Nov. 20, 1956 D. E. MORAN 2,771,528

THERMAL OVERLOAD SWITCH

Filed Feb. 25, 1954

Fig. 1.

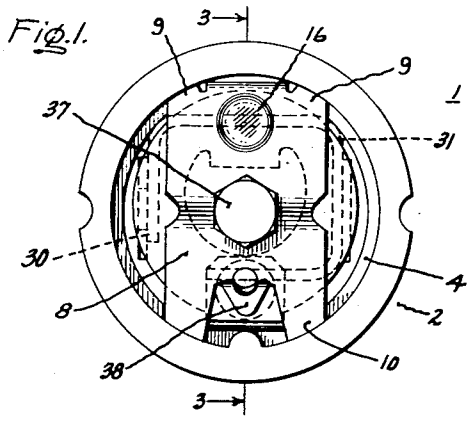


Fig. 2.

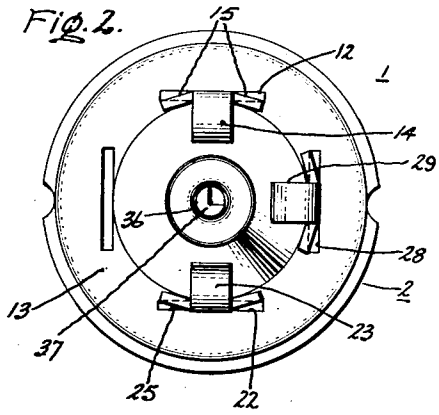


Fig. 3.

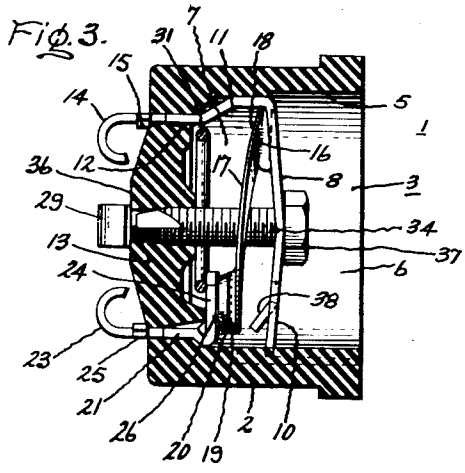


Fig. 4.

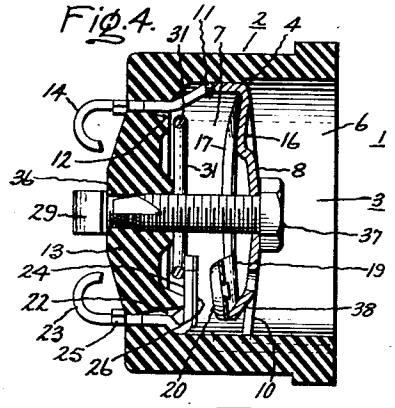
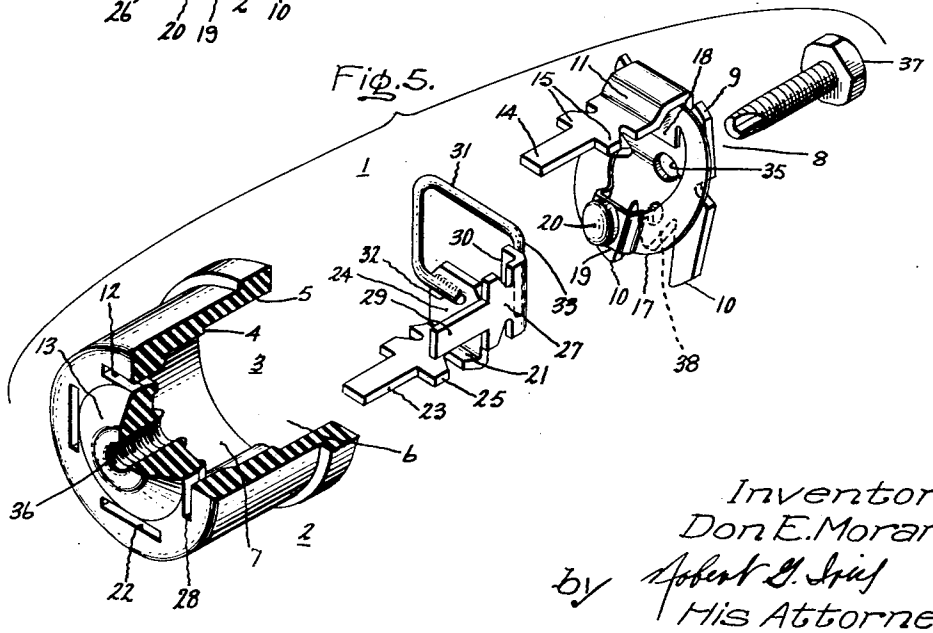


