

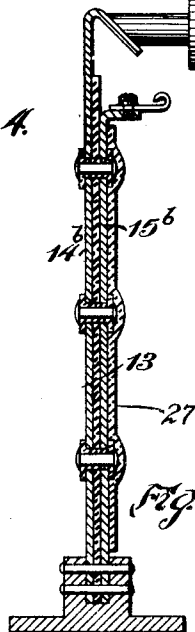
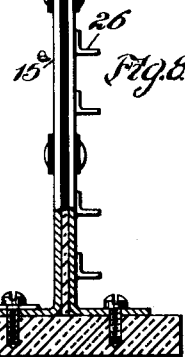
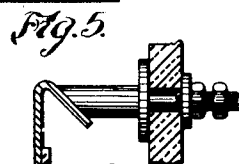
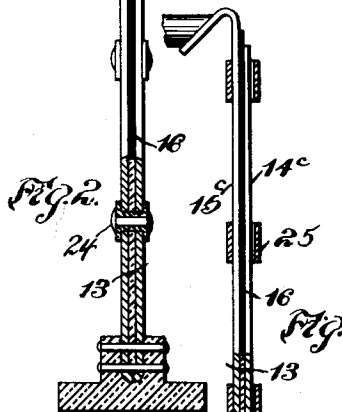
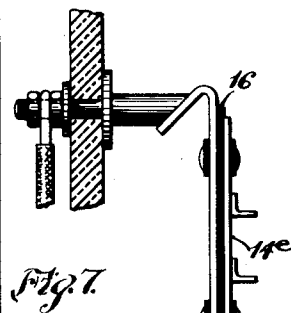
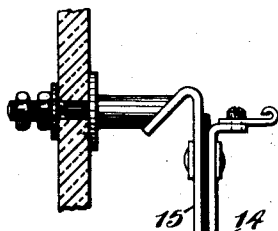
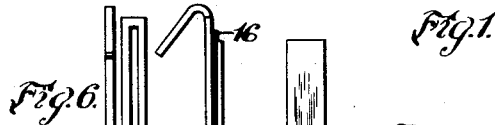
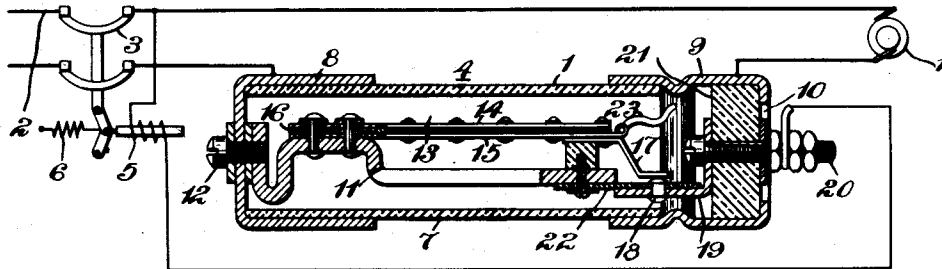
Oct. 14, 1924.

1,511,352

F. H. MILLER

THERMAL RELAY

Filed June 3, 1920



WITNESSES:

J. P. Mumm
J. E. Foster

INVENTOR

Frederick H. Miller

BY

Wesley S. Carr
ATTORNEY

UNITED STATES PATENT OFFICE.

FREDERICK H. MILLER, OF WILKINSBURG, PENNSYLVANIA, ASSIGNOR TO WESTINGHOUSE ELECTRIC & MANUFACTURING COMPANY, A CORPORATION OF PENNSYLVANIA.

THERMAL RELAY.

Application filed June 3, 1920. Serial No. 386,223.

To all whom it may concern:

Be it known that I, FREDERICK H. MILLER, a citizen of the United States, and a resident of Wilksburg, in the county of Allegheny and State of Pennsylvania, have invented a new and useful Improvement in Thermal Relays, of which the following is a specification.

