April 1, 1969 G. E. PERREAULT 3,436,698

RELAY HAVING IMPROVED CONSTRUCTION

Filed March 30, 1967

FIG. 1

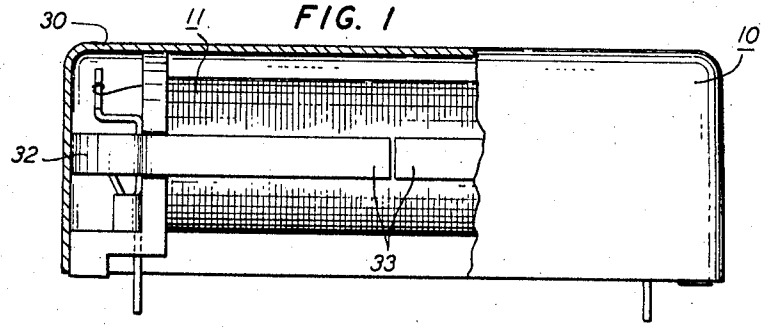


FIG. 2

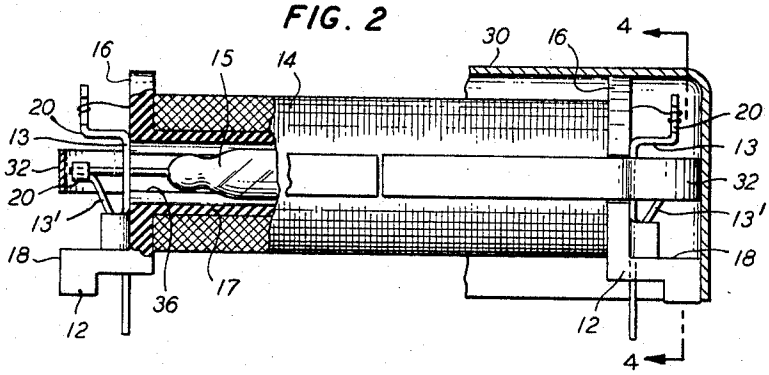
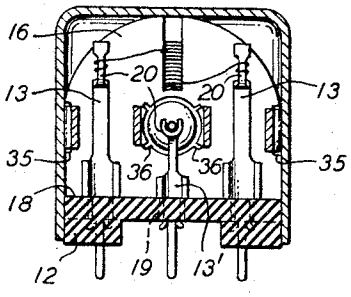


FIG. 4



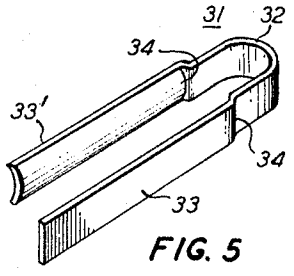
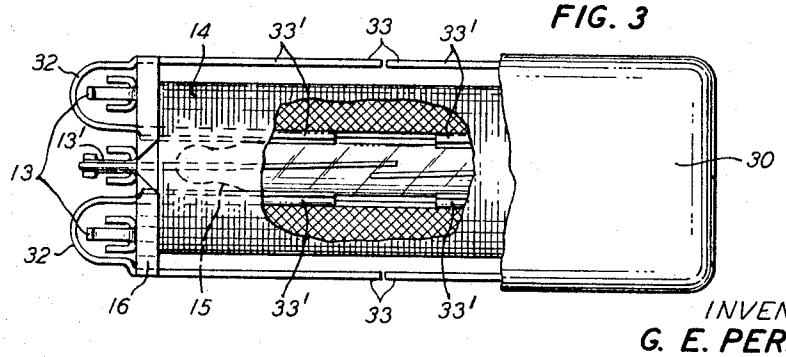


FIG. 5

FIG. 3



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RELAY HAVING IMPROVED CONSTRUCTION

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U.S. Cl. 335—154 8 Claims

ABSTRACT OF THE DISCLOSURE

A relay comprising a relay switching assembly, a magnetic cover and magnetic return path members. The relay switching assembly uses a coil and sealed contacts and is capable of independent operation. The return path members magnetically couple the operative elements in the relay while performing mechanical functions.

BACKGROUND OF THE INVENTION

Field of the invention

This invention relates to sealed contact relays and especially to those in which the supporting component is a bobbin.

Description of the prior art

Sealed contact relays generally comprise a switching element, a coil, terminals, a support for joining the switching element, coil and terminals together and a cover for protection and shielding. In relays to which this invention applies, the switching element contains one or more sealed contact units. Either dry contact switches or mercury contact switches are used. The coil provides the magnetic flux to operate the switching element, while the terminals provide support and appropriate electrical paths for the coil and the switching element.

SUMMARY OF THE INVENTION

According to a preferred embodiment of this invention, a sealed contact relay comprises a switching element, a coil, a plurality of terminals, a support, a magnetic cover and a plurality of magnetic return path members. The support is a hollow bobbin having an L-shaped flange at each end and a winding section in the middle. The coil is wound on the winding section, the terminals are mounted in the L-shaped flanges, and the switching element is disposed in the hollow of the bobbin and supported by the terminals.

