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⑤④ **Temperature responsive device and circuit breaker.**

⑤⑦ A temperature responsive device comprises a bimetal element (12) flexible on temperature and current overload conditions to engage a trip latch (14) to open the circuit. The bimetal element (12) is pivotally mounted between knife edges (22) provided on a mounting member (20), whilst one end portion of the bimetal element is connected to an adjustment means (24), by which said end portion may be moved, pivotally to move the bimetal element about its pivotal mounting.

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"Temperature responsive device and circuit breaker"

This invention is concerned with improvements relating to thermo-responsive devices, particularly of the kind (hereinafter referred to as being of the kind specified) utilising the movement of a bimetal element to effect switching of an electric circuit.

Devices of the kind specified conventionally use a bimetal element in the form of a strip of two metals having differing coefficients of thermal expansion, the element being secured at one (fixed) end portion and arranged so that the other (free) end portion moves on variation in temperature, which may be the ambient temperature to which the bimetal element is subjected, or the temperature of the element due to passage of electric current therethrough, or the temperature of the bimetal element when heated by a resistive heating element or a combination thereof.

The free end portion of the bimetal element is provided with an engagement member so arranged that when the element moves into a specific position, the engagement member moves into engagement with an operating member, such as a trip latch, which operates to open the electric circuit. Alternatively, in low current devices, the engagement member, conveniently in the form of an adjustable contact, may engage directly with a fixed contact of the circuit, closing or opening an electric circuit as the case may be.

Where the device is designed to operate on electrical overload conditions, a circuit branch is connected to the bimetal element, usually at a position separated from the engagement member, such as by a fixed tapping taken from the fixed end portion of the element, and a flexible tapping secured to a central region of the bimetal element.

In setting up the device so as to ensure that the circuit is tripped at a desired temperature, it is necessary to adjust the engagement member, conventionally by engaging the member with a tool, such as a screwdriver, and manipulating it so as to vary the position of the engagement member in relation to the bimetal element. Since the bimetal element is flexible this is difficult and time consuming to accomplish, particularly since it is in practice not possible to carry out such adjustment without temporary deformation of the bimetal element.

According to this invention there is provided a temperature responsive device of the kind specified wherein the bimetal element is pivotally mounted at a an intermediate region i.e. intermediate the ends, and adjustment means is provided to move the bimetal element about said pivotal mounting.

Advantageously the adjustment means is such as to enable the position of one end portion of the bimetal element to be moved about the pivotal

mounting in a manner such as to move the opposite end portion of the bimetal element towards or away from an operating member, such as a trip latch or fixed contact, advantageously in a manner in which a tool is used which is not in direct contact with the bimetal element, specifically direct contact either as would in itself tend to deflect the bimetal element, or providing electrically conductive contact with the bimetal element, or both.

Thus desirably the adjustment means comprises a screw-thread element mounted on a housing of the device and comprising a surface engagable with the bimetal element to move the bimetal element in response to positional adjustment of the screw-thread element.

Conveniently said surface is engagable to move the bimetal element in one direction, a spring being utilised to urge the bimetal element into engagement with said surface and thus to be operative to move the bimetal element in response to reverse positional adjustment of the screw-thread element.

In this manner, since adjustment of the device may be accomplished without deformation of the bimetal element, the device may be set up simply and quickly, in particular by positional adjustment of the screw-thread element under the desired operating conditions until the bimetal element opens or closes.

Advantageously the pivotal mounting for the bimetal element is afforded by a mounting member secured to the housing of the device, advantageously supporting the bimetal element between knife edges.

According to this invention there is also provided a circuit breaker comprising:

(a) a housing;

(b) a bimetallic element in the housing in the form of a strip of two metals having differing coefficients of thermal expansion;

(c) latch mechanism in the housing comprising an operating element adjacent to one end region of the bimetallic element; and

(d) conductors connected to the bimetallic element for the passage therethrough of electric current; wherein pivot mounting means is provided in the housing upon which the bimetallic element is pivotally mounted at a region thereof intermediate its end regions, and an adjustment device is provided at the end regions of the bimetallic element opposite to the operating element to cause the bimetallic element to move about its pivotal mounting and said one end to move towards or away from said operating element.

There will now be given a detailed description,

to be read with reference to the accompanying drawings, of a temperature responsive device which is a preferred embodiment of this invention, having been selected for the purposes of illustrating the invention by way of example.

