April 24, 1934. J. F. FRESE 1,956,346

COMPENSATING THERMAL SWITCH OPERATING MEANS

Filed Feb. 18, 1933

FIG. 1.

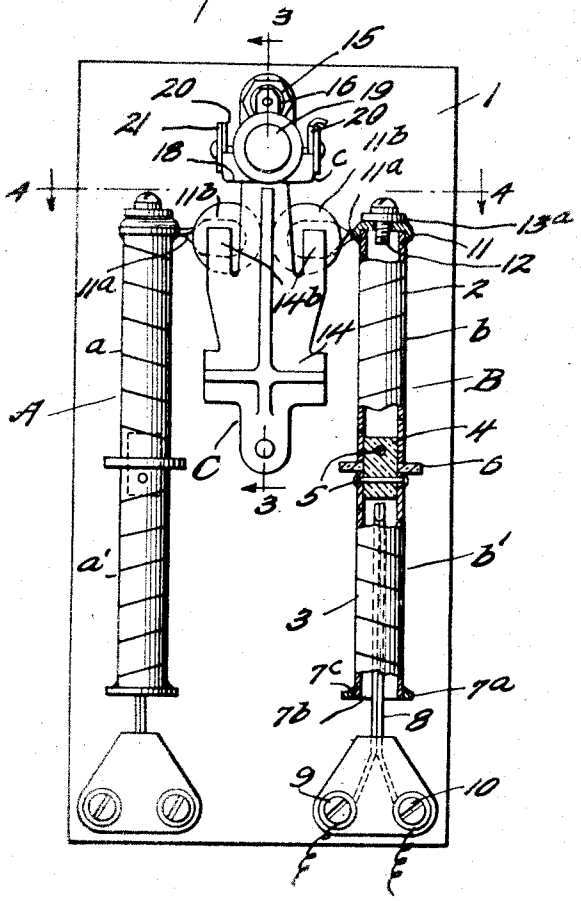



FIG. 2.

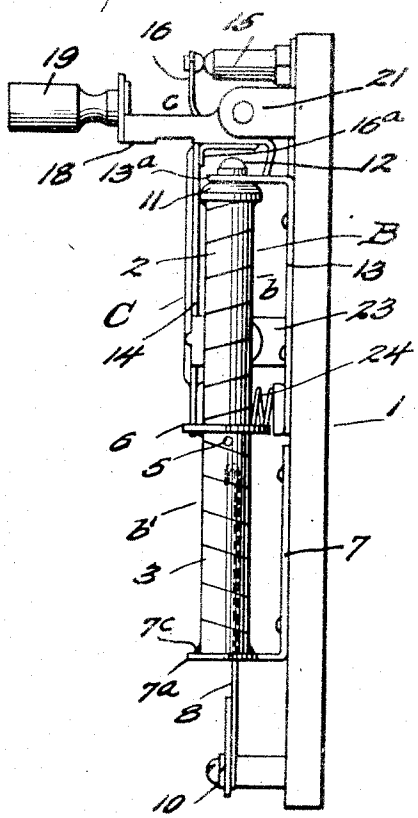



FIG. 3.

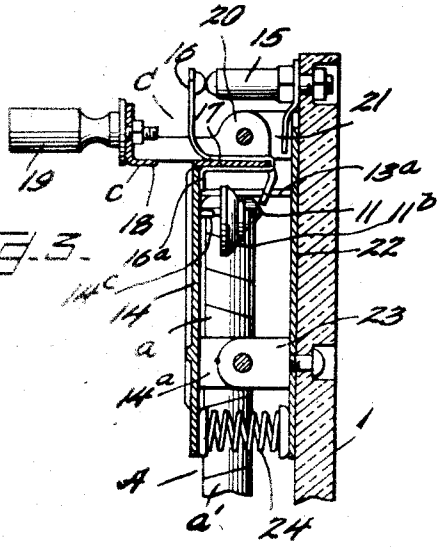
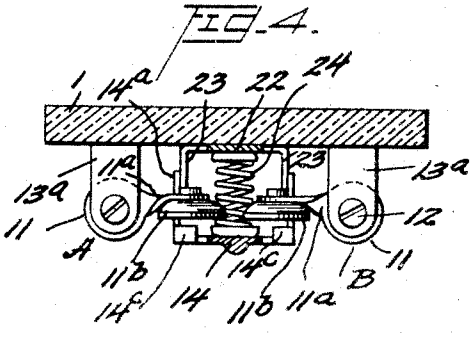



FIG. 4.