Fig. 5.



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THERMAL OVERLOAD SWITCH

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5 Claims. (Cl. 200—122)

This invention relates to thermal overload switches and more particularly to thermal overload switches of the automatically resetting type.

Thermal overload switches are frequently used to provide thermal protection for electrical apparatus, such as electric motors. One form of such a device incorporates a bimetallic element carrying a movable contact which cooperates with a stationary contact, the bimetallic element and the stationary contact being serially connected in the circuit to be protected. A heater may also be arranged in heat transfer relationship to the bimetallic element and may be arranged either for connection in series with the bimetallic element and the stationary contact, or in another circuit. Thus, such a device may be made responsive to both the supporting ambient temperature and overload current. It is desirable in some applications for such devices that the switch after opening in response to an overload, automatically reset itself when the surrounding ambient temperature has fallen to a predetermined level. It is further desirable that both the tripping and resetting temperatures be readily and independently adjustable and that the device be simple, easy to assemble and inexpensive.

It is therefore an object of this invention to provide a thermal overload switch incorporating the desirable features set forth above.

Further objects and advantages of this invention will become apparent by reference to the following description and the accompanying drawing, and the features of novelty which characterize this invention will be pointed out with particularity in the claims annexed to and forming a part of this specification.

This invention in its broadest aspects provides a thermal overload switch having a housing member with a cavity formed therein. A mounting member is positioned in the cavity spaced from the bottom thereof and extending substantially across the cavity. A bimetallic element is arranged in the cavity intermediate the housing member bottom and the mounting member and has one extremity secured to the mounting member adjacent one end thereof. A movable contact is mounted adjacent the other extremity of the bimetallic element and cooperates with a stationary contact. The mounting member is normally longitudinally bowed away from the housing member bottom and means are provided for selectively deflecting the mounting member toward the housing member bottom in order to set one characteristic of the switch, for example, the tripping temperature. The mounting member has a portion extending toward the bimetallic element to limit the movement thereof in order to set another characteristic of the switch, for example, the resetting temperature.

In the drawing, Fig. 1 is a top view of the improved thermal overload switch of this invention;

Fig. 2 is a bottom view of the switch of Fig. 1;

Fig. 3 is a cross sectional view taken along the line 3—3 of Fig. 1 and showing the switch in the contacts closed position;

Fig. 4 is a view similar to Fig. 3 showing the contacts in the open position; and

Fig. 5 is an exploded view in perspective, partially broken away, showing the assembly of the device of Figs. 1 to 4 inclusive.

Referring now to the figures of the drawing, the improved thermal overload switch 1 is provided with a cup-shaped housing member 2 formed of suitable insulating material, such as a molded plastic. Housing member 2 has a cavity 3 formed therein and an annular step 4 formed in the inner wall 5 divides cavity 3 into upper portion 6 and lower portion 7.

