Nov. 11, 1958 L. J. HADLEY 2,860,209

ELECTRIC RELAY

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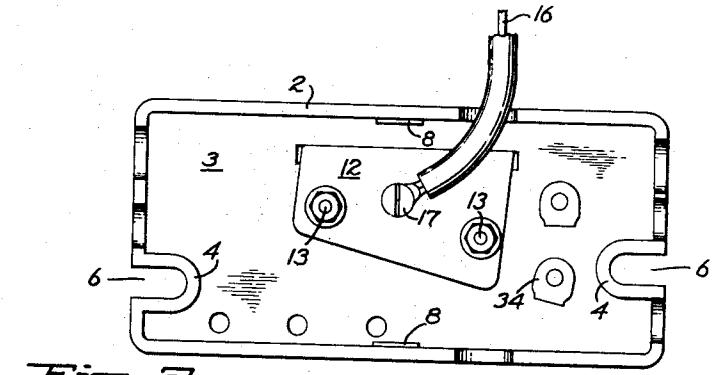


Fig-3

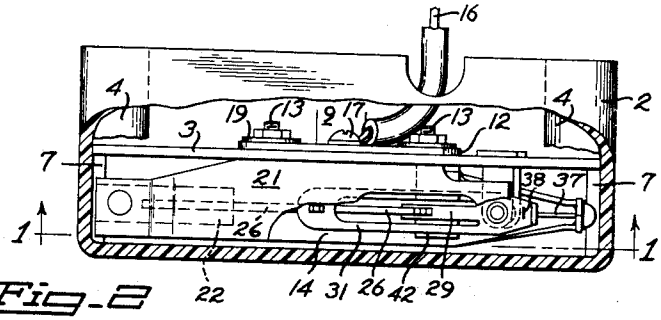


Fig-2

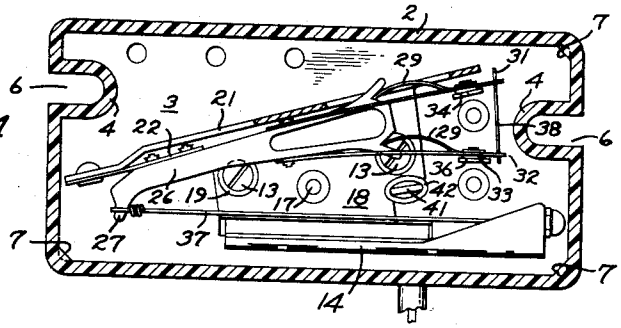


Fig-1

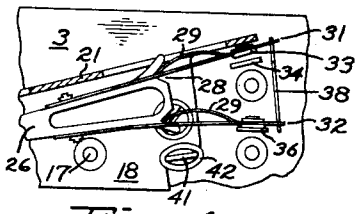


Fig-4

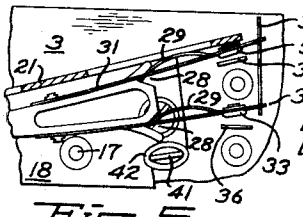


Fig-5

INVENTOR
LESTER J. HADLEY
BY Charles S. Evans
his ATTORNEY

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ELECTRIC RELAY

Lester J. Hadley, Newark, Calif.

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3 Claims. (Cl. 200—113)

My invention relates to electric relays, and particularly to motor starting and overload relays of the hot-wire type.

One of the objects of my invention is the provision of a hot-wire type relay incorporating means for preventing reestablishment of the circuit through the relay after accidental rupture of the hot wire.

The invention possesses other objects, some of which with the foregoing will be brought out in the following description of the invention. I do not limit myself to the showing made by the said description and the drawings, since I may adopt variant forms of the invention within the scope of the appended claims.

Referring to the drawings:

Fig. 1 is a vertical sectional view taken in the plane indicated by the line 1—1 of Fig. 2.

Fig. 2 is a side elevation with part of the housing broken away to disclose the underlying structure.

Fig. 3 is a bottom view showing the terminal means for connecting the relay into the circuit of an electric motor.

Fig. 4 is a fragmentary view taken in the same direction as Fig. 1, and showing the starting contact in open position.

