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W. D. MAYNARD

3,233,150

BUILT-IN ARC SUPPRESSION FOR ELECTROMAGNETIC DEVICES

Original Filed Nov. 28, 1962

FIG. 1

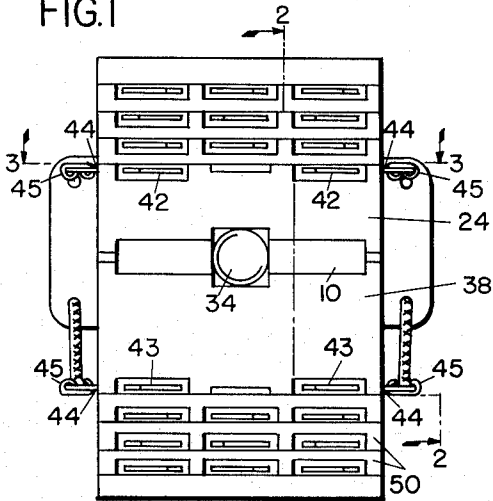


FIG. 2

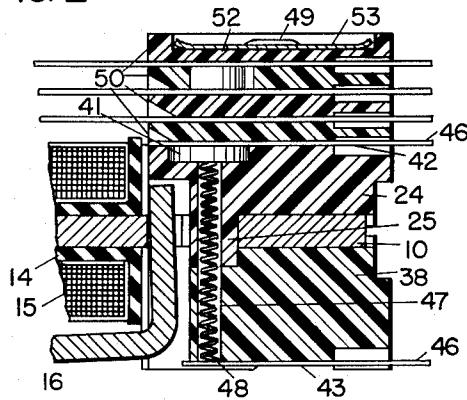


FIG. 3

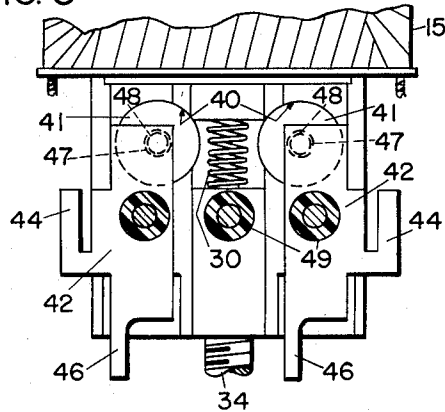
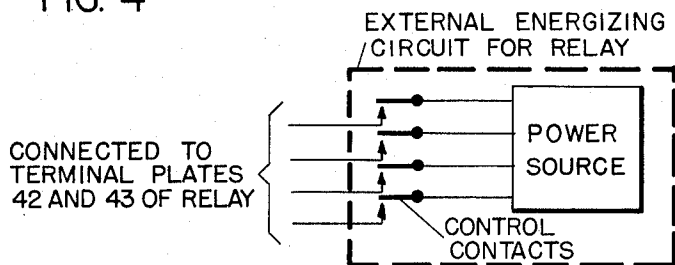


FIG. 4



INVENTOR.
W.D. MAYNARD
BY
Forest B. Withnook
HIS ATTORNEY

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BUILT-IN ARC SUPPRESSION FOR ELECTROMAGNETIC DEVICES

Wheeler D. Maynard, Mendon, N.Y., assignor to General
Signal Corporation, a corporation of New York
Original application Nov. 28, 1962, Ser. No. 240,637, now
Patent No. 3,204,061, dated Aug. 31, 1965. Divided
and this application Mar. 30, 1965, Ser. No. 443,985
3 Claims. (Cl. 317-11)

This application is a division of my co-pending application Ser. No. 240,637, filed November 28, 1962, now Patent No. 3,204,061, issued August 31, 1965, which is a continuation-in-part of Ser. No. 142,391, filed October 2, 1961, now abandoned.

Generally speaking, this invention relates to electromagnetic devices and more particularly pertains to a built-in arc suppression structure for said electromagnetic devices.

During the energization and deenergization of the coil or winding of electromagnetic devices, such as relays, etc., it is often necessary to provide arc suppression means connected between the terminals of such windings, so as to prevent arcing at the contacts used to control energization and deenergization of the electromagnetic device. Heretofore, this arcing at the controlling contacts has been minimized by connecting (for example, by soldering) a non-linear resistive element across the external terminals of the relay or other electromagnetic device being controlled. For example, a disc of Thyrite is suitable for connection across the winding terminals of a relay for this purpose, in that Thyrite possesses the necessary properties of such a non-linear resistor and has a relatively high resistance when subjected to the normal operating voltages of the relay winding, but, changes to a low resistance value when higher or surge voltages are impressed across the winding terminals.

In accordance with the present invention, it is proposed to provide such an arc suppression structure which is completely built-in within the body of the electromagnetic relay or similar device being controlled by external contact circuitry, and, which arc suppression structure is very simple to assemble within the electromagnetic device without requiring soldering or other permanent connection of the arc suppressing element to the winding or coil terminals.