The magnetic cover fits over the bobbin and the return path members bracket the L-shaped flanges and have two legs joined by a U-shaped end section. The U-shaped end section provides mounting space for selected terminals, while the legs are positioned adjacent the coil and switch element, respectively, to increase the magnetic coupling between the two.

BRIEF DESCRIPTION OF THE DRAWING

FIG. 1 is an elevation view of an embodiment of this invention with parts broken away to show interior details;

FIG. 2 is an elevation view of the interior of the embodiment shown in FIG. 1 with selected portions broken away to show detail;

FIG. 3 is a plan view of the embodiment shown in FIG. 1 with selected parts broken away and selected parts shown in phantom to illustrate detail;

FIG. 4 is an end section taken along the line 4—4 of the embodiment shown in FIG. 2;

FIG. 5 is a perspective view of a return path member.

DETAILED DESCRIPTION

A relay **10** embodying this invention is illustrated in

FIG. 1. The relay **10** comprises three basic elements, viz., a relay switch assembly **11**, a cover **30** and a plurality of return path members **31**.

The relay switch assembly **11** is a subassembly which comprises a support **12**, terminals **13**, a coil **14**, and a switch element **15**. The relay switch assembly **11** is the operative part of the relay **10** and can even function effectively by itself. As a help in understanding the nature of the relay switch assembly **11**, each of its components is separately described below in detail.

The support **12**, as illustrated in FIG. 2, is a bobbin comprising two end flanges **16** and a central portion **17**. The central portion **17** extends between the two end flanges **16** and is hollow so as to form a tunnel through the entire support **12**. The end flanges **16** each have a platform portion **18**. Each platform portion **18**, as illustrated in FIG. 4 has one or more apertures **19**. The bobbin structure is conveniently made of nylon.

The central portion **17** functions as a winding base for the coil **14**. The coil **14** supplies the magnetic flux which operates the relay **10**. It terminates on selected terminals **13**, and the end flanges **16** are slotted, as shown in FIGS. 3 and 4, so as to facilitate the passage of the coil ends from the winding portion to the terminals **13**.

The terminals **13** are made of an electrically conducting material such as brass. They divide naturally into upper and lower portions. As can be seen in FIG. 4, each lower portion fits into an aperture **19** while each upper portion serves generally as an electrical connecting point.

The upper portion of each terminal **13** includes a projection, or tab, **20**. In one case, the projection **20** extends generally parallel to the platform portion **18**, while in another, it extends generally perpendicular to the platform portion **18**. In both cases, however, the projections **20** facilitate electrical connections. In the former, viz., the central terminals **13'** best seen in FIGS. 3 and 4, the projections **20** also provide a positioning support for the switch element **15**. In fact, the switching element **15** is entirely supported and positioned between opposite terminals **13'** and within the support **12** by two of the projections **20**.

In the embodiment illustrated herein, the upper portions of the terminals **13** extend either straight up from the surface of the platform portion **18** or are bent at about a 45 degree angle. The bend simplifies manufacture and the angle can be adjusted from 45 degrees to any other angle required by changing circumstances.

The switching element **15** is the last component of the relay switch assembly **11**. As illustrated in FIG. 2, it contains a single conventional reed switch. It need not, however, be restricted to only one switch; two or more switches can readily be used. Moreover, the switches themselves can be of different types, viz, reed switches or mercury switches.

The components just described, when joined together, form the relay switch assembly **11**. To complete the relay **10** the relay switch assembly **11** is combined with the magnetic cover **30** and the magnetic return path members **31**.

The cover **30** functions principally to provide physical protection. It is made of a magnetic material, however, and cooperates with the magnetic return path members **31** to improve the use of available magnetic flux. In the embodiment illustrated herein, the cover is made of a low reluctance magnetic material such as annealed cold-rolled steel.

The magnetic return path members **31** are made of annealed Permalloy and have a low magnetic reductance. Their principal function is to improve the magnetic coupling between the coil **14** and the switch element **15**.

As shown in FIG. 5, each of the magnetic return path members **31** comprises a U-shaped end section **32** and

two parallel legs 33 and 33' joined to the end section 32 by a pair of shoulders 34. When positioned on the support 12, the legs 33 and 33' bracket portions of an end flange 16 and the central portion 17. As shown in FIG. 4, the periphery of the end flange 16 includes a pair of notches 35. One shoulder 34 on each magnetic return path member 31 engages a notch 35 when in place.

Similarly, each end flange 16 includes a pair of notches 36 disposed adjacent to the opening leading into the hollow part of the central portion 17. The notches 36 are illustrated in FIG. 4 and are adapted to engage the remaining shoulder 34 on the magnetic return path member 31. When the shoulders 34 are engaged by the notches 35 and 36, the magnetic return path member 31 is held in position with respect to the support 12.

As shown in FIG. 3, when the magnetic return path member 31 is in place, the U-shaped end section 32 is disposed around one of the terminals 13. As a result, the terminal 13 has increased protection from physical injury.

