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CIRCUIT BREAKER

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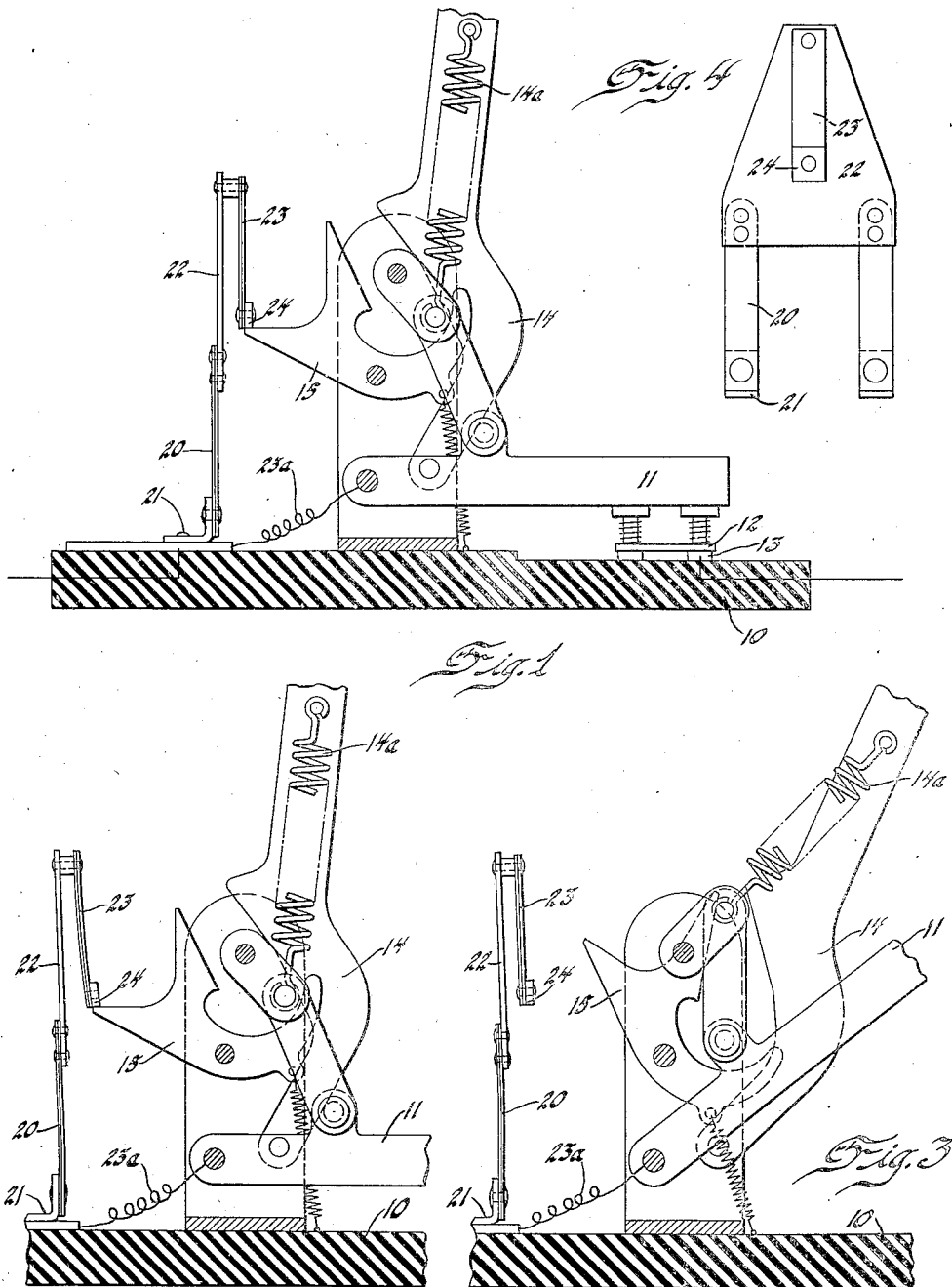


Fig. 2

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CIRCUIT BREAKER

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5 Claims. (Cl. 200—116)

This invention relates to improvements in latching, tripping, or holding means used in conjunction with circuit interrupting devices commonly known as circuit breakers.

