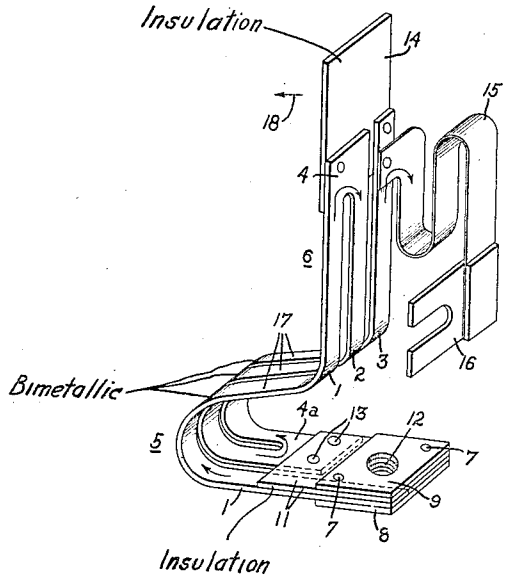
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BIMETALLIC THERMAL RELEASE

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BIMETALLIC THERMAL RELEASE

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This invention relates to bimetallic thermal releases such as are useful in the opening of circuit breakers in response to a predetermined current in the circuit breaker, and has for its object a bimetallic thermal release which is sensitive to normal low current values and which is adapted to withstand without damage, currents of many times these values.

With bimetallic thermal release devices, it has been found to be difficult to make the devices for small normal currents of approximately 10 amperes and under, particularly those below 6 amperes, so resistant to short circuits that they are not damaged by overheating upon the occurrence of short-circuit currents amounting to several hundred times their normal currents. Because of the fact that the specific resistance of bimetallic materials is not so high as the specific resistance of resistance alloys and, therefore, in order to get the required rate of heat generation, the thickness of the bimetal must be chosen too thin for the required magnetic strength and resistance to short-circuits, it is difficult when using ordinary bimetallic forms such as smooth strips or those slotted in U-form to heat the strip by passing current directly through it to a temperature high enough for its release operation. As a result, indirect heating of the bimetal by a separate resistance is often employed, but this has the disadvantages of indirect heating. The energy consumption in the heater must be increased to provide for loss of heat in its transmission through the layer of insulating material or air between the heating resistance and the bimetal. Furthermore, with indirect heating, the resistance to short-circuits is lower because of the comparatively high temperature and low heat-time constant of the heating coil, and also in connection with relay supported coils, on account of the danger of the turns coming together due to dynamic effects. Another disadvantage of the separate heater is that it is comparatively difficult and expensive to manufacture.

In accordance with the invention, a bimetallic release member is provided which is heated by a current passed directly through it and which is also adapted for operation with small normal currents and which is characterized by great strength, great resistance to short-circuits and also a comparatively large range of travel, great force in performing the release operation with a small watt consumption and which, nevertheless, as compared with indirectly heated devices, is comparatively simple and economical to manufacture.

To that end, according to the invention, a bimetallic strip slotted in U or zigzag form is bent over a portion of its length, preferably about one-half or two-thirds of its length, in a U-shaped loop with the sides of the loop substantially at right angles to the plane of the remainder of the strip, the free end of the bend being fastened to a support for the strip in which also is an electric terminal for connecting the strip in the circuit to be controlled.

For more complete understanding of the invention, reference should be had to the drawing, the single figure of which shows in perspective, a bimetallic release device embodying this invention.

Referring to the drawing, the bimetallic strip shown and embodying this invention in one form is subdivided, for example, in stamping it from a sheet of material, by two slots running longitudinally of the strip and parallel with each other in zigzag form to form three parallel strip lengths 1, 2, and 3. These lengths are connected together by the cross pieces 4 and 4a at their upper and lower ends and are thus connected in series in an approximately N form. A portion, approximately ⅔ of the total length, is bent into a U-shaped loop 5 which lies out of the plane of the upper end and opens toward the righthand side as viewed in the drawing. It will be observed that the substantially horizontal sides of the loop are substantially at right angles to the remaining straight portion 6 of the strip.

The lower end of the length 1 of the strip is extended beyond the cross piece 4a and is connected by means of the rivets 7 with two metal plates 8 and 9, a small plate 11 of insulating material being interposed between the strip 1 and the plate 9. A hole 12 is provided to facilitate the connection of the strip to an electric terminal post (not shown) which forms a support for the strip. The connecting cross bar 4a of the strips 2 and 3 is fixed to the insulating plate 11 by means of rivets 13. On the approximately vertical other end 6 of the three parallel strips, is riveted an insulating plate 14 which actuates a contact, a switch piece, latch or the like (not shown). To the upper end of the length 3 is connected a flexible lead 15 having a suitable cable clamp 16 for connection to an electric terminal.

