

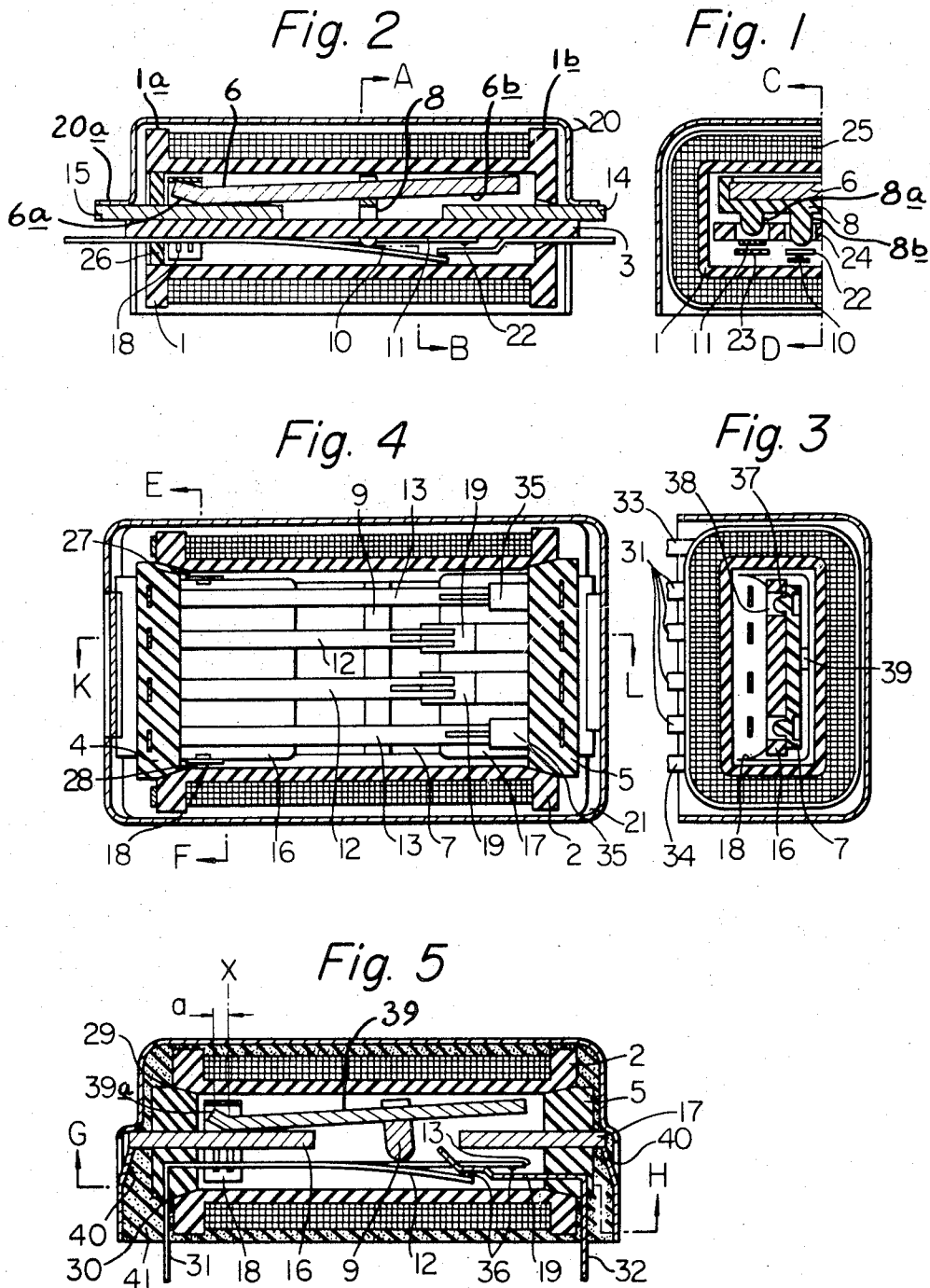
Dec. 1, 1970

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3,544,930

ELECTROMAGNETIC MULTICONTACT RELAY

Filed Feb. 27, 1969



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3,544,930

ELECTROMAGNETIC MULTICONTACT RELAY
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Filed Feb. 27, 1969, Ser. No. 803,039

Claims priority, application Germany, Feb. 29, 1968,
1,639,417

Int. Cl. H01h 51/28

U.S. Cl. 335—154

6 Claims

ABSTRACT OF THE DISCLOSURE

An electromagnetic multicontact relay having a single coil wound on a tubular insulating core. The magnetic circuit associated with the coil is insulated from the current-conducting contact elements within the core. More particularly, an armature is mounted within the core for pivotal movement in response to energization of the coil, and an insulating actuating member is mounted on the armature for operating two or more pairs of electrical contacts within the core in response to pivotal movement of the armature.