A well known form of circuit breaker has a tripping lever which forms a latch for the contact arm of the breaker, which tripping lever is normally held in untripped or closed circuit position by a bi-metallic or thermostatic holding element adapted to warp on overload to release the tripping lever and permit a breaker spring to move the contact arm for circuit breaking. The holding element is generally so calibrated that, not until a predetermined interval of overload has elapsed, will it warp for circuit breaking. The length of this interval is of extreme importance, for if it is too long, serious damage may occur to the parts intended to be protected by the breaker, and conversely, if the interval is not long enough, inconvenient and unnecessary circuit breaking occurs. For these reasons it is considered desirable to maintain the predetermined calibration of the holding elements.

One of the most potent influences in varying the predetermined interval before warping of the holding element sufficient to cause release, is the ambient temperature. If the ambient temperature is higher than that for which the breaker was calibrated, a part of the release movement of the holding element occurs even before overload arises, and since there is left only a part of the release movement, to be taken up by the element on overload, the interval is reduced. Conversely, if the ambient temperature is lower than the calibration temperature, the overload release travel is increased and the interval is lengthened, and the holding element will not release for circuit breaking, until, in many cases, too late. For this reason, there is provided, by this invention, means used in conjunction with the holding element of a circuit breaker for maintaining the predetermined interval constant despite variations in the ambient temperature.

Another way of describing the invention will now be offered. Holding elements of the thermal type function through temperature changes, and consequently are calibrated in terms of temperature. The ambient temperature, therefore, has a considerable effect on the calibration, since the ambient temperature affects the starting temperature, from which the current, on overload, builds up to the releasing temperature, the speed with which such building up occurs, being of course, dependent on the intensity of the overload.

Since the ambient temperature varies considerably, it is desirable to provide in a holding element, means for compensating for variations in ambient temperature, so the original calibration is unimpaired, and the provision of such a means constitutes an important object of the invention.

Another object of the invention is to minimize the cost of holding elements of circuit breakers. The ordinary thermal holding element is made U shaped, and bimetallic. The bight of the U need not be bimetallic and accordingly we make it of a low cost steel strip, it being riveted to and connecting the bimetallic legs of the U. By so doing, we reduce the amount of bimetallic stock required for a holding element, without, however, impairing its efficiency in the least.

In one of the embodiments of the invention, there are holding elements provided with two warping sections, arranged to compensate for ambient temperature influences on each other. In this embodiment the load current is passed through one of the warping sections and not through the other.

Further objects and aims of the invention are to provide means for preventing the original calibration of circuit breakers from being affected by variations of the ambient temperature.

Further objects are to provide novel details of holding means for circuit interrupter devices, which details and their functions will be more particularly described upon reference to the following detailed description and to the appended drawing in which—

Figure 1 shows a circuit breaker in circuit closing position with the holding element thereof in normal condition;

Fig. 2 is a view of the same circuit breaker but showing the condition of the holding element when the ambient temperature is high;

Fig. 3 shows the circuit breaker in circuit breaking or overload position but with the ambient temperature normal;

Fig. 4 shows a holding element, per se.

For a detailed description of the embodiment, reference will be had to the drawing, and referring to this it will be seen that Figure 1 shows a breaker mounted on an insulating base 10 and having a pivotally mounted contact arm 11 provided with a contact 12 adapted to engage mating line contacts 13 on the base for circuit closing. The contact arm 11 is actuated by a handle 14, controlled by a spring 14a and a pivotally mounted tripping lever 15. The latter, when held in the position of Figure 1, maintains the parts in circuit making position, and when released by

the holding element to be described, assumes the position of Figure 3, and permits the breaker parts to move to circuit breaking position. The specific breaker construction so far defined is of no particular importance here, and any form of breaker might well be used. It is noted that the breaker disclosed is of the form shown in the application of William H. Frank and Joseph Messing, Serial No. 579,482, filed December 7, 1931. For holding the tripping lever in its untripped or circuit making position, there is provided holding an element, whose specific constructions form important objects of the invention.

The holding element of Figures 1 to 4 includes a pair of bi-metallic posts 20, secured to the base by means referenced generally 21, and bridged by a metallic cross piece 22 to which is secured a depending bi-metallic element 23, the latter being electrically insulated from the bridging piece 22 and accordingly from the posts 20, these being connected to the load and being placed in series with the breaker contacts by a flexible connection 23a so as to be responsive to the current in the circuit.

The metals of the bi-metallic parts are so arranged that the posts 20 warp to the left upon an increase in the ambient temperature and/or an increase in the load current. The metals of the warping part 23 are so arranged that it warps to the right upon an increase in the ambient temperature but is unaffected by load conditions, since it is insulated from the current carrying parts 20.