My invention relates to thermal relays and particularly to thermal relays that embody bimetallic members.

One object of my invention is to provide a relay, of the above-indicated character, that shall have the two elements thereof electrically or thermally insulated from each other.

Another 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 against overloads.

Another object of my invention is to provide a thermal relay, of the above-indicated character, that shall embody a bimetallic member in which one of the elements is adapted to be heated to a greater degree than the other elements.

A further object of my invention is to provide a relay, of the above-indicated character, that shall be adapted for use in cartridge-type fuse clips, be relatively inexpensive to construct and be reliable and effective in its operation.

Heretofore, considerable difficulty has been encountered in developing sufficient heat in a small bimetallic member, by a current traversing the same, to obtain a movement that was sufficient to effect satisfactory operation of a contact member for controlling an auxiliary circuit. This difficulty was due to the fact that the current traversed the two elements in parallel and their resistance was very low.

In view of the difficulty of developing sufficient heat in the bimetallic member for obtaining a movement of predetermined extent, I separate the respective elements and cause the currents to traverse the two elements in series, thus increasing the resistance, and, consequently, the heating of the bimetallic member. By causing the current to traverse only one element of the bimetallic member, a greater degree of heat is obtained in that element than in the other. A higher temperature in one element effects a correspondingly greater expansion, and,

since the other element has a lower temperature and the two elements are mechanically joined but thermally insulated, a greater bending force, and, consequently, a movement of greater extent, is obtained.

Figure 1 of the accompanying drawings is a partially diagrammatic and partially sectional view of an electric circuit and an apparatus embodying my invention, and Figs. 2 to 8, inclusive, are mainly sectional views illustrating modifications of the device shown in Fig. 1.

A translating apparatus 1 is adapted to receive energy from a distribution circuit 2 through a circuit interrupter 3 and is provided with a thermal protective device 4 for permitting the interrupter 3 to interrupt the circuit of the translating apparatus 1 when the temperature of the latter attains or exceeds a predetermined value. The interrupter 3 is provided with an electromagnet 5 for maintaining the interrupter in its closed position and a restraining spring 6 for opening the interrupter when the electromagnet 5 becomes de-energized. The circuit of the winding of the electromagnet 5 is controlled by the thermal device 4.

The thermal device 4 comprises a cylindrical casing 7 that is provided with a ferrule 8 at one end and a ferrule 9 having an opening 10 therein, at the other end thereof. A supporting member 11 is secured, by a screw 12, to the ferrule 8 and serves to support a bimetallic member 13 that is secured, at one end thereof, to the supporting member 11. The bimetallic member 13 comprises an element 14 that has a low coefficient of expansion, an element 15 that has a high coefficient of expansion and an insulating element 16 that is disposed between the two elements 14 and 15. The bimetallic member 13 is provided with a contact member 17, at the movable end thereof, that is adapted to engage a stationary contact member 18 which is mounted upon a supporting member 19. The supporting member 19 is secured, by a screw 20, to an insulating member 21 and thus is maintained out of engagement with the ferrule 9. The supporting member 19 also serves to support one end of the supporting member 11 through an insulating member 22.

The bimetallic member 13 is so supported on the member 11 that the element 15 effects

electrical engagement therewith, whereas the element 14 is both electrically and thermally insulated from both the supporting member 11 and the element 15. The other end of the element 15 is electrically joined to the ferrule 9 through a flexible conductor 23. The two elements 14 and 15 are mechanically joined at several points along the length thereof, by insulated rivets 24 or other suitable means to preclude any lost motion therebetween.

The element 15 serves as a conductor for current between the ferrules 8 and 9 and is heated in accordance with the heating of the translating apparatus 1. As the element 15 becomes heated it expands, and, since the element 14 is not heated as rapidly as the element 15, a movement of considerable extent is obtained at the movable end of the bimetallic member and the contact members 17 and 18 become disengaged at a temperature corresponding to a predetermined condition or temperature in the apparatus 1. The winding of the electromagnet 5 is thereby open-circuited and the interrupter 3 is opened by the spring 6.

