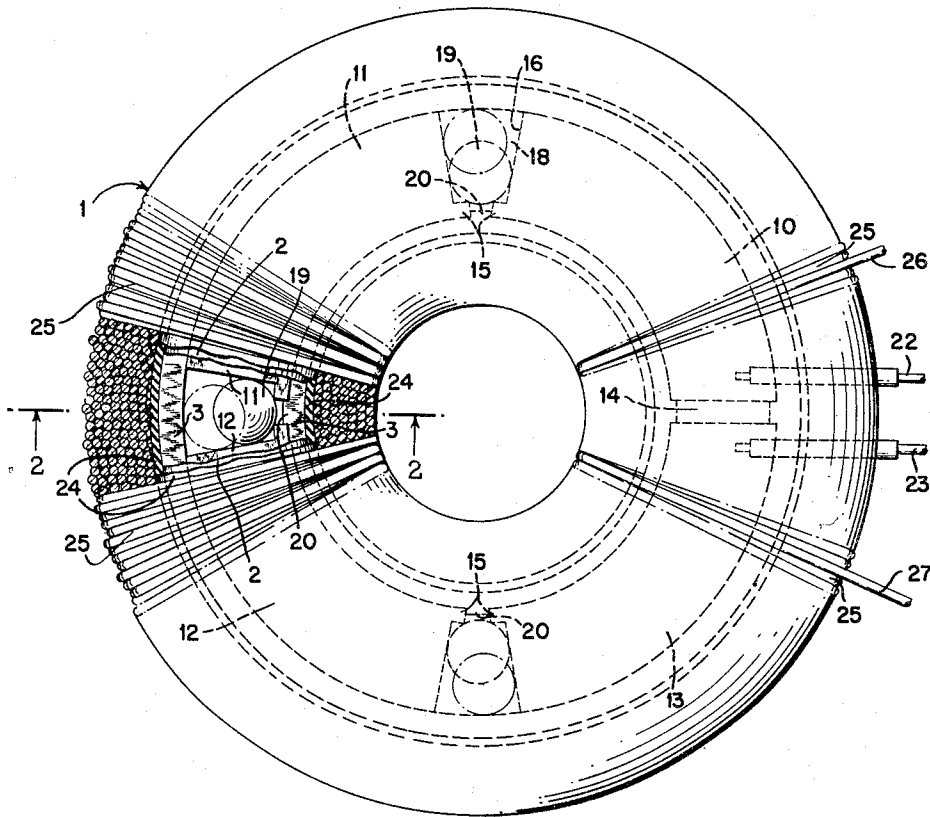


FIG. 2

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SHOCKPROOF RELAY

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4 Claims. (Cl. 200—87)

This invention relates to electromagnetic devices and more particularly to electromagnetic relay and switching devices.

Electromagnetic relay and switching devices used in locations where they would be subjected to vibration and shock frequently fail in the performance of their designated functions. Such devices, if designed to be held closed, will inadvertently open or, if designed to be held open, will close due to the effect of shock or vibration upon the movable elements in the device.

Therefore, it is an object of this invention to provide an electrically operated relay or switching device which will not fail when it is subjected to the most severe conditions of shock or vibration.

Another object of this invention is to provide an electrically operated relay or switching device, the construction of which provides for a device wherein the flux losses are a minimum and the forces of the same are a maximum.

A further object of this invention is to provide an electrically operated relay or switching device which is rapid in response to energization current.

Another object of this invention is to provide an electrically operated relay or switching device which is so constructed that it operates equally well in any position.

Other objects of the invention will be pointed out in the following description and claims and illustrated in the accompanying drawings, which disclose, by way of example, the principle of the invention and the best mode, which has been contemplated, of applying that principle.

In the drawings:

Fig. 1 is a plan view of the improved switching device with parts broken away to facilitate illustration.

Fig. 2 is a sectional view taken on line 2—2 in Fig. 1.

Referring to the drawings it will be noted that the improved switching device, generally designated 1, is in the form of a torrid but it must be appreciated that the invention may assume other physical configurations without deviating from the spirit of the present invention.

The switching device comprises a pair of annular members 2 and 3 which are of a semi-circular shape in cross section, as shown in Fig. 2. The flat faces of the members are cut away so as to provide an annular space 4 when the members are arranged one upon the other as shown. It will be noted that the space 4 on planes extending radially of the member 1 is bounded by surfaces 5 and 6 which flair outwardly from an inner surface 7. Any suitable insulating material, such as plastic or hard rubber, may be used in making the members 2 and 3.

Arranged within the space 4 are arcuate contact segments 10, 11, 12, and 13 made of a magnetic material. Each of these segments in cross section has substantially the same shape as the space 4 and fits snugly within this space. The ends of the segments 10 and 13 adjacent to each other are separated by insulating material 14 which may, for example, be plastic formed integral with the

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plastic members 2, 3, and project from the latter into the space 4. The other ends of the segments 10, 13 and both ends of the segments 11 and 12 are provided with projecting portions 15 at their inner edges. The remainder of each segment end is bounded by a plane surface 16 extending radially of the members 2 and 3. It will be noted that the surfaces 16 on adjacent ends of the segments cooperate with each other and with the surfaces 5 and 6 to form a pocket 18 which increases in cross sectional area in proportion to the radial distance from the center of the members 2 and 3.

