

April 16, 1929.

A. J. MOTT LAU

1,709,681

THERMAL RELAY

Filed July 27, 1926

3 Sheets-Sheet 1

Fig. 1.

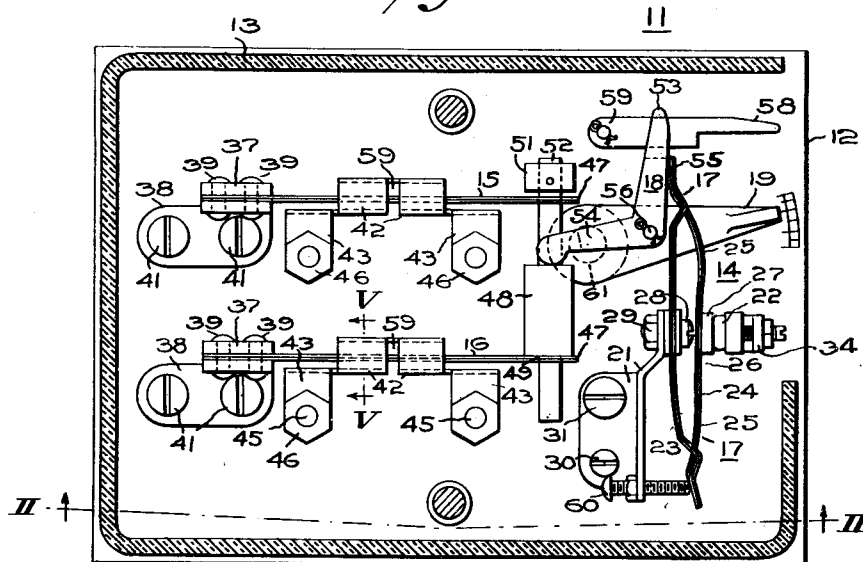
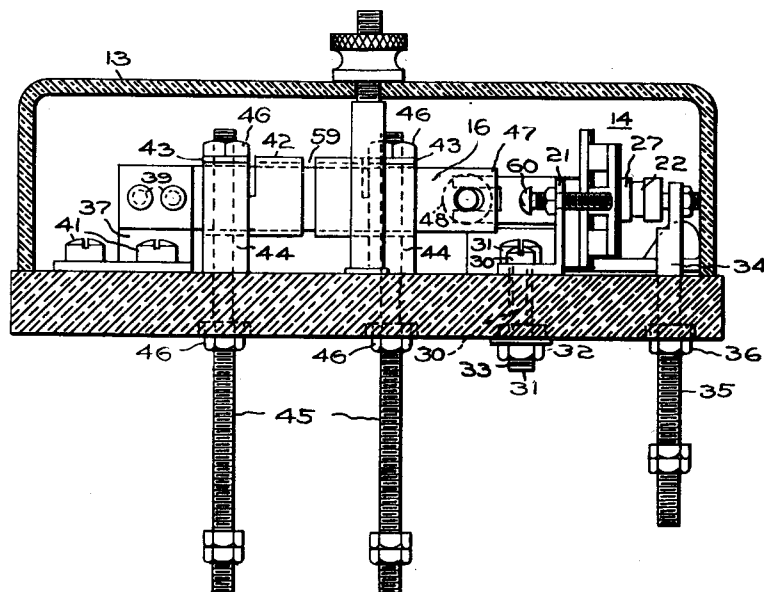


Fig. 2.



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Fig. 3.