DESCRIPTION OF THE INVENTION

The present invention relates generally to electromagnetic multicontact relays and, more particularly, to electromagnetic relays in which a single coil controls the operation of two or more pairs of contacts.

It is a primary object of the present invention to provide an improved electromagnetic multicontact relay which provides reliable operation of two or more contact pairs in response to the energization and de-energization of a single coil.

It is another object of the invention to provide an improved electromagnetic multicontact relay of the foregoing type in which manufacturing tolerances are less critical than in single-coil, multicontact relays available heretofore.

A further object of the invention is to provide an improved electromagnetic multicontact relay of the foregoing type which can be manufactured in relatively small sizes without affecting the reliability of the operation thereof.

Yet another object of the invention is to provide such an improved electromagnetic multicontact relay in which the power of the energizing signal is less critical than in single-coil, multicontact relays proposed heretofore.

It is a still further object of the invention to provide such an improved electromagnetic multicontact relay which permits the use of conventional metallic spring contacts.

Still another object of the invention is to provide such an improved electromagnetic multicontact relay which is positive acting and highly efficient in operation.

An additional object of the invention is to provide such an improved electromagnetic multicontact relay which can be efficiently manufactured at a relatively low cost.

Other objects and advantages of the invention will be apparent from the following detailed description taken in connection with the accompanying drawings, in which:

FIG. 1 is a section taken along line A-B in FIG. 2, showing a symmetrical half of a relay embodying the invention;

FIG. 2 is a section taken along line C-D in FIG. 1; FIG. 3 is a section taken along line E-F in FIG. 4, showing a modified embodiment of the invention;

FIG. 4 is a section along line G-H in FIG. 5; and

FIG. 5 is a section taken along line K-L in FIG. 4.

While the invention is susceptible of various modifications and alternative forms, certain specific embodiments thereof have been shown by way of example in the drawings which will be described in detail herein. It should be understood, however, that it is not intended to limit the invention to the particular forms disclosed but, on the contrary, the intention is to cover all modifications, equivalents and alternatives falling within the spirit and scope of the invention.

Turning now to the drawings and referring first to FIG. 1 and 2, there is shown an electromagnetic relay including a single coil 25 wound on a tubular insulating core 1. To facilitate winding of the coil 25 on the central portion of the core 1, outwardly extending peripheral flanges 1a and 1b are formed on opposite ends of the core 1. As will be apparent to those familiar with the art of electromagnetic relays, the coil 25 is adapted for connection in an electrical circuit which energizes and de-energizes the coil to operate a plurality of pairs of electrical contacts mounted within the core, for controlling selected circuit functions.

In accordance with one important aspect of the present invention, an armature is mounted within the core 1 for pivotal movement in response to energization of the coil, and an insulating actuating means is mounted on the armature for operating the electrical contacts in response to pivotal movement of the armature. Thus, in the particular embodiment illustrated in FIGS. 1 and 2, an armature 6 is pivotally mounted within the core 1 for opening and closing a magnetic circuit including two spaced magnetic plates 14 and 15 associated with opposite ends of the armature 6, and a magnetic cap 20 fitted over the upper portion of the coil 25 and the core 1 and operatively connected to the two magnetic plates 14 and 15. As can be seen in FIG. 2, both of the magnetic plates 14 and 15 extend longitudinally beyond the ends of the insulating core 1, for the purpose of making contact with a peripheral flange 20a formed on the magnetic cap 20. (As used herein, the term "magnetic" includes materials which are magnetically permeable or capable of conducting magnetic flux.)

When the coil 25 is not energized, the armature 6 is in the position illustrated in FIGS. 1 and 2, in which a biasing spring fastener 18 urges a canted end portion 6a of the armature 6 downwardly toward the magnetic plate 15, thereby pivoting the opposite end 6b of the armature upwardly away from the opposite magnetic plate 14. When the coil 25 is energized, the free end 6b of the armature is drawn downwardly against the magnetic plate 14, thereby closing the magnetic circuit formed by the two plates 14 and 15, the armature 6, and the magnetic cap 20. As the free end 6b of the armature is drawn down against the magnetic plate 14, the opposite canted end portion 6a is pivoted upwardly, thereby deflecting the spring fastener 18 upwardly away from the magnetic plate 15; when the coil 25 is de-energized, the biasing force exerted on the end portion 6a of the armature immediately pivots the armature about its fulcrum on the plate 15, thereby returning the armature to the open position illustrated in FIGS. 1 and 2.