Arranged within each pocket 18 is a ball shaped contact element 19 made of magnetic material and engageable with the projecting portions 15 on the segments to connect the latter electrically with each other. Regardless of the position in which the switching device is placed one or more of the contact elements 19 will tend to move outwardly from the projecting portions 15 by the force of gravity. When the switching device is in a horizontal plane, the contact elements will all tend to roll outwardly on either surface 5 or 6. When arranged in a vertical plane, at least one of the contact elements will tend to roll outwardly on one of the surfaces 16.

In order to prevent the contact segments from moving longitudinally relative to each other there are provided plastic portions 20 formed integral with the members 2, 3 and projecting into the space between the portions 15 on the contact segments. Care must be taken to make the portions 20 of such dimensions that they do not interfere with the seating of the contact elements. Fixed to the contact segments 10 and 13 near their adjacent ends are terminals 22 and 23 which project outwardly through openings between the members 2 and 3.

The structure so far described is assembled by placing the contact segments in their proper positions between the projecting plastic portions on either the member 2 or 3. The contact elements 19 are then placed in the member between the surfaces 16 on the contact segments and the other annular member is placed on the first. An insulating material 24, such as rubber or friction tape, is wrapped about the members 2 and 3 for holding them together. Turns of wire 25 are then made about the taped members as shown, and the ends 26, 27 of the wire extend outwardly for connection to a suitable energizing means.

In operation, the terminals 22 and 23 are connected in a circuit which is to be closed in response to an energizing of the wire turns 25. With the turns deenergized, at least one of the contact elements 19 moves outwardly under the force of gravity and breaks the circuit through the contact segments. When the turns are energized, the lines of force produced cause the contact elements to move inwardly into engagement with the projecting portions 15 and complete the circuit from the terminal 22 through the contact segments and the contact elements 19 to the terminal 23.

Upon deenergizing the wire turns 25, a residual magnetism exists and tends to hold the contact elements 19 in engagement with the projecting portions 15. To prevent this, a thin layer of silver is plated on the contact elements so that the reluctance to the lines of force at the points of contact between the contact elements and the portions 15 is sufficiently great to assure movement of the contact elements away from the projecting portions when the wire turns are deenergized. The contact elements may, if desired, be plated with any non-magnetic metal other than silver. It is only necessary that the metal used be a good conductor of electricity. The non-magnetic metal could be plated, if desired, on the end of the contact segments instead of the contact elements.

While there have been shown and described and pointed out the fundamental novel features of the in-

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vention as applied to a preferred embodiment, it will be understood that various omissions and substitutions and changes in the form and details of the device illustrated and in its operation may be made by those skilled in the art without departing from the spirit of the invention. It is the intention therefore, to be limited only as indicated by the scope of the following claims.

What is claimed is:

1. A switching device comprising in combination, an annular casing of insulating material, contact segments arranged in said casing and spaced from each other, terminals connected to the adjacent ends of two of said segments and projecting outwardly through said casing, the other ends of said segments having plane surfaces extending radially of said casing and cooperating with each other and said casing to form outwardly flared pockets, ball shaped contact elements arranged in said pockets and engageable with the adjacent ends of said contact segments when moved inwardly within said pockets, and wire turns wrapped about said annular casing for producing, when electrically energized, a magnetic force to move said ball elements inwardly within said pockets.

2. A switching device comprising, in combination, an annular casing of insulating material, contact segments arranged in said casing and spaced from each other, portions on said casing projecting into the spaces between said segments for holding the latter against longitudinal movement relative to each other, terminals connected to the adjacent ends of two of said segments and projecting outwardly through said casing, the other ends of said segments having plane surfaces extending radially of said casing and cooperating with each other and said casing to form outwardly flared pockets, portions on said segments projecting from the ends of the latter toward each other at the inner ends of said pockets, ball shaped contact elements arranged in said pockets, and engageable

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with said projecting portions of said segments when moved to the inner ends of said pockets and wire turns wrapped about said annular casing.

3. The switching device of claim 2 in which there are four contact segments cooperating with each other and said casing to form three pockets spaced 90° or more from each other.

4. A switching device comprising, in combination, a pair of annular plastic members recessed at one side and cooperating with each other to form a casing, contact segments of magnetic material arranged in said casing and spaced from each other, portions on said annular members projecting inwardly between said segments for holding the latter against longitudinal movement relative to each other, terminals connected to the adjacent ends of two of said segments and projecting outwardly through said casing, the other ends of said segments having plane surfaces extending radially of said casing and cooperating with each other and said casing to form outwardly flared pocket, ball shaped contact elements of magnetic material arranged in said pockets and engageable with the adjacent ends of said contact segments when moved inwardly within said pockets, a coating of non-magnetic material on said contact elements, and wire turns wrapped about said casing.

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