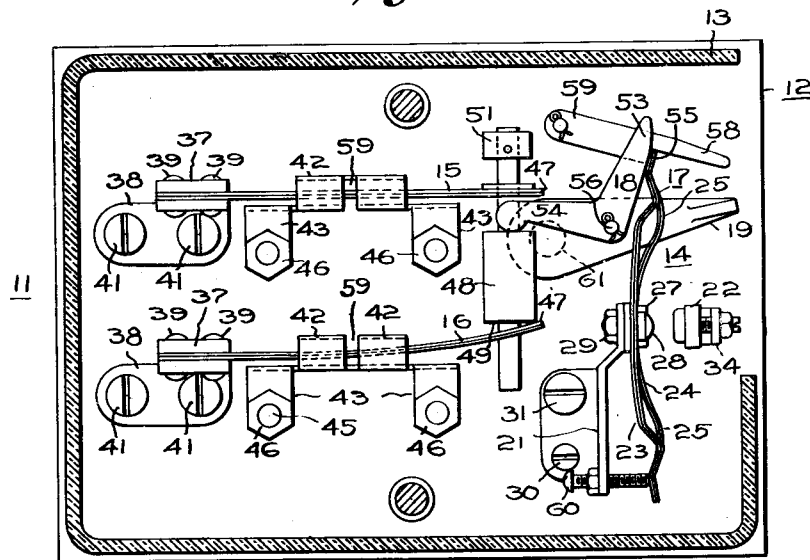


Fig. 4.

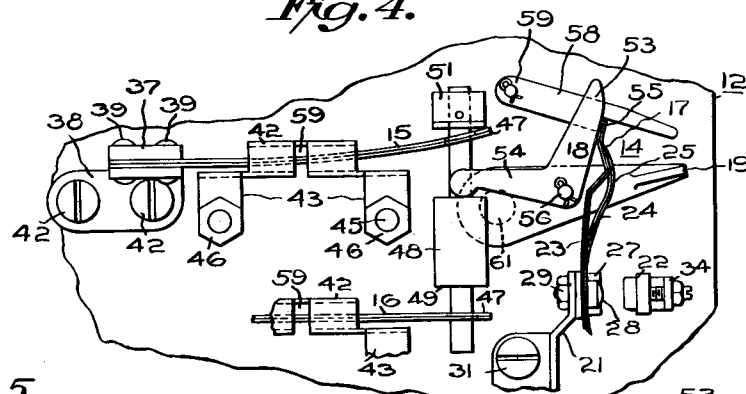


Fig. 5.

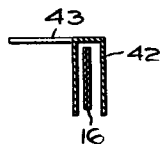
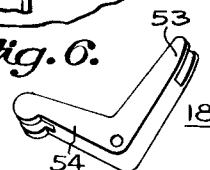


Fig. 6.



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3 Sheets-Sheet 3

Fig. 7.

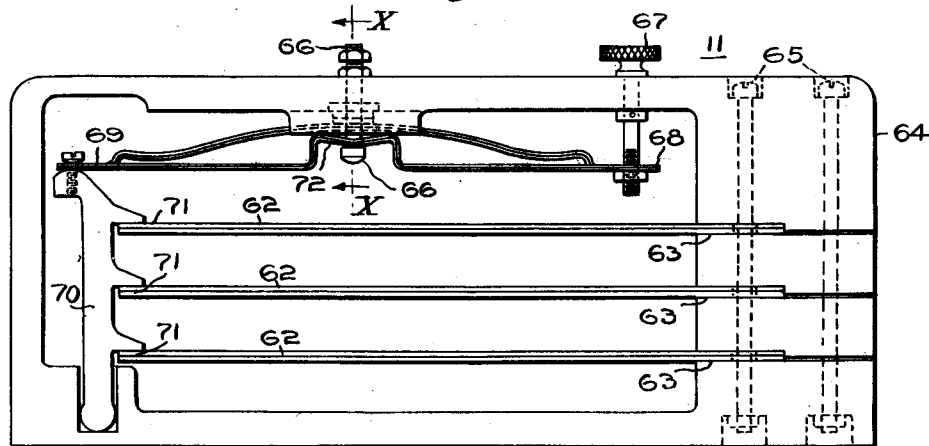


Fig. 8.