Fig. 5 is a fragmentary view similar to Fig. 4, showing both starting and overload contacts in open or overload position.

Broadly considered, my relay is of the hot-wire type, having a housing enclosing a mounting plate on which are mounted a terminal bracket and a contact bracket. The contact bracket supports a movable contact arm having a plurality of spring-pressed contacts, each normally engaging an associated fixed contact secured on the mounting plate. The fixed contacts are provided with terminals for connection to separate circuits, such, for example, as the starting and main circuits of an electric motor. A thermally responsive conductor is interposed between the terminal bracket and the movable contact arm, and its increase and decrease in length in response to temperature variations determines the range of movement of the contact arm. An increase in temperature in the conductor resulting from a heavy overload will lengthen the conductor and movement of the contact arm to open the contacts will occur. A reduction in length due to a decrease in temperature will result in movement of the contact arm to close the contacts. If the conductor should rupture for any reason the contact arm will move to open the contacts. Continued movement of the contact arm in this direction, if permitted, would reengage the contacts. Means are therefore provided to limit opening movement to a position in which the contacts remain in open position.

In more specific detail, the relay of my invention comprises a housing 2, preferably of dielectric material, having four sides and a top, and open at the bottom to admit a mounting plate 3, also of dielectric material. The mounting plate is guided into the housing by inwardly extending U-shaped projections 4, formed integrally in the housing, and providing exterior channels 6, adapted to

accommodate anchor bolts, not shown. The mounting plate cooperates with the housing to provide a substantially closed chamber.

The position of the mounting plate within the housing is determined by integral corner abutments 7 supporting the plate from within the chamber, and integral lock lugs 8 on two opposite side walls of the housing and abutting the outer side of the plate. The lock lugs are preferably formed with cam faces 9, which cooperate with the edges of the plate to spring the side walls outwardly an amount sufficient to permit the plate to snap into place.

The relay is connected into the motor circuit by a conductive treminal bracket 12, detachably secured on the outer surface of the mounting plate by bolts 13, and having an anchor flange 14 projecting through the plate into the chamber. Circuit lead 16, attached to the terminal bracket by screw 17, serves to charge the terminal bracket.

Mounted on the opposite or inner side of the mounting plate is a conductive contact bracket 18, also detachably secured by bolts 13. The terminal bracket and contact bracket are insulated from each other by the plate interposed therebetween and by fibre washers 19 on bolts 13. The contact bracket is provided with an integral support flange 21 perpendicular to the plate and extending diagonally thereacross. One end of the support flange is offset and provides a seat for the attachment of one end of leaf spring 22, the free end of which is fixed to one end of the movable contact arm 26.

The contact arm is stamped from sheet metal to provide a laterally projecting lug 27 adjacent the attached end of the arm. At its free end the arm is flared out to provide a pair of spaced notches 28, each adapted to receive the free end of an associated resilient tongue 29, struck from resilient contact blades 31 and 32, secured on opposite edges of the contact arm and extending freely past the free end thereof.

Tungsten wafers 33 fixed on the free ends of the contact blades, engage and disengage with spaced and insulated contact posts 34 and 36 fixed in the mounting plate 3. A thermally responsive conductive wire 37, integrally interposed between the laterally projecting lug 27 on the arm and the anchor flange 14 forms the conductive path therebetween; and normally biases the contact arm counterclockwise as viewed in Fig. 1. In this position of the contact arm, the resilient tongues 29 exert a downward force on the free ends of the contact blades, thus resiliently engaging the tungsten wafers 33 with their associated fixed contact posts 34 and 36.

Fixed contact posts 34 and 36 are adapted for connection to the starting and main windings, respectively, of an electric motor. Closing the main motor switch results in current flow through wire 37 and into both the starting and main windings of the motor. After a very few seconds, the wire 37 will heat sufficiently to lengthen a few thousandths of an inch. This will result in movement of the free end of the contact arm downwardly into the position shown in Fig. 4. In this position, the free end of resilient tongue 29 on contact blade 31 has been carried down past the plane of the blade 31, resulting in the free end of the blade 31 being biased upwardly and thus opening contact 33—34 and deenergizing the starting winding to the motor, which continues to operate on the main winding.