A mounting member 8, formed of relatively thin strip conductive material, such as steel, is provided, having projections 9 at one end thereof and projections 10 at the other end thereof seated on and engaging step 4, thus positioning mounting member 8 in the upper portion 6 of cavity 3. Mounting member 8 has a portion 11 extending downwardly between extensions 9 and through an opening 12 in bottom 13 of housing member 2. The extremity 14 of portion 11 is preferably curved, as shown in Figs. 3 and 4, to form one external terminal of the device. The portion 11 is preferably provided with ears 15 which, after the portion 11 has been inserted in opening 12, are bent inwardly engaging the bottom surface of bottom 13 thus locking mounting member 8 in place. Mounting member 8 has an indentation 16 formed therein adjacent extensions 9 for the purpose now to be described.

A bimetallic element 17 is provided, preferably having a substantially O-shaped configuration, as best seen in Fig. 5. A point 18 adjacent the edge of bimetallic element 17 is secured to indentation 16 in mounting member 8 in any suitable manner, as by spot welding and an indentation 19 is also formed in bimetallic element 17 opposite from point 18 and extending toward the bottom 13 of housing member 2. The indentation 19 prestresses the bimetallic element 17 to provide the requisite snap action in response to temperature changes. A movable contact 20 is secured to the underside of indentation 19 of bimetallic element 17 in any suitable manner, as by riveting or spot welding.

A terminal member 21 is provided extending through opening 22 in bottom 13 of housing member 2 and having its extension 23 preferably curved as shown in Figs. 3 and 4 to provide a second external terminal. Terminal member 21 has a portion 24 positioned in lower portion 7 of cavity 3 and generally disposed at right angles to the portion of member 21 positioned in the opening 22. Here again, ears 25 on terminal member 21 are bent inwardly after terminal member 21 is assembled in opening 22 and serve to lock terminal member 21 in place. A suitable stationary contact 26 is mounted on portion 24 of terminal member 21 and cooperates with movable contact 20 on bimetallic element 17. It is now seen that a circuit may be provided from external terminal 14 through mounting member 8, bimetallic element 17, movable contact 20, stationary contact 26, and terminal member 21 to external terminal 23 and that bimetallic element 17 will move in response to a predetermined ambient temperature to separate movable contact 20 from stationary contact 26, as shown in Fig. 4.

In order to render the thermal overload switch of this invention responsive to excessive current as well as to excessive ambient temperature the arrangement now to be described is provided. Another terminal member 27 is provided positioned in opening 28 in bottom 13 of housing member 2. The extension 29 of terminal member 27 is also preferably curved to form a third external terminal. Terminal member 27 has a portion 30 positioned in lower portion 7 of cavity 3 and disposed at

right angles to the portion of terminal member 27 in opening 28. A suitable heater coil 31 is provided in lower portion 7 of cavity 3 in heat transfer relationship with bimetallic element 17. Heater 31 has one end 32 secured to the underside of portion 24 of terminal member 21 in any suitable manner, as by brazing or soldering, and has its other end 33 similarly connected to portion 30 of terminal member 27. It is now seen that a circuit may be provided from external terminal 14 through mounting member 8, bimetallic element 17, movable contact 20, stationary contact 26, and heater 31 to external terminal 29. Alternatively, one circuit may be established through external terminal 14 through mounting member 8, bimetallic element 17, movable contact 20, and stationary contact 26 to external terminal 23 and another circuit established from external terminal 29 through heater 31 to external terminal 23.

It will be seen by reference to Figs. 3 and 4, that mounting member 8 is normally bowed outwardly away from bottom 13 of housing member 2, as at 34. Mounting member 8 has an opening 35 in the center thereof and a threaded opening 36 is formed in bottom 13 of housing member 2. A suitable screw 37 seated in opening 35 in mounting member 8 with its head engaging top surface of the mounting member and with its other end threadingly engaging threaded opening 36 in bottom 13 of housing member 2. It is now readily seen that mounting member 8 may be deflected toward bottom 13 by means of screw 37. A deflection of member 8 toward bottom 13 increases the pressure applied by bimetallic element 17 following engagement of movable contact 20 with stationary contact 26 and thus lowers the tripping temperature. Conversely, unscrewing screw 37 so that mounting member 8 is deflected away from bottom 13 decreases the contact pressure and raises the tripping temperature.