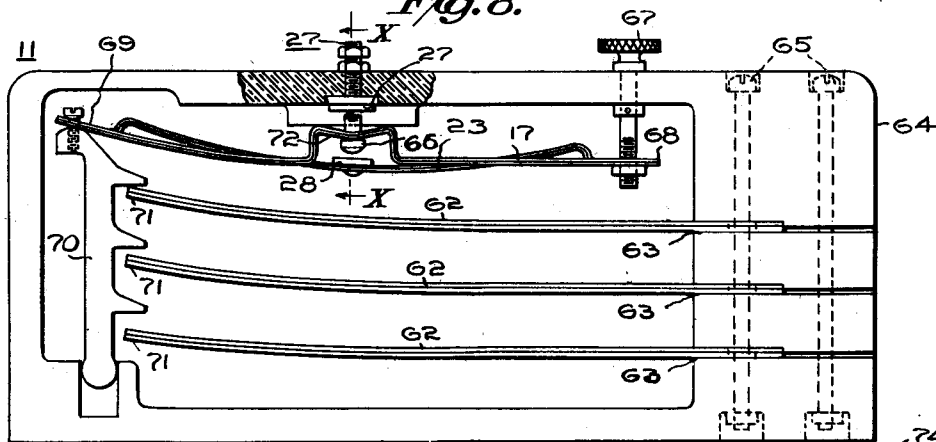


Fig. 9.

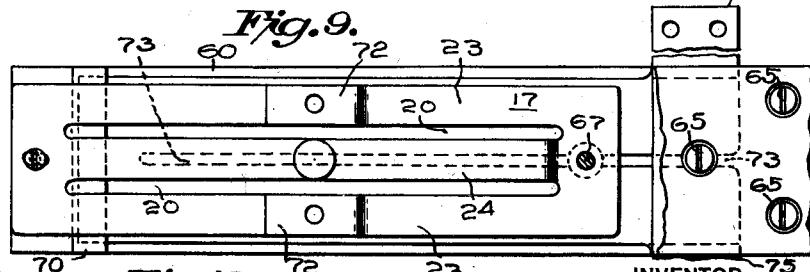
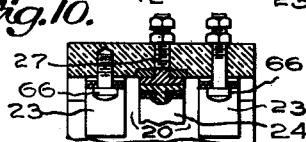


Fig. 10.



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UNITED STATES PATENT OFFICE.

AUGUST J. MOTT LAU, OF PITTSBURGH, PENNSYLVANIA, ASSIGNOR TO WESTINGHOUSE ELECTRIC & MANUFACTURING COMPANY, A CORPORATION OF PENNSYLVANIA.

THERMAL RELAY.

Application filed July 27, 1926. Serial No. 125,220.

My invention relates to protective relays for electric translating devices and particularly to thermal relays.

An object of my invention is to provide a thermal relay that shall be simple in construction and easily manufactured.

Another object of my invention is to provide a thermally actuatable relay that shall be operable to protect either single or multiphase circuits.

Another object of my invention is to provide a thermal protective relay that shall be adapted to return to its operative position automatically.

Another object of my invention is to provide a thermal relay that shall be adapted to be automatically maintained in an inoperative position after it has been actuated.

In practicing my invention, I provide a resilient switch member that shall be adapted to control the engaged and disengaged positions of a plurality of contact members and that shall be adapted also to so actuate one of said contact members as to disengage the other with a snap motion.

I provide also a plurality of thermally responsive bi-metallic members for actuating a switch member through the medium of an intervening link member that is operatively associated with the bi-metallic members. The link member that is associated with the bimetallic and the switching members is adjustably movable relatively thereto, whereby the switch member may be operated over a wide range of thermal conditions of the bimetallic members. Resistor members are disposed in thermal relation to the bi-metallic member to provide the thermal energy necessary to cause them to actuate the switch member.

In the accompanying drawings, Fig. 1 is a plan view, partially in section, of a device embodying my invention.

Fig. 2 is a view, in vertical section, the section being taken on the lines II—II of Fig. 1.

Fig. 3 is a view similar to Fig. 1, illustrating the switch member actuated to an inoperative position by one of a plurality of thermally responsive members.

Fig. 4 is a plan view of portions of the device illustrated in Figs. 1, 2 and 3.

Fig. 5 is a view, in vertical section, of a portion of the device illustrated in Fig. 1, the section being taken on the lines V—V.

Fig. 6 is a view, in perspective, of an actuat-

ing link member employed in the device illustrated in Figs. 1 to 4, inclusive.

Fig. 7 is a side elevational view of a modification of a device embodying my invention.

