March 7, 1967 L. D. LAKE 3,308,407

COMPACT ELECTROMAGNETIC RELAY

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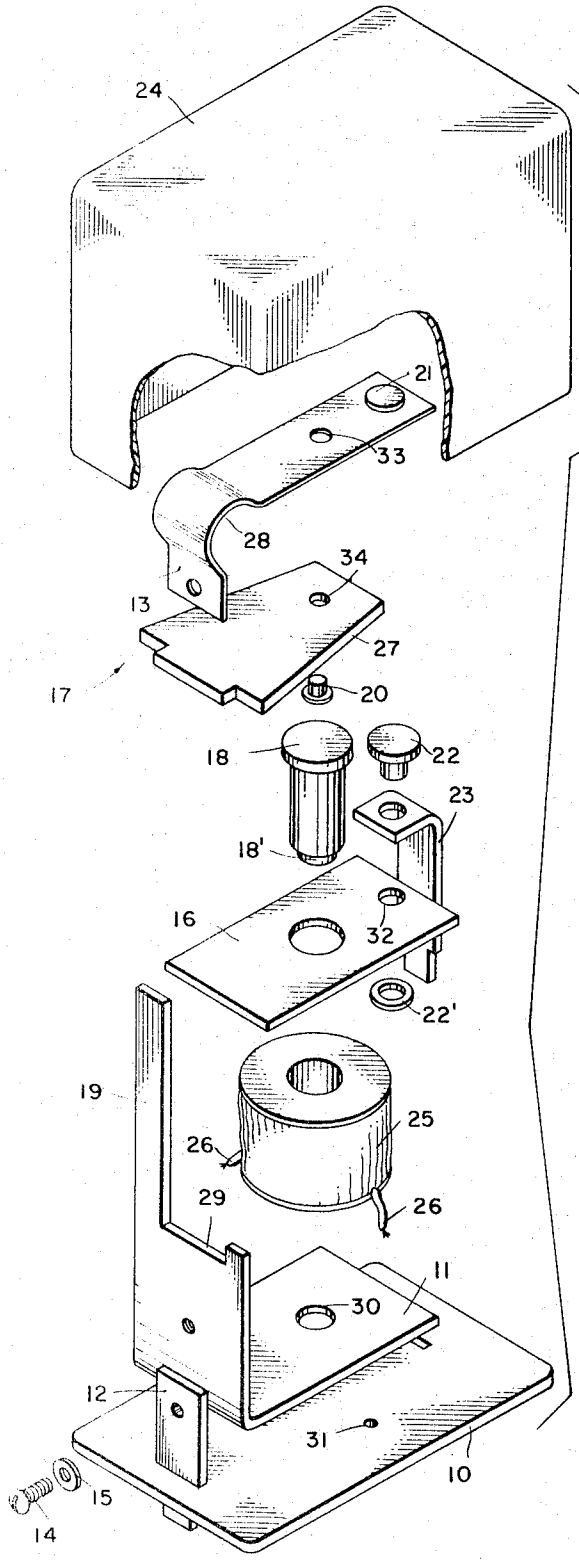

FIG. 2

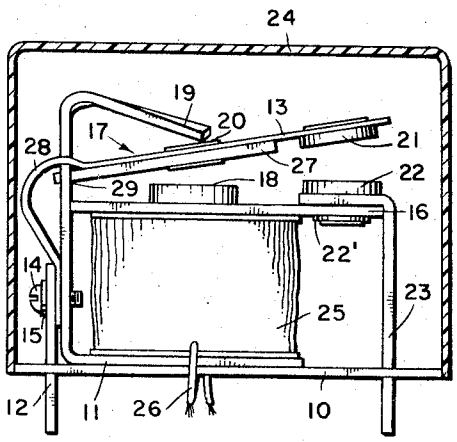

FIG. 1

INVENTOR.
LELYN D. LAKE
BY Robert Lerner
ATTORNEY

United States Patent Office

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COMPACT ELECTROMAGNETIC RELAY

Lelyn D. Lake, Carmel, Ind., assignor to P. R. Mallory & Co., Inc., Indianapolis, Ind., a corporation of Delaware

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The present invention relates to electromagnetic switching devices and more particularly to the means and method for providing an improved construction for such devices.

Although electromagnetic switching devices, commonly called relays, have been used for years, it is difficult to obtain such a device which is small, inexpensive, and which can reliably handle relatively high current switching jobs. The present invention meets these requirements.

There is presented herein a relay having a fixed contact member, a movable contact member, a coil, a magnetic circuit for moving an armature, and a spring member for biasing said armature to a deenergized position. The spring member of the relay also carries the movable contact member and is, therefore, a current carrying member. Terminal members are securely connected to the fixed contact member and to the spring member so as to eliminate the problem of having current flow through hinged, pivoted, or soldered joints as is common in contemporary relays.

Other features of the relay of the present invention will be discussed in the following paragraphs.

It is an object of the present invention, therefore, to provide a small, high current capacity relay which is economical to manufacture.