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## COMPENSATING THERMAL SWITCH OPERATING MEANS

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3 Claims. (Cl. 200—122)

This invention relates to thermally operated circuit controlling devices, and particularly to a compensating thermally responsive element which will operate the same under all changes in atmospheric temperature. The type of thermally responsive element to which the present invention relates is that shown in patent to George H. Whittingham No. 1,627,816, dated May 10, 1927, comprising a flat bi-metallic strip helically coiled to form a tube or housing, this tube having its lower end open and secured to a suitable support, while its upper end is closed and free to turn. A heating element, comprising a part of the circuit controlled by the switch, is insertable into the tube through its lower end, and the heat generated by the current in the heating element causes the tube to partly uncoil to operate a switch. This device is affected in its operation by the temperature of the surrounding atmosphere. In order to compensate for changes in atmospheric temperature, I add to the tubular device just described, having a heating element, a similar but oppositely coiled tube which is without a heating element and which is rigidly connected to the upper end of the first mentioned device by a heat insulating joint which closes communication between the tubes. Preferably also a device is placed at the joint to deflect warm air currents arising from the lower tube away from the upper tube. As both tubes are affected by atmospheric temperature, but are oppositely coiled, a switch arm arranged on the upper end of the upper tube will not be moved by reason of changes in atmospheric temperature, but only by changes in temperature caused by the heating element in the lower tube.

In the accompanying drawing,

Fig. 1 is a front elevation of a circuit breaker, partly in section, illustrating the invention;

Fig. 2 is a right side elevation of the same;

Fig. 3 is a section on the line 3—3 of Fig. 1, and,

Fig. 4 is a section on the line 4—4 of Fig. 1.

Referring to the drawing, 1 represents a suitable base of insulating material and A and B indicate thermally responsive elements, each adapted to operate a circuit breaking switch C. These elements are alike, except that, being arranged on opposite sides of the circuit breaking switch, they are constructed so as to twist in opposite directions to operate the switch. The construction of both elements will be understood from a description of element B, which is shown partly in section. This element comprises the tubes $b$ and $b'$, formed from similar helically coiled flat bi-metallic strips 2 and 3, respectively, the tubes being of the same diameter and length and the strips being oppositely coiled, as shown. The tubes are arranged end to end and are coupled to one another by a short plug 4 of non-metallic material which is a poor conductor of heat, such as bakelite. The adjacent end turns of the tubes are securely fastened to this plug by rivets 5. A washer 6 which may be of bakelite, fibre or other heat insulating material, fits around the plug between the ends of the tubes and projects laterally beyond the tubes, this washer serving to deflect warm air currents arising from the lower tube $b'$ away from the upper tube $b$.

The base and the elements thereon are, in practice, vertically arranged, as shown. One end of each element is fixed while the opposite end is free to turn. As shown in the drawing, the lower tube $b'$ is secured at its lower end, as by solder or brazing $7^c$, to the horizontal foot $7^a$ of a metal supporting strip 7 which is secured to the base 1. This foot has an opening $7^b$ registering with the lower open end of the tube and through which a heating element 8 may be inserted in the tube. This heating element, as shown, consists of a wire doubled upon itself and having its ends secured to binding posts 9 and 10 to which terminals of an electric circuit may be connected. A metal cap-piece 11, secured to the uppermost convolution of the tube $b$ has a central opening, and a guide pin 12, threaded into a forwardly extending end $13^a$ of a metal strip 13 extends into this opening. This strip is secured to the front of the base 1, as shown, and the pin carried by the strip prevents lateral displacement of the upper end of the element. The cap-piece has a laterally projecting arm $11^a$ at the outer end of which is a flat disk $11^b$ for tripping the circuit breaker.

The element A is identical in construction with the element B, except that its upper tube $a$ is oppositely wound with respect to the tube $b$ and its lower tube $a'$ is oppositely wound with respect to the tube $b'$, and the arm $11^a$ on the element A projects to the right, in Fig. 1, while the corresponding arm on the element B projects to the left in said figure. The disks on these arms extend under a tripping lever 14 of the circuit breaker so that either element may operate the lever.