In the accompanying drawings:

FIGURE 1 is a schematic sectional view of a conventional temperature responsive device;

FIGURE 2 is a view corresponding to Figure 1 of part of the temperature responsive device which is the preferred embodiment of this invention: and

FIGURE 3 is an enlarged view of part of the preferred embodiment.

The temperature responsive device shown in Figure 1 is of the kind specified, being a miniature circuit breaker (MCB) provided with thermal and magnetic overload protection, the device comprising a housing 6, a terminal 8 comprising a fixed terminal portion 10 within the housing, to which one end portion 12a of a bimetal element 12 is secured, the opposite end portion 12b of the bimetal element carrying a screw-thread adjustment device 16.

Welded to the bimetal element between the end portions is a flexible conductive element 13, which extends to a circuit branch of the circuit breaker, which is conventional, and not shown.

The position adopted by the bimetal element 12 within the housing will be dependent upon the temperature at the element, dependent upon the ambient temperature thereof in conjunction with the current flowing therethrough, namely from the connector 13 to the terminal 8, and under conditions of either thermal or current overload the bimetal will flex in a generally anti-clockwise direction about the fixed end portion 12 so that the adjustment device 16 engages an operating member such as an element 14 of a trip latch, to cause the circuit to open.

Disadvantages encountered in such a conventional circuit breaker are as follows:

(a) tapping of the bimetal element is difficult due to the small size of the adjustment screw 16;

(b) setting up of the device involves adjustment of the screw 16, conveniently through an aperture 18, by the use of a screwdriver, and this necessitates the application of deforming pressure on the bimetal element 12, which makes setting up to a specific condition difficult;

(c) the terminal portion 10 tends to remove heat from the bimetal element 12, producing variations in the conditions under which the device will trip.

The device which is the preferred embodiment of this invention is similarly a miniature circuit breaker, and similar numerals are used to indicate like parts. In the preferred embodiment the bimetal

element 12 is pivotally mounted at an intermediate region thereof on a mounting member 20, provided in the form of a metal pressing (shown in an enlarged view in Figure 2b) positioned in channels 19 provided in the housing 6, the mounting element providing flexible knife edges 22 between which the bimetal element 12 may be positioned.

At its lower end portion 12a, the bimetal element 12 is engaged by an adjustment means 24, comprising a spindle 26 extending freely through a boss 28 captive within the housing and through a screw-threaded bore 30 spaced axially from the boss 28. An aperture 18 is provided to enable the spindle 26 to be rotated by a tool such as a screwdriver, and hence moved axially by virtue of its engagement with the threaded bore 30.

The spindle 26 is provided with a flange 32 operative to engage one side of the bimetal element 12, the other side of the bimetal being engaged by a spring 34 pressing against the boss 28. In this manner rotation of the shaft 26 in one direction will cause the flange 32 to move the bimetal element pivotally in a clockwise direction about the mounting element 20, against the action of the spring 34, whilst rotation of the shaft 26 in the opposite direction will cause the bimetal element to be rotated in the opposite direction.

Alternatively the boss 28 may be substituted by a threaded nut with which the spindle may be threadably engaged, the bore 26 being unthreaded.

Two flexible straps 13a and 13b are welded to outer regions of the bimetal element, the strap 13a being connected to the terminal 8.

Thus in the use of the circuit breaker which is the preferred embodiment of this invention, under normal operating conditions the bimetal element will adopt a position similar to that shown in Figure 2, i.e. with its end portion 12b spaced from the trip latch 14. However on overload conditions the bimetal element will flex, with the engagement portion 12b moving into engagement with and tripping the latch 14.

By the use of the arrangement above described, no tapping of the bimetal element, as was previously required to accommodate the screw 16, is necessary, and loss of heat by means of connection to a fixed terminal portion 10 is avoided. Adjustment of the spindle 26 does not involve direct contact with the bimetal element itself, and thus does not tend to deflect the bimetal element. Thus, the position of the lower end portion 12a of the bimetal may be accurately adjusted to the point at which the latch 14 is tripped, and the bimetal can then be backed off (with spring assistance) to a desired setting gap.

It is to be appreciated that whilst the invention has been described above in relation to a circuit breaker of the kind in which the bimetal element

may be deflected by current flowing therethrough to trip a latch to open the circuit on overload conditions, the invention may be utilised in temperature responsive devices in which the bimetal is responding solely to ambient temperature, and in devices in which the upper end portion 12b of the bimetal element engages or is separated from an operating member in the form of a fixed contact to close or open an electric circuit.