It is another object of the present invention to provide a relay wherein current does not have to flow through a hinged, pivoted, or soldered joint.

It is another object of the present invention to provide a relay having a flat metallic spring for biasing the armature of said relay against a stop and for carrying a contact for which it is a current carrying member.

It is another object of the present invention to provide a relay having a bobbin would coil and associated magnetic circuitry for moving an armature when said coil is energized, thereby contacting a movable and a fixed contact.

It is another object of the present invention to provide a relay having a movable contact member supported on a spring member which is also the current carrying member for said contact member.

The present invention, in another of its aspects, relates to novel features of the instrumentalities described herein for teaching the principal object of the invention and to the novel principles employed in the instrumentalities whether or not these features and principles may be used in the said object and/or in the said field.

Other objects of the invention and the nature thereof will become apparent from the following description considered in conjunction with the accompanying drawings and wherein like reference numbers describe elements of similar function therein and wherein the scope of the invention is determined rather from the dependent claims.

For illustrative purposes, the invention will be described in conjunction with the accompanying drawings in which:

FIGURE 1 is a side view of the relay of the present invention.

FIGURE 2 is an exploded perspective view of the relay of the present invention showing the cooperative arrangement of all of the components.

Generally speaking, the present invention is a relay comprising: a base; a magnetic frame having a first portion in contact with said base, a second portion extending substantially perpendicular to said base, and a third portion bent down from said second portion so as to restrain an armature of said relay; said armature being pivotally mounted on said second portion of said magnetic frame; a spring member connected to said armature and to said magnetic frame so as to bias said armature against said third portion of said magnetic frame; a first contact member fastened to said spring member; a terminal member fastened to said spring member so as to be electrically connected to said first contact member; a coil disposed between said armature and said first portion of said magnetic frame; a magnetic pole piece located in the center of said coil and in contact with said first portion of said magnetic frame; a second contact member insulatively fastened to said coil so as to be contacted by said first contact member when said coil is energized; and a terminal member affixed to said second contact member.

Referring now to the drawing, and particularly to the side view of FIGURE 1, the component parts of the relay of the present invention can be visualized in conjunction with the following description. The base plate **10** is the main support for the relay and can be fabricated of any suitable insulating material. A frame **11** of any suitable magnetic material is held flat to the base plate **10** in a manner that will be discussed in the following paragraphs. A terminal member **12** and the spring member **13** are affixed to the frame **11** by means of the screw **14** and the washer **15**. The screw **14** is threaded into the frame **11**. There is an insulating member or top plate **16** which is secured to the coil **25** by the pole piece **18**. The frame **11** is bent down at the portion **19** in a direction towards the top plate **16**. There is an armature assembly **17** comprised of the armature **27**, the spring member **13**, the rivet **20** and the contact **21**. The bent end portion **19** of the frame **11** establishes the maximum travel of the armature assembly **17**. Thus, said bent end portion **19** is a stop means for the armature assembly **17**. Attached to the top plate **16** is the fixed contact **22** and the terminal member **23**. It will be noted that the contact **22** is riveted over at the bottom to hold the terminal member **23** to the top plate **16**. Both of the terminal members **12** and **23** extend down through apertures in the base plate **10**. There is a cover **24** over the relay of the present invention which is cemented to the base plate **10**. A pair of leads **26** provide a means for energizing the coil **25**.

It can be seen that the spring member **13** is bent at the portion **28** to provide a spring bias for the armature assembly **17**. It can also be seen that the current path from the terminal member **12** to the movable contact **21** is continuous through the spring member **13** which is securely held to the terminal member **12** by the screw **14**. Hence, there are no hinged, pivoted, or soldered joints for the current to flow through as is the case in contemporary relays.

The armature **27** pivots in the frame **11** at the pivot point **29** which provides a means for aligning the armature **27** to the pole piece **18**.

Referring now to FIGURE 2, a more complete understanding of the relay construction can be obtained. The pole piece **18** has a small end portion **18'** which extends through the hole **30** in the frame **11** and is riveted over to secure the coil **25**, and top plate **16** to the frame **11**. The leads **26** extend through the holes **31** in the base plate **10** to provide an external means for energizing the coil **25**. The contact **22** extends through the hole **32** in the top plate **16** and is riveted over the washer **22'** to secure the terminal member **23** to the top plate **16**. The rivet **20** extends through the hole **33** in the spring member **13** and the hole **34** in the armature **27** to secure the armature to the spring member **13**.

The relay of the present invention is designed to be mounted to a printed circuit board by inserting the terminal members 12 and 23 into appropriate cut-outs and soldering. A threaded hole in the end portion 18' of the pole piece 18 could be provided for mounting the relay to any desired bracket.