The current flows through the strip lengths 1, 2, and 3 in series connection in the direction indicated by the arrows. On account of the shape of the strip, which is mounted with the portion 6 substantially vertical as shown, the heat there-

by generated is utilized very efficiently. On the one hand, the heat in the lower U-shaped part 5 is confined in that part, and on the other hand, the heat generated in the lower side of the U flows primarily upward on account of the rising of the heated air and, therefore, additional heat is imparted to the upper length 17 of the U. As a result, this upper length 17 of the U which is a central section of the strip, becomes especially hot since it is heated not only by the passage of the current through it, but also by heat transmitted by radiation, conduction and convection from the lower portion of the U. By means of the remaining upright portion 6, the movement of the portion 17 is transmitted with great amplification through the insulating plate 14 when the direct heating of the portion 17 by the current passing through it and also the indirect heating coming from below produces a deflection of the portion 17 itself. The loss of heat by conduction from the lower end of the strip to its fastening and supporting terminal means is small because only one of the three lengths, i. e., the length 1 is in electric and heat conducting relation with the supporting terminal, the other two lengths, 2 and 3, being insulated thermally from the supporting terminal by means of the electrically insulating plate 11.

Preferably, as tests have shown, it is advantageous to arrange the strip in such manner that the bending in response to an increase in temperature is in the sense of opening of the U-shaped portion 5, that is, in the direction of the arrow 18.

Tests have shown that a bimetallic strip insulated, as previously described, has a particularly small watt consumption, for example, strips for 4 amperes can be bent for about .75 watt consumption. Here each of the three parts 1, 2, and 3 has a width of three millimeters and a thickness of one millimeter. This bimetallic member thus constitutes, as compared with a thermal release device with direct heating, a particularly strong and mechanically resistance structure which supplies for all purposes of indirect and direct release a sufficient bending capacity and sufficient release force. The resistance to short-circuits is particularly high in consequence of the direct heating and of the comparatively large cross section. In switches of recent construction, these thermal releases have carried without damage short-circuit currents of 300 or more times the normal current.

The embodiment shown and described is only an example.

Suitable alterations come within the scope of the invention. The ratio of length between the U bend and the straight part 6 may be chosen differently. The position of the bimetallic member may also be different although the one shown gives, as explained, very desirable results.

What I claim as new and desire to secure by Letters Patent of the United States is:

1. A bimetallic thermal member adapted to be heated by current passed directly therethrough comprising a bimetallic strip provided with a longitudinal slot to increase the length of the current path therethrough, said strip having from one-half to two-thirds of its length at one end bent into an approximately U-shaped loop with the sides of the loop substantially at right angles with the remaining portion of the strip, and means for securing the free end of said loop to a support with the remaining portion of the strip substantially vertical and movable in response to changes in temperature.

2. A bimetallic thermal member adapted to be heated by current passed directly therethrough comprising a bimetallic strip provided with longitudinal slots dividing said strip into three parts connected electrically in series with each other in N-form, said strip having a substantial portion of its length at one end bent into an approximately U-shaped loop, one of the outer of said parts being extended beyond the other parts at the outer end of the loop, means for securing said extending part in conducting relation to electric terminal supporting means, means electrically insulating the adjacent ends of the other parts from said extended part and means for connecting the end of the other outer part to an electric circuit.

3. A bimetallic thermal member adapted to be heated by current passed directly therethrough comprising a bimetallic strip provided with longitudinal slots dividing said strip into three parts connected electrically in series with one another in N-form, said strip having from one-half to two-thirds of its length at one end bent into an approximately U-shaped loop with the sides of the loop substantially at right angles with the remaining portion of the strip, one of the outer of said parts being extended beyond the other parts at the outer end of the loop, means for securing said extending part in conducting relation to electric terminal supporting means, means electrically insulating the adjacent ends of the other parts from said extended part and means for connecting the end of the other outer part to an electric circuit.

4. A bimetallic thermal member adapted to be heated by current passed directly therethrough, comprising a bimetallic strip provided with longitudinal slots dividing said strip into at least three parts connected electrically in series with each other in N-form, said strip having a substantial portion of its length at one end bent into an approximate U-shaped loop with the sides of the loop substantially at right angles with the remaining portion of the strip, one of the outer of said parts being extended beyond the joined ends of the other two parts at the outer end of the loop, clamping plates made of electrically conducting material secured on opposite sides of said extended end, a plate of insulating material between one of said clamping plates and said extended end and projecting from said clamping plates in over-lapping relation with the adjacent joined ends of the other two parts, and means securing said plates to said projecting end and said insulating plate to said joined ends.

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