The features disclosed in the foregoing description, or the following claims, or the accompanying drawings, expressed in their specific forms or in terms of a means for performing the disclosed function, or a method or process for attaining the disclosed result, or a class or group of substances or compositions, as appropriate, may, separately or in any combination of such features, be utilised for realising the invention in diverse forms thereof.

Claims

1. A temperature responsive device of the kind utilising movement of a bimetal element to effect switching of an electric circuit, wherein the bimetal element (12) is pivotally mounted at a an intermediate region, and adjustment means (24) is provided to move the bimetal element about said pivotal mounting (20).

2. A device according to Claim 1 wherein the adjustment means (24) is such as to enable the position of one end portion (12a) of the bimetal element to be moved about the pivotal mounting in a manner such as to move the opposite end portion (12b) of the bimetal element towards or away from a fixed contact (14).

3. A device according to Claim 2 wherein the position of said one end portion (12a) of the bimetal element is moved by a tool which is not in direct contact with the bimetal element.

4. A device according to any one of preceding claims wherein the adjustment means (24) comprises a screw-thread element (26) mounted on a housing (6) of the device and which comprises a surface (32) engagable with the bimetal element to move the bimetal element in response to positional adjustment of the screw-thread element.

5. A device according to Claim 4 wherein said surface (32) is engagable to move the bimetal element in one direction, a spring (34) being utilised to urge the bimetal element into engagement with said surface.

6. A device according to any one of the preceding claims wherein the adjustment means (24) is of or comprises insulating material.

7. A device according to any one of the preceding claims wherein the pivotal mounting for the bimetal element is afforded by a mounting member (20) secured to the housing (6) of the device.

8. A device according to Claim 7 wherein the mounting member (20) supports the bimetal element between knife edges (22, 22).

9. A device according to any one of the preceding claims, wherein the bimetal element is adapted to respond both to temperature overload conditions and to current overload conditions.

10. A circuit breaker comprising:

(a) a housing (6);

(b) a bimetallic element (12) in the housing in the form of a strip of two metals having differing coefficients of thermal expansion;

(c) latch mechanism in the housing comprising an operating element (14) adjacent to one end region (12b) of the bimetallic element; and

(d) conductors (13a, 13b) connected to the bimetallic element (12) for the passage therethrough of electric current;

wherein pivot mounting means (20) is provided in the housing upon which the bimetallic element is pivotally mounted at a region thereof intermediate its end regions, and an adjustment device (24) is provided at the end region (12a) of the bimetallic element opposite to the operating element (14) to cause the bimetallic element to move about its pivotal mounting and said one end to move towards or away from said operating element.

FIG 1

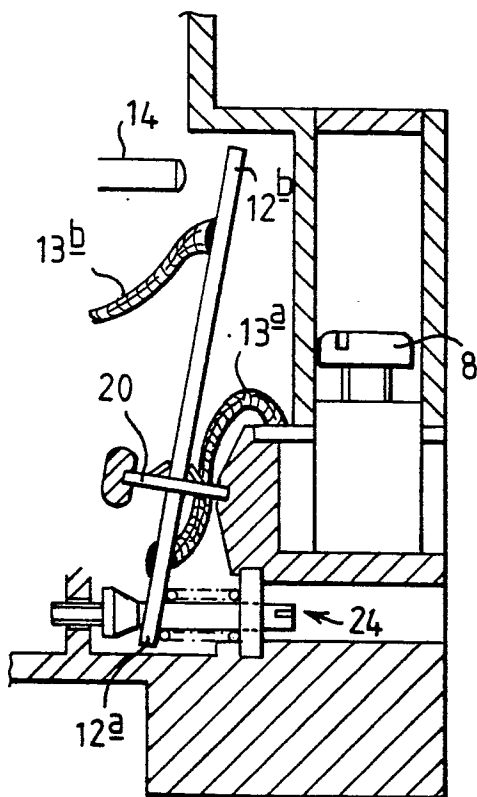
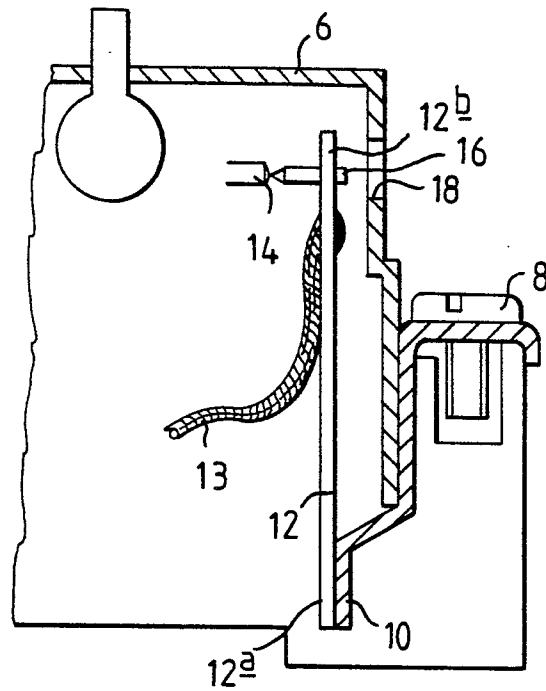