Fig. 8 is a view similar to Fig. 7 but showing the switch members actuated to inoperative positions.

Fig. 9 is a top plan view of a portion of the device illustrated in Figs. 7 and 8, and

Fig. 10 is a sectional view taken on the line X—X of Figs. 7 and 8.

Referring more particularly to the drawings, a thermal relay 11 comprises, in general, a base 12, a cover member 13 therefor, a switch mechanism 14 and a plurality of thermally responsive members 15 and 16. The base member 12 and the cover member 13 may be of any electric insulating material that is suitable for molding into the desired shape to provide insulating and enclosing means for electric-circuit controlling devices, such as the switch mechanism 14 and the thermally responsive members 15 and 16.

The switch mechanism 14 comprises a resilient switch member 17, an adjustably mounted link member 18, a pivotally mounted member 19 for varying the position of the link member 18 with respect to the switch member 17, a supporting terminal member 21 and a stationary contact member 22.

The switch member 17 comprises an integral frame member 23 which has a plurality of apertures 20 therein (see Fig. 9) and a bridging member 24 that is of substantially greater length than the aperture in the frame member 23. The bridging member 24 is provided with curved end portions 25 and an intermediate, oppositely deflected portion 26.

A contact member 27 is mounted on the bridge-member 17, intermediate the ends thereof, and is adapted to engage the contact member 22. The frame member 23 is secured to the supporting terminal member 21 at the sides thereof and intermediate its ends by suitable means such as a screw-threaded member 28 and a nut member 29.

The terminal member 21 is secured to the base member 12 by a screw member 30 and a terminal member 31. The terminal member 31 extends through the base member 12 and is secured thereto by a nut member 32 that registers with a screw threaded portion 33. The terminal member 22 is provided with a supporting member 34 that is adapted to rest on the base member 12, as illustrated in Fig. 110

2, and is provided with a screw threaded portion 35 that extends through the base member 12. The terminal member 34 is maintained in positive operative relation with the base member 12 and the switch member 17 by a nut member 36 that registers with the screw threaded portion 35.

The thermally responsive bimetallic members 15 and 16 are secured to upright portions 37 of suitable supporting members 38 by rivet members 39. The supporting members 38 are secured to the base member 12 by suitable screw-bolt members 41. The bi-metallic members 15 and 16 are energized from a pair of resistor members 42 that are disposed in thermal relation around a predetermined portion thereof.

The resistor members 42 are provided with horizontally extending portions 43 that are mounted on suitable tubular insulating members 44. Terminal members 45 are provided for each of the horizontally extending end portions 43 and extend through the base member 12 and the tubular members 44. The terminal members 45 are maintained in operative relation to the horizontally extending portions 43, the tubular members 44 and the base member 12 by suitable nut members 46 that register with suitable screw threaded end portions of the terminals 45.

The free ends 47 of the bi-metallic members 15 and 16 are flexibly connected by a member 48. The member 48 rests on the bi-metallic members 15 and 16 at a shoulder portion 49 thereof, and a collar member 51 secured thereto at an upwardly extending portion 52. The link member 18 is provided with a pair of angularly disposed portions 53 and 54 that are operatively engaged by an end portion 55 of the switch member 17 and an intermediate portion of the flexibly connected link member 48. The link member 18 is pivotally mounted to the pivotally mounted member 19 by a suitable pin 56.

Upon the thermal energization of the bi-metallic members 15 and 16, caused by passing electric current through the resistor members 42, the link member 18 is actuated about the pin 56 by an upward movement of the bi-metallic members, as illustrated in Figs. 3 and 4, thereby so deflecting the end 55 of the switch member 17 that the contact member 27 is disengaged from the stationary contact member 22, as illustrated in Figs. 3 and 4.

In the event that it may be desirable to prevent the switch member 17 from reclosing automatically after it has been actuated to the position illustrated in Figs. 3 and 4, a locking member 58 may be provided for holding the switch member 17 in its open circuit position. The member 58 is pivotally mounted at one end 59 thereof, substantially as illustrated in Figs. 1, 3 and 4.