Referring again to the element B, it will be evident that since the bi-metallic strips of the upper and lower tubes are oppositely coiled and rigidly connected together at their adjacent ends, and since both are exposed to the surrounding atmosphere, a change in atmospheric tempera-

ture which would cause the lower tube to twist in one direction would cause the upper coil to twist in the opposite direction to the same extent, and hence, the position of the arm $11^a$ and disk $11^b$ will not be affected by changes in atmospheric temperature. If the lower tube is heated by current in the heating element 8, this tube will untwist and rotate the upper tube *b*, which is not heated, and the arm $11^a$ on the latter tube will swing toward the tripping lever 14, and if the lower tube is sufficiently heated, the lever will be moved to trip the switch.

The heat generated in the lower tube by the heating element is not transmitted to the upper tube because the plug or coupling member 4 closes communication between the tubes and holds them apart from one another, and the washer 6 deflects warm air currents flowing up around the lower tube away from the upper tube.

The operation of the element A is the same as that of the element B, except that being placed on the opposite side of the circuit breaker, its tubes are coiled in the opposite direction from the corresponding tubes of element B.

The elements A and B may be used to operate individual switches of any kind, but for the purpose of illustration, I have shown them arranged to operate the same circuit breaking switch, which is arranged between them near their upper ends. It is necessary to have one end of each element secured to a fixed support and the other end free to turn. In the illustration, the lower ends of these elements are fixed and the upper ends are free and this arrangement is preferred, but it is obvious that if the upper ends were fixed and the lower ends were left free to turn, the result would be the same and arms connected to the lower elements might be used to operate the switch by suitably locating the latter.

The switch mechanism shown in the drawing comprises a stationary contact member 15, mounted on the base 1, and a spring contact arm 16 is secured to a cross-piece 17 on a resetting lever *c*. This lever comprises a sheet metal crosspiece 18 having a handle 19 secured to its central portion and having at its ends two parallel arms 20 which are pivoted to ears 21 projecting outwardly from a sheet metal plate 22 which is secured to the front of the base 1. The cross-piece 17 is secured to the lower edges of the arms 18 and the spring contact member 16 is bent into U-form and fits around the inner edge of said cross-piece, the end $16^a$ of the member being turned downwardly near the outer edge of the cross-piece to form a stop for the tripping lever 14. The tripping lever has ears $14^a$ at its opposite edges which are pivoted to ears 23 projecting outwardly from the plate 22. A spring 24 between the lower end of the tripping lever and the plate 22 presses the upper end of the lever toward the stop $16^a$ and when the switch is closed, this upper end engages the cross-piece 17 of the resetting lever and keeps the switch closed. When the lever is moved by either of the thermally responsive elements, the upper end of the lever is disengaged from the cross-piece 17, and the switch then drops open. The tripping lever has fingers $14^b$ with flanges $14^c$ at their ends which project toward the disks $11^b$ of the thermally responsive elements and the disks are adapted to engage these flanges.

What I claim is:

1. In a circuit-controlling device, a suitable support, a compensating thermally responsive element comprising two tubes and a heat insulating joint connecting said tubes end to end, each tube composed of a helically coiled bi-metallic strip, the strips of the different tubes being oppositely coiled, said element being vertically arranged on said support and having one end fixed thereto, the other end being free to turn, the lower tube having its lower end open and its upper end closed, and an electric heating element insertable into the lower tube through its open end.

2. In a circuit-controlling device, a suitable support, a compensating thermally responsive element comprising two tubes and a heat insulating joint connecting said tubes end to end, each tube composed of a helically coiled bi-metallic strip, the strips of the different tubes being oppositely coiled, said element being vertically arranged on said support and having one end fixed thereto, the other end being free to turn, the lower tube having its lower end open and its upper end closed, a heat deflecting disk projecting laterally from the element adjacent said joint, and an electric heating element insertable into the lower tube through its open end.

3. In a circuit-controlling device, a suitable support, a compensating thermally responsive element comprising two tubes and a plug of heat insulating material fitting within and secured to one end of each tube, thereby connecting the tubes end to end, each tube composed of a helically coiled bimetallic strip, the strips of the different tubes being oppositely coiled, said element being vertically arranged on said support and having one end fixed thereto, the other end being free to turn, the lower tube having its lower end open and its upper end closed by said plug, a heat deflecting disk mounted on said plug and projecting laterally therefrom between the tubes, and an electric heating element insertable into the lower tube through its open end.

JOSEPH F. FRESE.