It will be seen that upon a rise in the ambient temperature the posts 20 will warp one way and the part 23 will warp another, the combined effect of the warping being such that the free end of the part 23, namely the tip 24 which holds the tripping lever 15, will be in the same position with respect to the latter regardless of variations in the ambient temperature. Conversely, when the ambient temperature drops, the posts 20 will warp to the right and the part 23 will warp to the left, the net effect however being such that the tip 24 is not displaced with respect to the tripping lever.

When an overload occurs, regardless of the ambient temperature and the then existing condition of the warping parts, the primary warping section, namely the posts 20, will warp to the left and move the holding element bodily away from the tripping lever to free the latter. Since the secondary warping section, the part 23, is out of the overloaded circuit, being insulated therefrom, the overload has no effect on the part 23 except as the latter is carried with the posts 20.

It will be observed at this time that while throughout the foregoing particular reference has been made to the operation of the parts on a rise in ambient temperature, the parts operate to produce the desired result, namely, to keep the tripping lever latched with the same degree of latching influence, even though the ambient temperature falls. For example, in the embodiment of Figures 1 to 4 the tip 24 of the warping element will be in its original location whether the ambient temperature be low or high.

It is contemplated also to use different bi-metals for the different thermal elements. To illustrate, if we made the compensating bi-metal element of the same dimensions and length as the current bi-metal element, and also of the same material and if they both are subjected to the same temperature, they will warp equally in op-

posite directions and thus compensate for each other.

In order to make the device more compact, however, it is contemplated to make the compensating element, for example, of a bi-metal which warps twice as fast as the current bi-metal, so that the compensating element would have to be made half as long as the current element in order to compensate for the deflection of the current element when subjected to the same temperature.

Further, while it is intended that the warping effects of the portions neutralize each other, it will be understood that the portions may be arranged so that an incomplete neutralization takes place, whereby the overload interval may intentionally be permitted to vary, within limits. This may prove useful where, for example, it is considered desirable to have the overload interval of one length, when the ambient temperature is normal, and of a different length when the ambient temperature is not normal.

What we claim is:—

1. A circuit controlling means comprising an anchored but movable, self-heated, thermally responsive element connected in series with the controlled circuit through its anchorage and being otherwise free to move in one direction, under the influence of a rise in temperature, due to overload conditions or due to an increase in the ambient temperature, and a second thermally responsive element anchored to and carried by the first element and being otherwise free to move, and disconnected from the controlled circuit and arranged to move in the opposite direction on a rise in the ambient temperature to compensate for the ambient temperature movement of the first element, and being thermally and electrically insulated from the first element.

2. A circuit breaker controlling means mounted at one end on a base and comprising separate and independent thermally responsive elements arranged to move in response to variations of temperature, the element nearer the base being placed in series connection with the controlled circuit through its anchorage on the base, and being otherwise free to move, the element more remote from the base being out of electrical connection with the controlled circuit, and being thermally and electrically insulated from the element nearer the base.

3. A circuit controlling means comprising thermally responsive elements connected to each other at adjacent ends thereof and having oppositely reacting movement characteristics, one of said elements being anchored and being connected in series with the controlled circuit by a connection at its anchorage and being otherwise free to move, the anchored element carrying the other, and also being thermally and electrically insulated therefrom, the unanchored or floating element being out of electrical connection with the controlled circuit.

4. A circuit controlling means comprising thermally responsive elements connected to each other at adjacent ends thereof, and having oppositely reacting movement characteristics, one of said elements being anchored, and being connected in series with the controlled circuit by a connection at its anchorage, so as to be heated by the current passing through it, and being otherwise free to move, the anchored element carrying the other, and also being thermally and electrically insulated therefrom, the unanchored or floating ele-

ment being out of electrical connection with the controlled circuit.

element connected to the bight of the first element and carried thereby and disconnected from the controlled circuit, and arranged to move in the opposite direction on a rise in ambient temperature to compensate for the ambient temperature movement of the first element, the two elements being thermally and electrically insulated from each other.

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5 A circuit controlling means comprising a U-shaped thermally responsive element anchored to a base at the ends of its legs, and placed in series connection with the controlled circuit through its anchorages and arranged to move in one direction under the influence of a rise in temperature, due to a rise in the ambient temperature or due to an overload, and a second thermally responsive

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