An adjusting screw member 60 that is secured to the supporting terminal member 21

is provided to deflect one end of the switch member 17 to a predetermined position. The amount of deflection produced by the screw member 60 determines the amount of deflection necessary at the end 55 of the switch member 17 to cause the contact member 27 to be disengaged from the contact member 22.

The terminal members 31 and 35 may be assumed to be connected to a control circuit of an electric translating device to be protected. The circuit to be controlled will be actuated in accordance with the relative positions of the contact members 27 and 22. The terminal members 45 may be assumed to be connected in a heavy-current circuit to be protected. If the value of the current exceeds a predetermined value, the heating effect produced in the resistor members 42 will be such as to actuate the bi-metallic members 15 and 16 to control the contact members 27 and 22, thereby controlling the control circuit of an electric translating device (not shown) which is operable to control the heavy current circuit (not shown) with which the terminal members 45 are in circuit.

As illustrated in the drawings, the portions of the resistor members 42 intervening between the terminal members 45 are of substantially C-shape and extend downwardly over the bi-metallic members 15 and 16. The bi-metallic members 15 and 16 are free to move between the downwardly extending portions of the resistor members 42, substantially as illustrated in Fig. 5. The resistor members 42 are provided also with a central lateral slot 59, whereby a resistor of relatively long length and small section is provided.

The thermal conditions at which the bi-metallic members 15 and 16 are adapted to actuate the switch member 17 are controlled by moving the member 19 about its pivot point 61. If the bimetallic members 15 and 16 are to be responsive to a relatively large current before actuating the switch member 17, the member 19 is moved in a counter clockwise direction. If the bi-metallic members 17 are to be actuated by relatively small current the member 19 is moved in a clockwise direction.

In the modification illustrated in Figs. 7 to 10 inclusive, I have shown a plurality of current conducting bi-metallic members 62 that are self-heating. The bi-metallic members 62 as illustrated in Figs. 7 to 10, are secured within suitable grooved portions of a frame member 64 and are secured therein by suitable bolt members 65.

The switch member 17 is adjustably secured to the frame 64 by suitable screw threaded members 66. An adjusting means 67 is provided to maintain an end portion 68 of the switch member 17 in a predetermined deflected position. An end portion 69 of the switch member 17 is operatively secured to an actuating member 70 that is ac-

tuated by the free end portions 71 of the bi-metallic members 62 either individually or jointly.

The value of current necessary to operate the switch 17 is determined by the relative position of the end portion 68 thereof and by the stress applied to the frame 23 by the screw members 66. By moving the end portion 68 upwardly by means of the member 67, a relatively small current is required to flow in the bimetallic members 62 to actuate the switch member 17 to its inoperative position (see Fig. 8). Likewise, if the screw members 66 are so adjusted as to straighten a deformed portion 72 of the frame 23, a relatively small current flowing in the bimetallic members 62 will actuate the switch 17 to the position as illustrated in Fig. 8.

If it is desirable that the bimetallic elements be effective to operate the switch member 17 in response to a relatively large value of current, the end portion 68 is moved downwardly by means of the adjusting screw-threaded member 67. A similar adjustment may be attained by releasing the stress of the screw-threaded members 66 upon the portions 72 of the frame portions 23.

In Fig. 9 of the drawing, I have illustrated a slotted portion 73 in the bi-metallic members 62 whereby a substantially long conductor of relatively high resistance is provided. Current may be assumed to enter the bimetallic members 62 at an end portion 74 and to leave at a similar end portion 75 thereof.

The particular construction of the switch member 17 illustrated in the drawings forms the subject matter of my copending applications Serial No. 725,408, filed July 11, 1924, now Patent #1,668,973, issued May 8, 1928, and Serial No. 94,192, filed March 12, 1926, now Patent #1,668,974, issued May 8, 1928, and the switch member 17 illustrated in Figs. 7 to 10 inclusive forms the subject-matter of a third co-pending application Serial No. 141,712, filed Oct. 15, 1926, now Patent #1,689,795, issued October 30, 1928.