Fig. 2 of the accompanying drawings illustrates a modification of the device embodying my invention wherein the two elements 14^a and 15^a of the bimetallic member 13 are thermally insulated along the length thereof but are joined at one end to permit a current to traverse the two elements in series. By means of this arrangement, a greater degree of heat and a correspondingly greater movement may be obtained in the bimetallic member 13. That is, the resistance of the device is increased, and, consequently, its heating will be increased.

Fig. 3 of the accompanying drawings illustrates a modified form of the device embodying my invention wherein the two members 14^b and 15^b are connected in series and the member 15 that has a greater coefficient of expansion is heat lagged, by the heat-insulating material 27, to increase its temperature.

Figs. 4 to 8, inclusive, illustrate further modifications of the device embodying my invention wherein the two elements 14 and 15 are both electrically and thermally insulated from each other and wherein only one element 15 is traversed by the circuit current. In the device that is illustrated in Fig. 4, a plurality of magnetizable bands 25 are so disposed as to surround the bimetallic member 13. The hysteresis losses developed in the magnetizable bands 25 serve to increase the temperature of the bimetallic member 13 and thereby to increase the movement effected therein. Fig. 5 is an edge view of a modified form of bimetallic member 13 embodying my invention, wherein the current-carrying element 15^a is slotted, as illustrated in Fig. 6, and

the other element 14^a is employed unslotted, as illustrated in Fig. 7. By slotting the current-carrying element 15^a, as illustrated in Fig. 6, the cross-sectional area is decreased and the effective length and resistance of that member and the consequent temperature are increased. A greater difference in temperature is thus developed between the two elements 14^a and 15^a as illustrated in Figs. 6 and 7, respectively, and a correspondingly larger movement is obtained in the bimetallic member 13 that comprises the two elements.

Fig. 8 of the accompanying drawings illustrates a further modification wherein the element 15^c that has a high coefficient of expansion is traversed by the circuit current and the other element 14^c that has a low coefficient of expansion is provided with metallic radiating fins 26 to provide a greater thermal-storage capacity and thereby decrease the resulting temperature of that element.

While I have shown a preferred form and several modifications of a device embodying my invention, I do not limit my invention to the specific structure of the preferred form that is illustrated, since the various modifications that are illustrated 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 relay comprising a heat-responsive device consisting of two elements having different coefficients of expansion, one element only of which is adapted to be heated.
2. A thermal-responsive relay comprising two elements having different heat-storage capacities.
3. A thermal relay comprising two elements mechanically joined along their length and thermally insulated.
4. A thermal relay for an electric circuit comprising two metallic elements having different coefficients of expansion one only of which may be traversed by the circuit current.
5. A bimetallic thermal relay for an electric circuit comprising two elements having different coefficients of expansion, the two elements being mechanically joined and one of the elements being thermally insulated to permit an increase in its temperature and, consequently, in the bending effort caused by unequal expansion when subjected to the circuit current.
6. A bimetallic thermal relay for an electric circuit comprising two elements having different coefficients of expansion, one of the elements serving as a conductor for the circuit current and being so thermally insulated as to reproduce predetermined thermal conditions corresponding to predeter-

mined values of current in the circuit and, consequently, a corresponding differential movement between said elements.

7. In an electric circuit, the combination with a translating device, of a bimetallic thermal device for reproducing the temperature conditions in the translating device comprising two mechanically-joined elements thermally insulated and having different coefficient of expansion.

8. In an electric circuit, the combination with a translating device and a circuit interrupter, of means for precluding a rise in the temperature of the translating device above a predetermined value comprising two thermally-responsive mechanically-joined elements thermally insulated from each other having different coefficients of expansion, one of which members is traversed by the circuit current, means for actuating the interrupter, and a plurality of contact members engagement of which is controlled by the thermal-responsive means for controlling the circuit of the interrupter actuating means.

