July 3, 1928.

1,675,370

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THERMAL RELAY

Original Filed June 9, 1920

Fig. 1.

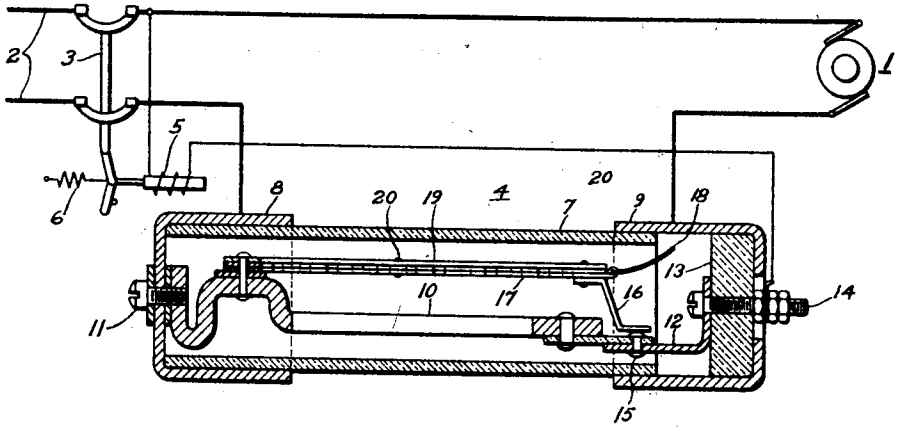


Fig. 2.

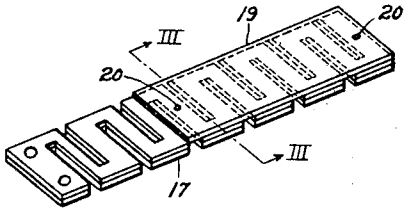
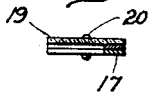


Fig. 3.



WITNESSES:

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UNITED STATES PATENT OFFICE.

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THERMAL RELAY.

Continuation of application Serial No. 387,571, filed June 9, 1920. This application filed March 12, 1925. Serial No. 14,963.

My invention relates to electrical protective devices and particularly to thermal relays.

One object of my invention is to provide a thermal relay that shall have sufficient time interval in the operation thereof to effect protection of electrical apparatus from overloads.

Another object of my invention is to provide a relay, of the above-indicated character, that shall employ a bimetallic element of such shape that a relatively large quantity of heat, and, consequently, a relatively large torque may be developed therein.

Another object of my invention is to provide a relay of the above-indicated character, that shall be simple and economical in construction and reliable in operation.

Heretofore, considerable difficulty has been encountered in developing sufficient heat in a small bimetallic element to obtain a torque of the required value because the resistance of the element was too small to cause a heat loss therein of sufficient value to develop the required torque.

In view of this difficulty of developing sufficient heat in a bimetallic element, I provide an element that corresponds in size to that previously employed but so slotted as to embody a current-conducting path greatly exceeding in length the original current-conducting path of the element. By reason of the slotting of the element, not only is the length of the current-conducting path greatly increased but the cross-sectional area of the conducting path is so decreased that the effective resistance of the element is greatly multiplied. The heat losses and, consequently, the torque developed, are correspondingly increased.

Figure 1 of the accompanying drawings is a diagrammatic view of an electric circuit embodying my invention.

Fig. 2 is a perspective view of the bimetallic element employed in the device shown in Fig. 1.

Fig. 3 is an end view, partially in elevation and partially in section, of the bimetallic element shown in Fig. 2.

An electrical apparatus 1 is adapted to receive energy from a circuit 2 through a circuit interrupter 3 and is provided with a thermal relay 4 to permit the interrupter 3 to open when the temperature of the apparatus 1 attains or exceeds a predetermined dangerous value. The interrupter 3 is provided with a holding electromagnet 5 and a restraining spring 6 that is adapted to open the interrupter 3 when the holding magnet 5 becomes de-energized.

The relay 4 comprises a cylindrical casing 7 that has two ferrules 8 and 9 mounted on the respective ends thereof. A supporting member 10 is supported, at one end, by a screw 11, that extends through the ferrule 8, and at the other end, by a supporting member 12 that is mounted on an insulating block 13 by means of a screw 14. The insulated block 13 is disposed within the ferrule 9 adjacent to the end thereof, and the screw 14 is so accessible as to readily permit the connection of an external conductor thereto. A contact member 15 is also mounted on the supporting member 12 and is adapted to be engaged by a movable contact member 16 that is supported by a bimetallic element 17. The bimetallic element 17 is composed of two metals having unequal coefficients of expansion. One end of the bimetallic element 17 is so mounted on the supporting member 10 as to be in electrical engagement therewith, and the other end of the element is electrically connected to the ferrule 9 by means of a flexible conductor 18. A supporting member 19, of flexible insulating material, is disposed along one side of the bimetallic element 17 and is secured thereto by a plurality of rivets 20, or some similar means, and serves to maintain the bimetallic element substantially rigid. The movable contact member 16 is secured to the movable end of the bimetallic member 17 and is in electrical engagement therewith.

As current traverses the circuit to energize, or to actuate, the apparatus 1, the bimetallic element 17 of the relay 4 serves as a conductor between the ferrule 8 and the ferrule 9, in connection with the flexible conductor 18, and is, therefore, heated in accordance with the heating of the apparatus 1 by the current passing therethrough. As the bimetallic element 17 is heated to a predetermined degree, the torque developed therein by the current traversing the same serves to so actuate the element as to cause

the contact member 16 to be disengaged from the contact member 15.

By so constructing the bimetallic element 17 that the resistance thereof is of the correct value to generate a predetermined amount of heat therein in accordance with the temperature rise of an electric translating device to be protected and that the combined heat-storage capacity of said element and of the cylindrical casing 7 is of the correct value, the relay 4 may be caused to function in accordance with the thermal characteristics of the electric translating device with which it may be in circuit.

The circuit of the electromagnet 5, which is normally completed through the contact members 15 and 16, is opened upon the disengagement of the contact members. The electromagnet 5 is thereupon de-energized, and the circuit interrupter 3 is, consequently, opened by the restraining spring 6.

When current ceases to traverse the element 17, the temperature thereof decreases, and engagement between the contact members 15 and 16 is re-established.

It will be understood that the main feature of my invention is to increase the inherent heating capacity of a bimetallic element to permit the use of a relatively stiff element to obtain protection when the element is traversed by relatively low values of current without the use of external heating means.

Although I have shown one form of relay embodying a slotted bimetallic element, I do not limit the element to the particular mode of slotting that is illustrated, or to a relay embodying an element having the particular arrangement that is illustrated, as various modifications may be made therein within the spirit and scope of the invention as set forth in the appended claims.

I claim as my invention:

1. A thermal element comprising a bimetallic strip having a plurality of laterally extending slots, said slots being alternately open at opposite edges thereof to increase the length of the current-conducting path therethrough, and means for controlling the relative movement between the different portions so constituted.

2. A thermal element comprising a bimetallic strip having a plurality of lateral slots alternately open at opposite edges to increase the resistance of the bimetallic element as a conductor to a current traversing the same.

3. A thermal relay comprising a bimetallic strip having a plurality of lateral alternately open-ended oppositely-extending slots therein to constitute a plurality of portions relatively movable with respect to each other, and means whereby said portions are caused to cooperate to effect a predetermined operation of the bimetallic element as a whole.

In testimony whereof, I have hereunto subscribed my name this 11th day of March, 1925.

FREDERICK H. MILLER.