By my invention I have provided a thermal relay that is simple in construction, easily manufactured and is operable to control a control circuit of either single or multiphase characteristics. The device is so adjustable as to be responsive to a relatively wide range of thermal conditions to which the particular translating device which is to be protected by the thermal relay may be subjected. Various modifications may be made in the device embodying my invention without departing from the spirit and the scope thereof. I desire, therefore, that only such limitations shall be placed thereon as are imposed by the prior art and the appended claims.

I claim as my invention:

1. The combination with a plurality of bi-metallic members, means for thermally ener-

gizing said members individually, and a preshaped resilient member restrained against longitudinal movement, of means actuable by said bimetallic members for actuating said resilient member laterally, with a snap motion when said bimetallic members have attained a predetermined thermal condition.

2. The combination with a plurality of bimetallic members, means for individually thermally energizing said members, and a preshaped resilient member restrained against longitudinal movement, of means, actuable by said bimetallic members individually, for causing said resilient member to deflect laterally thereof when said bimetallic members have individually attained a predetermined thermal condition.

3. The combination with a plurality of bimetallic members, means for thermally energizing said members, a preshaped resilient member restrained against longitudinal movement, and a pair of relatively movable contact members controlled thereby, of means controlled by said bimetallic members for actuating said resilient member to thereby control said contact members.

4. The combination with a plurality of bimetallic members, means for thermally energizing said members, a preshaped resilient member restrained against longitudinal movement, and a pair of relatively movable contact members controlled thereby, of adjustable means actuable by said bimetallic member for actuating said resilient member to thereby control said contact member.

5. The combination with a switch member comprising a resilient frame having an aperture therein and a preshaped resilient bridging member therefor of substantially greater length than said aperture, said resilient member being adapted to deflect laterally in response to a predetermined deformation of said frame member, of a means for deforming said frame member comprising a bimetallic member operatively associated with said frame member for producing a predetermined deformation therein in accordance with the thermal condition of said bimetallic member.

6. In a thermally actuable relay, the combination with a switch member comprising a stationary contact member, a movable contact member and a preshaped resilient member operatively associated with said contact members and adapted to actuate said movable contact member into and out of engagement with said stationary contact member upon a predetermined lateral deformation thereof, said resilient member being restrained from lateral movement, of means for deforming said resilient member comprising a plurality of thermally actuable bimetallic members and means operatively associated with said bimetallic and resilient members for deforming said resilient member in ac-

cordance with the thermal condition of the bimetallic member.

7. The combination with a thermo-responsive member, a pivotally mounted member actuated thereby, of a switch member actuated by said pivotally mounted member in accordance with a predetermined thermal condition of said thermo-responsive member, said switch member comprising a resilient frame having an aperture therein, means for so supporting said frame as to permit of deflecting one end thereof laterally of said longitudinal dimensions, a resilient bridging member for said aperture of substantially greater length than the aperture, and a contact member actuated thereby in accordance with a predetermined deflection of one of said frame members.

8. The combination with a switch member comprising a resilient frame having an elongated aperture therein, a bridging member of greater length than said aperture and extending thereacross, means for supporting said frame intermediate the ends thereof, and means associated with one end of said frame for producing a predetermined deflection therein, of thermally actuatable means for actuating the other end of said frame to cause said bridging member to deflect laterally between the ends thereof.

9. The combination with a switch member comprising a resilient frame having an elongated aperture therein, a bridging member of greater length than said aperture and extending thereacross, means for supporting said frame intermediate the ends thereof, and means associated with one end of said frame for producing a predetermined deflection therein, of adjustable thermally actuatable means for actuating the other end of said frame to cause said bridging member to deflect laterally between the ends thereof.

10. The combination with a switch member comprising a resilient frame having an elongated aperture therein, a bridging member of substantially greater length than the aperture and extending thereacross for controlling the engaged and disengaged position of a pair of contact members associated with said switch member, means for supporting said frame intermediate the ends thereof, and means associated with one end of said frame for producing a predetermined deflection therein, of thermally actuatable means for actuating the other end of said frame to cause said bridging member to deflect laterally between the ends thereof.

In testimony whereof, I have hereunto subscribed my name this 23rd day of July, 1926.

AUGUST J. MOTT LAU.