Accordingly, one object of the present invention is to provide a built-in arc suppression structure for an electromagnetic device such as a relay.

A further object of the present invention is to provide a relatively simple arc suppressing structure adapted to be readily assembled within the body of an electromagnetic device without requiring permanent or fixed connection to the terminals of the coil or winding of the electromagnetic device.

Other objects, purposes and characteristic features of the present invention will be in part pointed out as the description of the invention progresses, and, in part be obvious from the accompanying drawings in which:

FIG. 1 is a rear view of an electromagnetic relay incorporating the built-in arc suppression feature of the present invention;

FIG. 2 is a fragmentary sectional view taken along line 2-2 in FIG. 1 and viewed in the direction of the

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arrows to show the novel built-in arc suppression means provided by the present invention;

FIG. 3 is a fragmentary sectional view taken along line 3-3 of FIG. 1 and viewed in the direction of the arrows to illustrate the way in which the winding terminal plates are mounted within the relay embodying the present invention; and

FIG. 4 is a diagrammatic illustration of a general form of external energizing circuit for the electromagnetic relay of FIG. 1.

The relay illustrated in the accompanying drawings, and, incorporating the built-in arc suppression means of the present invention is disclosed in detail in my co-pending application Ser. No. 240,637, filed November 28, 1962, and, generally includes an armature pivotally mounted adjacent one end of an electromagnetic core structure. A pair of blocks of suitable insulating material, such as molded plastic, are mounted above and below this same end of the core and are provided with suitable recesses or slots adapted to receive terminal plates connected electrically to the ends of the windings which form part of the electromagnetic structure of the relay.

One of these insulating blocks is also configured, for example, by injection molding, to have a circular recess contiguous with each terminal plate slot therein, and, is adapted to receive a disc of Thyrite or other similar material. Each circular recess is of a depth such that the exposed surface of the Thyrite disc will be flush with the surface of the associated terminal plate slot within the block.

Each of the blocks is furthermore configured to have a cylindrical bore therein in such a position that, when the pair of blocks are in assembled position on either side of the relay core structure, their respective bores mate together to form an elongated cylindrical bore communicating the bottom of each of the aforementioned circular recesses with the terminal plate slot in the opposite block.

An electrically conducting resilient means is adapted to be inserted into this elongated cylindrical bore and, when the Thyrite discs and the pair of terminal plates are in assembled position, the resilient means are compressed and firmly hold one surface on the disc of Thyrite in physical and electrical contact with an inner surface of the adjacent one of the terminal plates, while the opposing end of the resilient means electrically connects the opposite surface of the Thyrite disc to the other terminal plate. In this manner, the disc of Thyrite is connected electrically between the terminal plates and serves to provide a low resistance shunt across the terminal plates when the windings of the relay are subjected to higher or surge voltages, as a result of the opening and closing of the external contacts used to control energization and deenergization of such windings.

With more particular reference now to the drawings, the relay structure incorporating the built-in arc suppression feature of the present invention comprises the magnetic core 10 having spool 14 and windings 15 mounted thereon, along with a cooperating armature 16 adapted to be hung from the core 10 for pivotal movement relative thereto in accordance with the energization and deenergization of the windings 15. The relay shown in the drawings is assumed to be provided with a pair of windings 15, with one end of each winding connected

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to a terminal plate 42 and the other end connected to a terminal plate 43.

At the fixed or right-hand end of the relay (FIG. 2), a pair of molded blocks 24 and 38 are disposed to lie on the respective upper and lower plain surfaces of the core 10, and, the upper block 24 is configured to have a projection 25 which extends downwardly through an opening within the core 10 and mates with the molded block 38. As is fully described in my copending application Ser. No. 240,637, filed November 28, 1962, the projection 25 serves to retain the armature 16 in its proper assembled position on the core 10 and furthermore, supports a coil spring 30 (FIG. 3) which constantly biases the armature against its pivoting edge on the core 10.

As seen most clearly in FIG. 3, the upper surface of the molded block 24 is furthermore configured with a pair of slots adapted to receive terminal plates 42 which are, in turn, provided with extending ears 44 adapted to receive connectors 45 (see FIG. 1) for electrically connecting the ends of the relay windings 15 to the terminal plates 42. The terminal plates 42 furthermore include extensions 46 to facilitate connection of these ends of the relay windings to the external energizing circuitry.

Similarly, the lower-most surface of the bottom molded block 38 is also configured with a pair of slots to receive a second pair of terminal plates 43 connected to the other ends of the relay windings 15.

Mounted in stacked up relationship on the respective molded blocks 24 and 38 are a plurality of insulating wafers 50 configured to mate with the molded blocks 24 and 38 and also to hold the contact blades of the relay in proper assembled position.