FIG 2

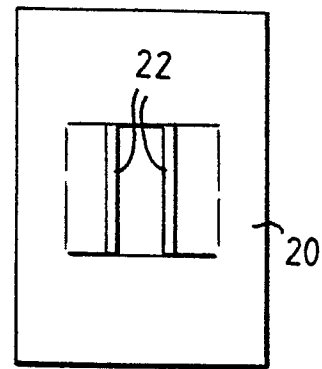


FIG 2b

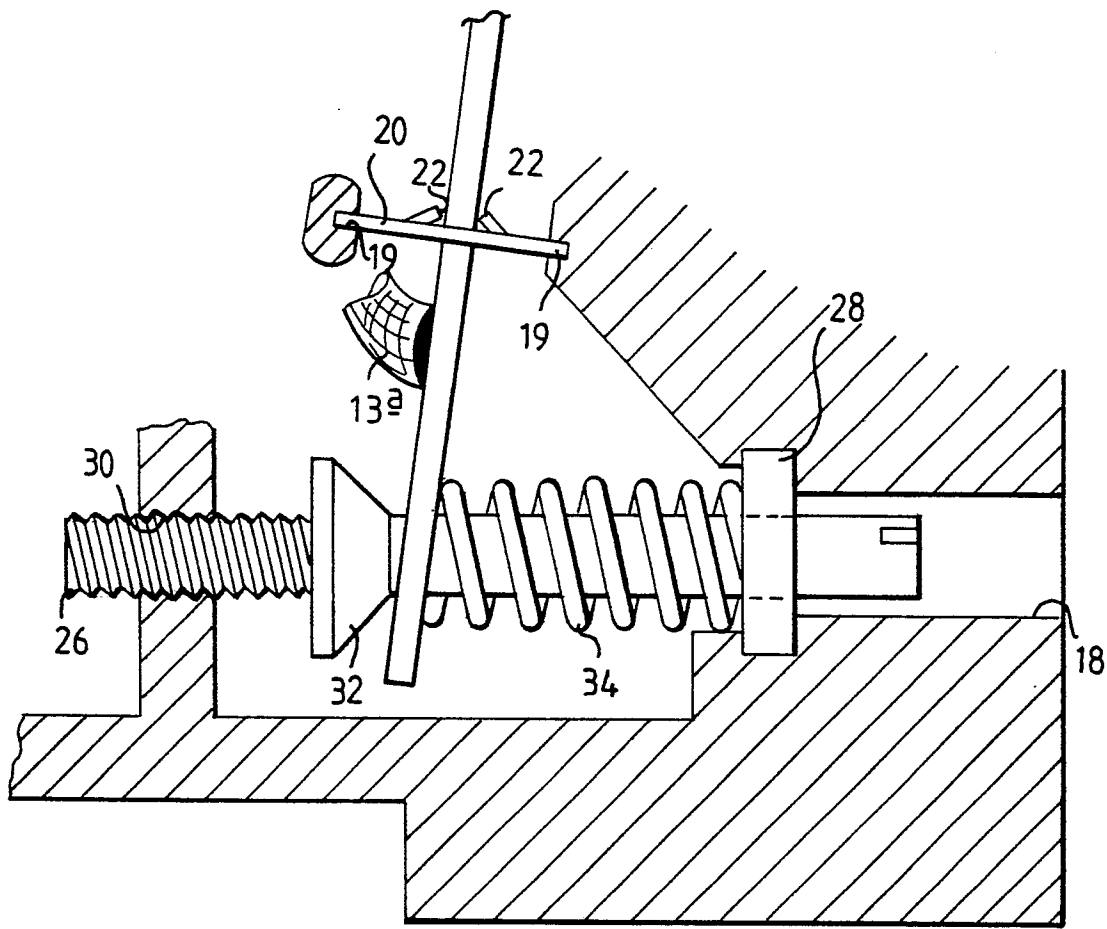


FIG 3