In order to set the resetting temperature, mounting member 8 is provided with a tab portion 38 between extensions 10. Tab portion 38 is bent downwardly to limit the upward movement of bimetallic element 17 and thus to set the resetting temperature. Tab portion 38 may be bent by means of suitable tools in order to selectively adjust the resetting temperature. In order to adjust the tripping temperature, the device is placed in the ambient temperature at which the device is required to trip. The screw 37 is adjusted until bimetallic element 17 snaps from the position shown in Fig. 3 to the position shown in Fig. 4. In order to adjust the resetting temperature, the device is placed in the ambient temperature at which it is required to automatically reset and the tab portion 38 of mounting member 8 is bent downwardly until bimetallic element 17 snaps back to the contacts closed position.

Referring specifically to Fig. 5, the improved thermal overload switch of this invention is assembled by first positioning terminal members 21 and 27 with the attached heater 31 in openings 22 and 28 in bottom portion 13 of housing member 2. Portion 11 of mounting member 8 is then positioned in opening 12 in bottom 13 and lastly screw 37 is inserted through opening 35 in mounting member 8 and threaded into opening 36 in bottom 13.

It is now seen that this invention provides an extremely simple automatic resetting thermal overload switch incorporating only eight component parts. The switch is simple to assemble, simple to adjust, and thus relatively inexpensive. While a single heater 31 is shown, it will be readily understood that the device may be utilized without a heater 31, or with more than one heater if desired.

While I have shown and described a particular embodiment of this invention, further modifications and improvements will occur to those skilled in the art. I desire it to be understood therefore that this invention is not limited to the particular form shown and I intend in the appended claims to cover all modifications which do not depart from the spirit and scope of this invention.

What I claim as new and desire to secure by Letters Patent of the United States is:

1. A thermal overload switch comprising a housing member of insulating material having a cavity formed therein, a metallic mounting member positioned in said cavity spaced from the bottom thereof and extending substantially across the same, said mounting member having a portion extending through said housing member bottom to form an external terminal, a bimetallic element in said cavity intermediate said housing member bottom and said mounting member and having a point thereon secured to said mounting member adjacent one end thereof, a movable contact mounted on said bimetallic element opposite from said point and facing said housing member bottom, a terminal member having one end in said cavity and extending through said housing member bottom to form a second external terminal, a stationary contact mounted on said one end of said terminal member and cooperating with said movable contact, another terminal member having one end in said cavity and extending through said housing member bottom to form a third external terminal, a heater positioned in said cavity and having its ends respectively connected to said one end of said terminal members, said mounting member being normally longitudinally bowed away from said housing member bottom, and means for selectively deflecting said mounting member toward said bottom thereby to set one characteristic of said switch, said mounting member having a portion extending toward said bimetallic element and adapted to limit movement of the same thereby to set another characteristic of said switch.

2. A thermal overload switch comprising a housing member of insulating material having a cavity formed therein, said housing member having a step formed in its inner wall thereby dividing said cavity into an upper larger portion and a lower smaller portion, a metallic mounting member positioned in said upper cavity portion extending substantially across the same and engaging said step, said mounting member having a portion extending from one end thereof and through said housing member bottom to form an external terminal, a bimetallic element in said lower cavity portion having a point thereon secured to said mounting member adjacent one end thereof, a movable contact mounted on said bimetallic element opposite from said point and facing said housing member bottom, a terminal member having one end in said lower cavity portion and extending through said housing member bottom to form a second external terminal, a stationary contact mounted on said one end of said terminal member cooperating with said movable contact, said mounting member being normally longitudinally bowed away from said housing member bottom, said housing member bottom having a threaded opening formed therein, and screw means engaging housing member bottom opening and said mounting member for selectively deflecting the same toward said bottom thereby to set the tripping temperature of said switch, said mounting member having another portion extending from the other end thereof toward said bimetallic element, said other mounting member portion being selectively deflectible thereby to place a predetermined limit on the movement of said bimetallic element whereby the resetting temperature of said switch is set.