9. A thermal relay for electrical apparatus comprising an enclosing casing, connecting ferrules at the ends thereof, a bimetallic member comprising two mechanically-joined elements thermally insulated from each other and having different coefficients of expansion and connecting means for the ferrules, said means being controlled by the bimetallic member.

10. A thermal relay for electrical apparatus comprising an enclosing casing, connecting ferrules at the ends thereof, a bimetallic member comprising two mechanically-joined elements thermally insulated from each other and having different coefficients of expansion, one only of the elements serving as a conducting means between the two ferrules.

11. A thermal relay for an electric circuit containing electrical apparatus comprising an enclosing casing, two thermal-responsive elements having different coefficients of expansion, one of which is connected in circuit with the apparatus and means controlled by the relay for disconnecting the apparatus from the circuit when predetermined conditions obtain in the apparatus.

12. A thermal relay for controlling the automatic disconnection of an electrical apparatus from an electric circuit when a predetermined temperature is developed in the apparatus comprising two thermally-responsive thermally-insulated elements having different coefficients of expansion and means controlled by the co-operation of the two elements for effecting the disconnection of the apparatus.

13. A thermal relay for controlling the automatic disconnection of an electrical apparatus from an electric circuit when a pre-

determined temperature is developed in the apparatus comprising two thermally-responsive thermally-insulated elements having different thermal-storage capacities and means controlled by the co-operation of the two elements for effecting the disconnection of the apparatus.

14. A thermal relay for controlling the automatic disconnection of an electrical apparatus from an electric circuit when a predetermined temperature is developed in the apparatus comprising two thermally-responsive thermally-insulated elements having different coefficients of expansion, one of which is connected in circuit with the electrical apparatus to be heated in accordance therewith and means controlled by the co-operation of the two elements for effecting the disconnection of the apparatus.

15. A thermal relay comprising two elements secured to effect a differential movement at one end thereof and means for effecting a greater degree of heating in one element than in the other by an electric current traversing the same.

16. A thermal relay comprising an enclosing casing, connecting ferrules at the ends thereof, two thermally-responsive thermally-insulated elements having different coefficients of expansion and a contact member controlled by one of the elements.

17. A thermal relay comprising an enclosing casing, connecting ferrules at the ends thereof, two thermally-responsive thermally-insulated elements having different coefficients of expansion one element only of which serves as a conducting means between the ferrules and a contact member controlled by one element.

18. A thermal relay comprising two thermally-responsive elements having different coefficients of expansion fixedly mounted at one end, mechanically joined to produce a turning force at the other end, one of the elements being heat-insulated from the other to produce a greater temperature therein and a correspondingly greater turning force, when subjected to an electric current.

19. A thermal-responsive device comprising two elements having different coefficients of expansion and means for permitting one element to be heated to a greater degree than the other, when traversed by an electric current.

20. The method of obtaining a magnified movement in a bimetallic member which consists in insulating the two elements from each other, heating one element and heat-lagging one element to control the dissipation of heat therefrom.

21. In a bimetallic member, the combination with the two metallic elements and insulating means therebetween, of means for securing the elements along the length thereof to preclude any lost motion therebetween.

22. A thermal-responsive member comprising two elements of different coefficients of expansion mechanically secured together to effect a differential expansion movement
5 therein and means for thermally insulating said elements from each other.

23. A thermal-responsive member comprising two elements of different coefficients of expansion mechanically secured together
10 to effect a differential expansion movement therein and means for heating one only of said elements.

24. A thermal-responsive member comprising two elements of different coefficients of expansion mechanically secured together
15 to effect a differential expansion movement therein and means for affecting the temperature of each of said elements independently of the other.

In testimony whereof, I have hereunto
20 subscribed my name this 27th day of May 1920.

FREDERICK H. MILLER.