As shown in FIG. 2, a further molded member 52 is mounted on top of the upper-most wafer 50 and is provided with a rectangular recess into which a retaining member 53 is disposed for anchoring the fixed end of the relay together by means of suitable rivets, which is shown in FIG. 2 by the reference number 49, and, which extends throughout the entire depth of the stacked up assembly forming the fixed end of the relay (see FIG. 1). Extending outwardly from the fixed end of the relay structure is a mounting bolt 34 for attaching the relay to a suitable mounting rack or the like.

As viewed in FIG. 2, the upper surface of the block 24 and the lower surface of the block 38 are provided with irregularly shaped shallow recesses into which correspondingly configured terminal plates 42 (FIG. 3) and terminal plates 43 seat. Each of the terminal plates 42 and 43, which may be stamped from sheet copper has a laterally projecting ear 44 to which a connector 45 of the windings 15 is attached. Each of the terminal plates 42 and 43 also has a rearwardly extending projection 46 for connection to an external source of energy for energizing the winding 15. Thus, the terminals for energizing each of the windings 15 includes a terminal plate 42 and a terminal plate 43. The block 24 furthermore has a pair of arcuate recesses 40 formed in its upper surface to receive discs of material 41, such as Thyrite, for example, which has a property of providing high resistance to low operating voltage values, while providing low resistance to surge voltages. The discs 41, when seated in their recesses 40, are substantially flush with the surface of the contact slots formed in block 24.

The projection 25 of the molded block 24 also has a pair of cylindrical bores, each of which communicates at its upper end with the bottom of a respective recess 40, and, communicates at its lower end with the lower surface of the block 24 in registry with a corresponding bore extending through the block 38 to form an elongated bore 47 (FIG. 2) when the blocks 24 and 38 are in mounted position on the right-hand end of the core 10. A spring 48 is inserted in each long cylindrical bore 47

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and is slightly compressed to be in good contact with the lower surface of disc 41 and the upper surface of a respective terminal plate 43 positioned on the lower surface of the block 38. The spring 48 also urges the upper surface of each disc 41 in good electrical and physical contact with its respective terminal plate 42. Thus, the energizing circuit for each of the windings 15 is electrically shunted by a path that extends from a terminal plate 42, disc 41, spring 48, and a terminal 43. During operation, this assembly, which is built-in at the fixed end of the relay, prevents excessive arcing at contacts such as those illustrated, by way of example, in the general external energizing circuit shown in FIG. 4 that are used to control energization and deenergization of the relay windings 15.

In view of the foregoing description, it is thus seen that the present invention provides a simply built-in arc suppression structure adapted to be incorporated into an electromagnetic relay or like device, which built-in structure requires no soldering or other such permanent manner of connecting the arc suppressing means across the winding terminals, but, instead the arc suppressing device (in this case a disc of Thyrite) is firmly held in good electrical contact between the terminal plates of the relay windings, by electrically conducting resilient means.

Having thus described a built-in arc suppression structure, as one specific embodiment of the present invention, it is to be understood that various modifications, adaptations and alterations may be applied to the specific form of the invention shown, to meet the requirements of practice, without in any manner departing from the spirit or scope of the present invention.

What I claim is:

1. In an electromagnetic relay,
 - (a) a core,
 - (b) a winding mounted on said core,
 - (c) an armature mounted movably to be attracted to and released from said core in accordance with the selective energization of said winding,
 - (d) insulator blocks fixedly secured to one end of said core,
 - (e) a terminal member for each end of said winding to permit energization and deenergization of said winding by an external circuit,
 - (f) said terminal members being mounted in spaced slots in said insulator blocks and being electrically insulated from said core by said insulator blocks,
 - (g) said insulator blocks also having a hole therein extending between said spaced slots,
 - (h) a non-linear resistive element mounted in said hole having relatively high resistance at operating voltages and relatively low resistance to higher voltages, and
 - (i) electrically conducting resilient means compressibly mounted in said hole and having one end contacting one of said terminal members and its opposite end contacting said non-linear resistive element for biasing said non-linear resistive element into electrical contact with the other of said terminal members to provide a high voltage shunt across said winding, whereby arcing in the external circuit is suppressed when said winding is energized and deenergized.
2. A relay as specified in claim 1 wherein said resilient means is a coil spring.
3. An electromagnetic structure comprising,
 - (a) an insulator member,
 - (b) a winding having its ends fixedly and insulatedly supported by said insulator member and adapted to be energized and deenergized by an external circuit,
 - (c) a non-linear resistive element having relatively high resistance at operating voltages impressed

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across said winding and relatively low resistance to higher voltages, and

- (d) electrically conducting resilient means extending through said insulator member and having one of its ends connected to one end of said winding and its opposite end connected to said non-linear resistive element for urging said resistive element into electrical contact with the opposite end of said winding to provide a high voltage shunt across said winding, whereby arcing in said external circuit is prevented when said winding is energized and deenergized.

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SAMUEL BERNSTEIN, *Primary Examiner.*R. V. LUPO, *Assistant Examiner.*