In keeping with the invention, the magnetic circuit associated with the armature 6 is insulated from two or more pairs of cooperating electrical contacts mounted within the coil 25 and its supporting core 1. Thus, in the embodiment of FIGS. 1 and 2, two pairs of electrical contacts 10, 22 and 11, 23 are mounted on the underside of an in-

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insulating separator plate 3 which extends longitudinally through the open ends of the tubular core 1. Contact 22, which is the stationary contact of the contact pair 10, 22, is mounted on the underside of one end of the insulating separator plate 3, while the movable contact 10 is mounted on the other end of the plate 3 and overlaps the stationary contact 22 on the underside thereof. To provide a normally closed contact pair, the spring portion of contact 10 biases the contact element on the end thereof upwardly into engagement with the underside of the stationary contact 22. The other contact pair 11, 23 is normally open, with the stationary contact 23 having a configuration similar to that of contact 22 described previously, and the movable contact 11 overlapping the stationary contact 23 on the top side thereof and being biased upwardly against the under surface of the separator plate 3 so that it is normally spaced apart from the stationary contact 23 to provide the desired normally open condition.

For the purpose of operating the contacts on one side of the separator plate 13 in response to pivotal movement of the armature on the other side of the separator plate, an actuator 8 mounted on the armature 6 extends through the insulating separator plate 3. More particularly, the insulating actuator 8 includes a pair of integral depending fingers 8a and 8b which extend downwardly through registering apertures formed in the separator plate 3. The actuating finger 8a is registered with the spring portion of contact 11 so that downward movement of the armature 6 in response to energization of the coil 25 causes the finger 8a to depress the movable contact 11 into engagement with the stationary contact 23, thereby closing the contact pair 11, 23. Similarly, the actuating finger 8b is registered with the movable contact 10, so that downward movement of the armature 6 causes the actuating finger 8b to depress the movable contact 10, thereby disengaging the contact element thereof from the stationary contact 22 to open the normally closed contact pair 10, 11.

In accordance with one specific aspect of the invention, the actuator 8 in the particular embodiment illustrated in FIGS. 1 and 2 is adapted to operate the two contact pairs 10, 22 and 11, 23 sequentially. Thus, the actuating finger 8b associated with contact pair 10, 22 normally rests on the upper surface of the movable contact 10, as shown in FIG. 2, when the armature 6 is in its elevated or open position. Consequently, the actuating finger 8b opens the contact pair 10, 22 immediately in response to downward movement of the armature 6. However, the actuating finger 8a associated with the other contact pair 11, 23 is normally spaced slightly above the movable contact 11, as shown in FIG. 1, so that there is a slight delay between initiation of the downward movement of the armature 6 and the closing of contacts 11 and 23. Consequently, the contact pair 10, 11 is opened before the contact pair 11, 23 is closed, thereby providing sequential operation of the two contact pairs.

It will be appreciated that the particular relay arrangement shown in FIGS. 1 and 2 can be easily assembled by preassembling the entire internal structure, and then inserting this internal structure as a single unit through the relatively large opening formed in the left-hand end of the tubular core 1. This unit is advanced longitudinally through the hollow interior of the core 1 until the forward end thereof extends through the relatively small opening formed in the right-hand end of the core 1, in the longitudinal position illustrated in FIG. 2. A cover plate 26 is then fitted over the left-hand end of the internal unit and advanced to the position shown in FIG. 2. If desired, the cover plate 26 can be sealed in place by bonding it to the inner surface of the tubular core 1. In preassembling the internal unit, the two magnetic plates 14 and 15 are preferably fastened to the upper surface of the separator plate 3, while the contacts 10, 11, 22, and 23 are fastened to the lower surface of the plate 3, by conventional fastening means such as riveting, soldering, adhesive bonding, or the like. This insures that the various

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elements remain in the desired positions relative to each other during the final assembling operation. The spring fastener 18 is also secured to the internal unit, to hold the armature 6 in place, before the unit is inserted within the hollow core 1.

In the modified embodiment of the invention illustrated in FIGS. 3 through 5, the internal subassembly is preformed as two separate units which are inserted through opposite ends of a tubular core member 2. In this arrangement, the two magnetic plates 16 and 17 cooperating with the armature 39 are supported by two frusto-conical insulating plugs 4 and 5 adapted to fit within complementally formed end openings in the core member 2. The insulating plugs 4 and 5 also carry the various movable and stationary contact elements 12, 13, 35, and 36, all of which are bent within the plug members 4 and 5 so as to emerge from a common surface of the relay to facilitate connection to a printed circuit board, for example.