It will be noted that the relay of the present invention is adapted to provide a heavy direct current capacity in a relatively small package. The contacts 21 and 22, the terminal members 12 and 23, and the spring member 28 are oversized with the respect to the balance of the structure to provide the current carrying capacity. A sample relay has been constructed in conformance with the illustrated embodiment of this specification to carry 30 to 50 amperes. The sample relay mentioned above was approximately 1½ inches long, 1 inch wide, and 1¼ inches high. The method of connecting the movable contact 21 directly to the terminal member 12 via the spring member 13 facilitates the carrying of high current.

The magnetic circuit of the relay comprised of the coil 25, the frame 11, the armature 27, and the pole piece 18 provides an efficient means for closing the contacts 21 and 22. The metallic components of the above mentioned magnetic circuit are constructed of high permeability iron or steel. Thus, a relatively small amount of power derived from an electronic control circuit can switch a relatively high current.

The operation of the relay of the present invention is similar to that of relays of this character and, therefore, need not be further discussed in this specification. That is, the coil 25 is energized to attract the armature assembly 17 to close the contacts 21 and 22.

The relay of the present invention, as hereinbefore described in one of its embodiments, is merely illustrative and not exhaustive in scope. Since many widely different embodiments of the present invention can be made without departing from the scope thereof, it is intended that all matter contained in the above description and shown in the accompanying drawing shall be interposed in illustrative and not in a limiting sense.

What is claimed is:

1. A relay comprising: a base; a magnetic frame having a first portion in contact with said base, a second portion extending substantially perpendicular to said base, and a third portion bent down from said second portion so as to restrain an armature of said relay; said armature being pivotally mounted on said second portion of said magnetic frame; a spring member connected to said armature and to said magnetic frame so as to bias said armature against said third portion of said magnetic frame; a first contact member fastened to said spring member; a terminal member fastened to said spring member so as to be electrically connected to said first contact member; a coil disposed between said armature and said first portion of said magnetic frame; a magnetic pole piece located in the center of said coil and in contact with said first portion of said magnetic frame; a second contact member insulatively fastened to said coil so as to be contacted by said first contact member when said coil is energized; and a terminal member affixed to said second contact member.

2. A relay as in claim 1 wherein said third portion of said magnetic frame is a means for adjusting the travel of said armature.

3. A relay as in claim 1 wherein said spring member is a flat metallic spring bent so as to bias said armature against said third portion of said magnetic frame.

4. A relay as in claim 1 wherein said magnetic pole piece is a means for securing said coil to said first poriton of said magnetic frame.

5. A relay as in claim 1 wherein said coil is a bobbin wound coil having a center axis perpendicular to said base.

6. A relay as in claim 1 wherein there is an insulating plate secured to said coil by said magnetic pole piece so as to be adjacent to said armature, said insulating plate being a means for carrying said second contact member.

7. A relay comprising: a bobbin wound coil having a magnetic pole piece extending axially therethrough and insulated therefrom; an insulating member secured to one end of said coil carrying a fixed contact member; a terminal member affixed to said fixed contact member; a magnetic frame having a first portion in contact with said pole piece at an end of said coil opposite to said insulating member, a second portion extending substantially parallel to the axis of said coil, and a third portion bent down from said second portion so as to restrain an armature of said relay; said armature being pivotally mounted on said second portion of said magnetic frame so as to extend towards said pole piece; a spring member connected to said armature and to said magnetic frame so as to bias said armature against said third portion of said magnetic frame; a contact member fastened to said spring member so as to contact said fixed contact member when said coil is energized; and a terminal member connected to said spring member so as to be electrically connected to said contact member which is fastened thereto.

8. A relay comprising: a base; a magnetic frame having a first portion carried by said base, a second portion extending substantially perpendicular to said base, and a third portion bent down from said second portion toward said first portion; an armature assembly including an armature pivotally connected to said second portion of said magnetic frame, a substantially L-shaped spring member including an arcuate deformation at the joint of said spring member and having a portion of a free end thereof fixedly connected to said armature so as to normally bias said armature assembly into engagement with said bent down extremity of said frame, said bent down extremity restraining said armature assembly, and a movable contact member carried by said free end of said spring member; a terminal member fixedly connected to said end of said spring member connected to said magnetic frame so as to be electrically connected to said movable contact member; a coil disposed between said armature and said first portion of said magnetic frame; a magnetic pole piece extending axially through said coil and connected to said first portion of said magnetic frame; a fixed contact member connected to and insulated from said coil and normally spaced from said movable contact, said armature assembly displaced as said coil is energized thereby engaging said movable contact and said fixed contact and displacing said spring member storing energy therein, deenergization of said coil causing said spring member to release said stored energy so as to displace said armature assembly into engagement with said bent down portion of said magnetic frame thereby disengaging said engaged contacts; and a terminal member fixedly connected to said second contact member.

9. A relay as claimed in claim 8 wherein said bent down portion of said frame is adjustable so as to provide means for adjusting the travel of said armature.

10. A relay as claimed in claim 8 wherein said spring means is a substantially flat metallic spring.

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BERNARD A. GILHEANY, *Primary Examiner.*

J. J. BAKER, R. N. ENVALL, JR., *Assistant Examiners.*