If the motor should now become overloaded, the resulting increase in current passing through the wire will raise the temperature of the wire, causing the wire to lengthen, and the contact arm to move downwardly into the position shown in Fig. 5. In this position, the main winding contact 33—36 has been opened, as shown, by movement of the free end of tongue 29 on blade 32. This breaks the circuit to the motor and the motor will stop. The blade 32 will remain in its biased open posi-

tion until the wire has cooled and contracted sufficiently to bias the contact arm upwardly and re-make contacts 33—36.

It will be noted that the extreme free ends of the contact blades 31 and 32 are joined by a metallic strip 38, the ends of which are reduced in width and project through slots in the contact blades. The strip 38 cooperates with contact blade 32 to prevent contacts 33—34 being closed while contacts 33—36 are open.

Under some circumstances the wire 37 will rupture between its ends or pull loose from its moorings as a result of heat-softened solder. When this happens the contact arm 26 is biased downwardly by the leaf spring 22, opening both contacts 33—34 and 33—36. However, in conventional relays, rupture of the wire eliminates its restraining influence on the contact arm after both contacts have been opened, and the contact arm continues to move downwardly, thus closing the contacts through abnormal displacement, and in all likelihood resulting in a burned out motor.

To prevent accidental reestablishment of the circuits, stop means are provided limiting movement of the contact arm to a position in which the contacts will remain in open position. The stop means comprises a lug 41 fixed on the mounting plate in position to form an abutment against which the contact arm may come to rest. The lug may be integral with the contact bracket 18, as shown, or it may be adjustably and releasably secured by a bolt 13. A dielectric cushion 42 placed around the lug insures insulation of the lug from accidental electrical connection with the wire 37. Fig. 5 illustrates the limit to which the contact arm may move.

I claim:

1. An overload relay for electric circuits comprising a housing, a mounting plate secured within the housing and forming therewith a substantially closed chamber, a metallic terminal bracket fixed on the mounting plate, a contact bracket fixed on the mounting plate and within the chamber, a pair of spaced contacts fixed on the mounting plate within the chamber and having terminals outside the chamber, a contact arm movably mounted on the contact bracket within the chamber and having a pair of spaced spring-pressed contacts thereon normally engaging the fixed contacts, thermally responsive conductor means interposed between the terminal bracket and said movably mounted contact arm to effect opening and closing of said contacts in accordance with the thermal response of said conductor, and means within the chamber limiting opening movement of the contact arm to a position in which said spring-pressed contacts remain in open position.

2. An overload relay for electric circuits comprising a housing, a mounting plate secured within the housing and forming therewith a substantially closed chamber, a metallic terminal bracket fixed on the mounting plate, a contact bracket fixed on the mounting plate and within the chamber, a pair of spaced contacts fixed on the mounting plate within the chamber and having terminals outside the chamber, a contact arm movably mounted on the contact bracket within the chamber and having a pair of spaced spring-pressed contacts thereon normally engaging the fixed contacts, thermally responsive conductor means interposed between the terminal bracket and said movably mounted contact arm to effect opening and closing of said contacts in accordance with the thermal response of said conductor, and means within the chamber fixed on the mounting plate and interposed between the contact arm and the conductor for limiting opening movement of the contact arm to a position in which said spring-pressed contacts remain in open position.

3. An overload relay for electric circuits comprising a housing, a mounting plate secured within the housing and forming therewith a substantially closed chamber, a metallic terminal bracket fixed on the mounting plate, a contact bracket fixed on the mounting plate and within the chamber, a pair of spaced contacts fixed on the mounting plate within the chamber and having terminals outside the chamber, a contact arm movably mounted on the contact bracket within the chamber and having a pair of spaced spring-pressed contacts thereon normally engaging the fixed contacts, thermally responsive conductor means interposed between the terminal bracket and said movably mounted contact arm to effect opening and closing of said contacts in accordance with the thermal response of said conductor, means within the chamber limiting opening movement of the contact arm to a position in which said spring-pressed contacts remain in open position, and dielectric cushioning means interposed between the limiting means and the conductor and between the limiting means and the contact arm.

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