When the two units supported by the two insulating plugs 4 and 5 are inserted within the opposite ends of the core member 2, the various contact elements cooperate with each other to automatically position the same within the interior of the hollow core member 2. Thus, in the particular embodiment illustrated in FIGS. 3 through 5, the contact pairs 12, 19 are automatically cammed into normally closed positions. More specifically, the forward ends of the contact elements 19 are bent upwardly, as shown most clearly in FIG. 5, so as to cam the forward end of the opposed contact elements 9 downwardly, thereby biasing the contact elements 36 upwardly into engagement with the contact elements 19. When the armature 39 is lowered in response to energization of the relay coil, the movable contact element 12 is depressed to disengage it from the contact 19, thereby opening the contact pair 12, 19. The other contact pairs 13, 35 are normally open, with the movable contacts 13 being depressed by downward movement of the armature 39 to bring the same into engagement with the corresponding stationary contacts 35.

After the subassembly plugs 4 and 5 are inserted within the open ends of the tubular core member 2, a magnetic cap 21 is fitted over the entire assembly, with a pair of spring tabs 40 being bent inwardly from the main body portion of the cap 21 to engage the lower surfaces of the magnetic plates 16 and 17. The tabs 40 insure contact between the cap 21 and the plates 16 and 17 to form the same type of magnetic circuit described previously in connection with FIGS. 1 and 2, and also help to support the plates 16 and 17 in the desired positions. After the cap 21 is in place, the hollow space between the interior surface of the cap 21 and the exterior surfaces of the coil, the tubular core 2, and the insulating plugs 4 and 5 may be filled with an insulating casting composition, such as "Araldite" for example.

It will be appreciated that the modified embodiment of the invention illustrated in FIGS. 3-5 eliminates the insulating separator plate 3 utilized in the structure of FIGS. 1 and 2. The various elements of both the magnetic circuit associated with the armature 39, and the electrical circuit associated with the contact elements 12, 13, 19, and 35 are held in the desired positions by the insulating plugs 4 and 5, and the actuator 9 is made of an insulating material; consequently, the magnetic circuit and the electrical circuit are insulated from one another without the use of the separator plate 3. As can be seen in FIG. 5, the armature 39 is pivotally mounted on the magnetic plate 16 in the same manner as the armature 6 described previously. That is, a spring fastener 18 is disposed around the elements mounted on the insulating plug 4, so that the armature 39 is normally biased to the open position illustrated in FIG. 5, while still permitting pivotal movement of the armature 39 into contact with the magnetic plate 17 in response to energization of the relay coil wound around the core 2.

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As can be seen from the foregoing detailed description, this invention provides an improved electromagnetic multicontact relay which provides reliable operation of two or more contact pairs in response to the energization and de-energization of a single coil. Since conventional metallic spring contacts are employed, and are actuated by a single armature in the magnetic circuit of the relay, manufacturing tolerances are less critical than in single coil multicontact relays available heretofore. Furthermore, the improved relay provided by this invention can be manufactured in relatively small sizes without affecting the reliability of the operation thereof, and the power of the energizing signal is less critical than in multicontact relays proposed heretofore. Moreover, each of the contact pairs is positively operated by the actuator carried by the magnetic armature, and the operation of the relay is highly efficient because the magnetic circuit associated with the armature is completely closed in response to energization of the relay coil. Finally, the improved relay provided by this invention can be efficiently manufactured at a relatively low cost.

I claim as my invention:

1. An electromagnetic multicontact relay comprising the combination of a single coil wound on a single tubular insulating core, at least two pairs of cooperating electrical contacts mounted within said core, an armature mounted within the same core for pivotal movement in response to energization of said coil, insulating actuating means mounted on said armature for operating said contacts in response to pivotal movement of said armature, a pair of spaced magnetic elements operatively associated with opposite ends of said armature for connecting said armature in a magnetic circuit associated with said coil, and magnetic means directly connecting said pair of magnetic elements externally of said core for forming a completely

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closed magnetic circuit upon pivotal movement of said armature.

2. An electromagnetic multicontact relay as set forth in claim 1 which includes an insulating plate disposed between said armature and said contacts, and said actuating means extends through said insulating plate for operating said contacts.

3. An electromagnetic multicontact relay as set forth in claim 2 wherein said contacts are mounted on said insulating plate.

4. An electromagnetic multicontact relay as set forth in claim 1 wherein one end of said armature is pivotally connected to one of said magnetic elements and the other end of said armature cooperates with the other magnetic element for opening and closing the magnetic circuit in response to de-energization and energization of said coil.

5. An electromagnetic multicontact relay as set forth in claim 1 wherein said contacts are spring mounted with each contact pair being normally biased to an open or closed condition.

6. An electromagnetic multicontact relay as set forth in claim 1 wherein said actuating means is adapted to operate two or more pairs of said contacts sequentially.

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U.S. Cl. X.R.

335—202