The two legs 33 and 33' on each magnetic return path member 31 are of different lengths. When installed, as shown in FIG. 3, the two outer legs 33 of opposite magnetic return path members 31 practically abut while the inner legs 33' have a space between their ends. The inner spacing forces flux from the coil 14 to concentrate in the contacts of the switching element 15.

The shape of each magnetic return path member 31 helps to improve flux usage. Specifically, the shorter leg 33' as shown in FIG. 5 has a curvature adapted to fit the curved side of the switching element 15. The close fit between the two saves spaces and improves the magnetic coupling between the leg 33' and the switching element 15. The remaining leg 33 is flat so as to lie along the magnetic cover 30. As the magnetic cover 30 has a low magnetic reluctance, coupling is improved between the magnetic cover 30 and the coil 14. Finally, as shown in FIGS. 1 and 2, the end section 32 is positioned so as to abut the magnetic cover 30. As a result, still more of the magnetic return path member 31 is in contact with the magnetic cover 30 thereby further improving magnetic coupling. Thus, the magnetic coupling between the elements in the operative magnetic circuit of the relay 10 is improved.

When the relay 10 is operated, the coil 14 induces a magnetic flux. The magnetic flux surrounds the coil 14 and passes through the central portion 17 of the bobbin. The cover 30 and the legs 33 of the return path members 31 form a preferred path around the coil 14 while the legs 33' direct the flux in the central portion 17 of the bobbin into a specific part of the switching element 15. As a result, the available flux is concentrated in the operative portions of the relay 10.

Test results comparing the operating characteristics of relays show that the magnetic return path members 31 increase the sensitivity of the relay by a factor of two to one.

Finally, the relay 10 is particularly suited for use with printed circuit boards. The terminals 13 mounted opposite each other in opposite end flanges 16, for example, are aligned with each other. Similarly, the spacings between the terminals 13 in the same end flange 16 are all equal. Thus, when the relay 10 is assembled, it can readily be arranged to fit the integral mounting multiples found in standard printed circuit boards.

In summary, a relay has been disclosed herein which exhibits markedly improved characteristics. While only one embodiment has been disclosed, it is to be understood that it is merely illustrative of the principles of this invention and those skilled in the art will readily be able to construct other embodiments which fall within the scope of the invention.

What is claimed is:

1. In a switching device, the combination comprising:
- a relay switch assembly including a hollow support, a switching element mounted in the hollow of said support, terminals mounted at the ends of said support, and a coil wound around the middle of said support;
- a skirted cover mounted on said support to encapsulate said switching element, terminals and coil; and
- metallic return path members for concentrating magnetic flux from said coil in said switching unit, each of said return path members being attached to said relay switch assembly and having an end section extending from one end of said support and pressing against the skirt of said cover whereby the magnetic coupling between said cover and said coil is improved and spaces are provided at the ends of said support for the mounting of terminals.

2. The combination in accordance with claim 1 wherein each return path member includes two parallel legs, a U-shaped end section and two shoulders for joining said legs to said U-shaped end section and for positioning said return path on said support.

3. The combination in accordance with claim 1 wherein said return path members include two legs, one of said legs being positioned adjacent said switch unit and being curved to follow the contour of said switch unit whereby the efficiency of flux usage is improved.

4. The combination in accordance with claim 1 wherein said support has a flange at each end.

5. The combination in accordance with claim 4 wherein each flange includes a platform portion for mounting said terminals.

6. In a switching device the combination comprising:
- a support adapted to accept a magnetic cover and having two L-shaped flanges separated by a hollow winding portion;
- a plurality of terminals projecting from said L-shaped flanges;
- a magnetic flux generating coil wound on said winding portion and connected to at least two of said terminals;
- a switching unit operatively responsive to magnetic flux from said coil, said switching unit being disposed in the hollow of said winding portion and supported at each end by a leadout element resting on one of said terminals; and
- a plurality of return path members wherein each return path member brackets a portion of said support and is adapted to concentrate magnetic flux from said coil in said switching unit, said return path members each including two parallel legs disposed along opposite sides of said winding portion, an end section, and two shoulders for joining said legs to said end section and for positioning the return path member on a flange, each end section adapted to fit around one or more terminals on said flanges and to be positioned by the cover when placed on said support.

7. The combination in accordance with claim 6 wherein said end section is U-shaped.

8. In a relay, the combination comprising:
- a support having two ends with a flange on each end and a tunnel extending continuously through said support from end to end, each of said flanges having a platform portion with at least one aperture therein;
- a control coil wound on said support structure between said flanges;
- terminals mounted in said apertures in said platforms with an upper portion and a lower portion of each terminal extending, respectively, above and below said platform portion, each of said upper portions having a projection thereon extending parallel to said platform portion;
- a switching element having leadout elements extending from each end thereof, said switching element being suspended within said tunnel between a pair of positioned terminals with said leadout elements mounted on the projections on said terminals; and
- return path members attached to said support, each of

said return path members having a low magnetic reluctance and including two parallel legs joined by a U-shaped end section, each of said legs being disposed inside of said tunnel adjacent to said switching element and said end section being disposed around one of said terminals.

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