3. A thermal overload switch comprising a housing member of insulating material having a cavity formed therein, a metallic mounting member positioned in said cavity spaced from the bottom thereof and extending substantially across the same, said mounting member having a portion extending from one end thereof and through said housing member bottom to form an external terminal, a substantially O-shaped bimetallic element in said cavity intermediate said housing member bottom and said

mounting member and having a point thereon secured to said mounting member adjacent one end thereof, a movable contact mounted on said bimetallic element opposite from said point and facing said housing member bottom, a terminal member having one end in said cavity extending through said housing member bottom to form a second external terminal, a stationary contact mounted on said one end of said terminal member and cooperating with said movable contact, said mounting member being normally longitudinally bowed away from said housing member bottom, said housing member bottom having a threaded opening formed therein, and screw means engaging said housing member bottom opening and said mounting member for selectively deflecting the same toward said bottom thereby to set the tripping temperature of said switch, said mounting member having another portion extending from the other end thereof toward said bimetallic element, said other mounting member portion being selectively deflectible thereby to place a predetermined limit on the movement of said bimetallic element whereby the resetting temperature of said switch is set.

4. A thermal overload switch comprising a housing member of insulating material having a cavity formed therein, a metallic mounting member positioned in said cavity spaced from the bottom thereof and extending substantially across the same, said mounting member having a portion extending from one end thereof and through said housing member bottom to form an external terminal, a substantially O-shaped bimetallic element in said cavity intermediate said housing member bottom in said mounting member and having a point thereon secured to said mounting member adjacent one end thereof, a movable contact mounted on said bimetallic element opposite from said point and facing said housing member bottom, a terminal member having one end in said cavity extending through said housing member bottom to form a second external terminal, a stationary contact mounted on said one end of said terminal member and cooperating with said movable contact, another terminal member having one end in said cavity and extending through said housing member bottom to form a third external terminal, a heater positioned in said cavity intermediate said bimetallic element and said housing member bottom and having its ends respectively connected to said one end of said terminal members, said mounting member being normally longitudinally bowed away from said housing member bottom, said housing member bottom having a threaded opening formed therein, and screw means engaging said housing member bottom opening and said mounting member for selectively deflecting the same toward said bottom thereby to present the tripping temperature of said switch, said mounting member having another portion extending from the other end thereof toward said bimetallic element, said other mounting member portion being selectively deflectible thereby to place a predetermined limit on the movement of said bimetallic element whereby the resetting temperature of said switch is set.

5. A thermal switch comprising a housing member of insulating material having a cavity formed therein, said housing member having a step formed in its inner wall thereby dividing said cavity into an upper larger portion and a lower smaller portion, a metallic mounting member positioned in said upper cavity portion extending substantially across the same and engaging said step, said mounting member having a portion extending from one end thereof and through said housing member bottom to form an external terminal, a substantially O-shaped bimetallic element in said lower cavity portion and having a point thereon secured to said mounting member adjacent one end thereof, said bimetallic element having an indentation formed therein opposite said point and extending toward said housing member bottom, a movable contact mounted on said indentation and facing toward said housing member bottom, a terminal member having one end in said lower cavity portion extending through said housing member bottom to form a second external terminal, a stationary contact mounted on said one end of said terminal member and cooperating with said movable contact, another terminal member having one end in said lower cavity portion and extending through said housing member bottom to form a third external terminal, a heater positioned in said lower cavity portion intermediate said bimetallic element and said housing member bottom and having its ends respectively connected to said one end of said terminal members, said mounting member being normally longitudinally bowed away from said housing member bottom, said housing member bottom having a threaded opening formed therein, and screw means engaging said housing member bottom opening and said mounting member for selectively deflecting the same toward said bottom thereby to reset the tripping temperature of said switch, said mounting member having another portion extending from the other end thereof toward said bimetallic element, said other mounting member portion being selectively deflectible thereby to place a predetermined limit on the movement of said bimetallic element whereby the resetting temperature of said switch is set.

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