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SWITCH HAVING SIMPLIFIED STRUCTURAL FEATURES

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1 Claim. (Cl. 337-365)

This invention relates to switches and more particularly to a temperature sensitive snap-acting thermal bimetallic-type switch.

It is an object of the invention to provide an inexpensive thermostatic switch which is simple in construction and inexpensive to manufacture.

It is another object of the invention to provide a thermostatic switch which is adapted for miniaturization so as to be easily inserted into the small spaces directly adjacent the heated parts of motors, transformers and other electrical apparatus, to the heated parts of which a temperature response is to be made by the switch.

It is another object of the invention to provide a thermostatic switch which is safe and reliable in operation and easily and simply calibrated.

Another object of the invention is to provide a thermostatic switch of such simplicity as to make it feasible for mass production.

A feature of the invention is a thermostatic switch whose size is largely determined by the size of its temperature sensitive snap-acting bimetallic element.

Other objects and features of the invention will become more readily understood from the following detailed description and appended claims when read in conjunction with the accompanying drawing in which like reference numerals designate like parts throughout the figures thereof, and in which:

FIGURE 1 is a pictorial perspective view of the switch of the present invention.

FIGURE 2 is a top plan view of the switch of the present invention.

FIGURE 3 is a front plan view of the switch, showing the bimetallic element with the contacts in a closed position in solid lines and in an open position in broken lines, and

FIGURE 4 is a section taken through section line 4-4 of FIGURE 3 showing the end view of the switch contacts and the insulating material which insulates one contact member from the other.

Referring now to the drawing, there is illustrated in FIGURES 1-4 a thermostatic switch device 1, which comprises a support member 10, a stationary contact member 11, an insulator 14 and a bimetallic thermal strip or element 12. Member 10 is a single metallic electrically conductive piece having a part bent around a radius to form a U-shaped portion 10a which supports the bimetallic strip 12, said strip being preferably attached to and cantilever mounted on the upper surface of said portion 10a by rivet 13, adjacent one end of strip 12, an outwardly extending lobe 16 having an opening 17 to which a wire may be attached, and a bent-up portion 15a having stop 15 to limit the upward travel of the bimetallic strip 12 in the open position. This limitation on the travel of the strip 12 not only increases the life of the strip by preventing excessive flexing, but also prevents the strip from hitting a part of the apparatus on which it is mounted, thus avoiding possible short circuits. Stop 15 may also be used to calibrate the reset temperature of strip 12. By depressing 15 to limit the upward travel of strip 12, the amount of upward flexure is limited thereby requiring a smaller drop in temperature to cause the strip to return to the closed position.

Thermal strip 12 is a snap-acting element and generally

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comprises a relatively thin elongated thermostatic piece of metal having a dished out area which extends over almost its entire length. Such an element is shown and described in United States Patent No. 1, 448,240, issued to John A. Spencer on Mar. 13, 1923. As shown in FIGURE 3, the high expansion metal M₁ constitutes the bottom side of the element 12 while the low expansion metal M₂ constitutes the upper side. Basically, strip 12 is one of the so-called inherent differential type of snap-acting thermostats, the dished portion thereof comprises a non-developable surface which is responsible for snap action of strip 12 in response to predetermined temperature change. The temperature at which element 12 snaps when heated and when cooled is at least in part determined by the amount of "dish" of element 12 and the shape of the dished area. The element 12 may be formed of conventional thermostatic material, such as, for example, bimetal or trimetal. The strip is provided with an electrical contact 20 which may be formed of conventional material such as silver or a silver alloy, and is secured to the free end of the strip by any conventional means. The unequal expansion of the metals of the strip will produce a tendency to flatten the non-developable surface until, at a predetermined temperature, a sudden curving of the non-developable surface in the opposite direction occurs, producing a sudden reversal in curvature of the shape or flexure which will be maintained until the temperature has been substantially lowered. Thereafter, upon reaching the substantially lower predetermined temperature, the strip will suddenly return (i.e., snap) to its initial shape. In both of these movements the reversal of curvature is exceedingly abrupt and is caused by the expansion and contraction of the metals of which the strip is composed.

Secured to the support member 10 but insulated from it by a strip of insulating material 14 is the stationary contact 11 which is provided with a looped portion 19 at one end for the attachment of an electric conductor thereto. The manner in which the support member 10 extends under the stationary contact 11 provides a rigid support for the stationary contact 11. This arrangement makes the element 12 push down upon its own support member, and the thickness of said member, which is approximately four times greater than the thickness of element 12, provides a rigidity which restricts the movement of the stationary contact from its original position and provides a more stable device for calibration purposes. Contact member 11 has an inlay portion 18 which forms the actual contact area of the stationary contact terminal 11. The inlay portion may be, for example, of silver alloy to provide a high electrically conducting contact area.

As previously stated, stationary contact 11 rests upon the lower end of support member 10 and is attached thereto by the insulating material 14, which may, for example, be a Mylar film coated on both sides with an adhesive. The adhesive may be either thermo-setting or thermo-plastic in character depending upon the intended operating temperatures of the device. By inserting the insulating material 14 between the two correctly oriented metal parts 11 and 10, and applying pressure at a temperature sufficient to cure the thermo-setting adhesive, a bond is made which firmly secures the parts one to the other. These parts are also electrically insulated from each other by the insulating film 14.

After the stationary contact member has been bonded to the support member 10, the switch is calibrated. In calibrating, the curved shelf 10a of support member 10 is pressed down until contact 20 comes into engagement with the contact inlay 18. Additional pressure may then be applied to force the contact 20 down harder against the contact inlay 18. This is to prevent creep or

movement of the contact strip 12 prior to its abrupt flexure when contact 20 moves away from contact 18 and opens the switch before the high temperature limit is reached.

The operation of the switch is as follows: The switch is wired into an electrical circuit to protect an electrical apparatus from over-heating or excess current. Heat from the operating apparatus will not affect bimetallic snap-acting element 12 as long as the operating temperature of the apparatus remains within the prescribed limits. The element 12 will be in the closed position indicated by the solid lines in FIGURE 3, the element being bent downwardly with contact 20 into engagement with metallic inlay contact 18. Current flows through terminal 16 to the element 12, through contacts 20 and 18, and out through contact member 11, thus applying current to the apparatus. The switch may be connected in either direction since it is bilateral and offers the same resistance to current in either direction of flow. It should be noted that current flowing through element 12 has a heating effect due to the resistance of its bimetallic parts, thus permitting reaction not only to the heated environment about the switch, but also to the amount of current flowing through the element. Excessive current could heat the element to a temperature sufficient to cause the switch to open.

When the temperature about and/or current through the switch exceeds a predetermined level, the bimetallic element 12 deforms suddenly, snapping upward in the position indicated at 12a by dotted lines in FIGURE 3, opening the circuit and turning off the current to the apparatus. The switch will stay open until the temperature is lowered below a predetermined level, at which time the element 12 will snap in the opposite direction, indicated at 12 in FIGURE 3, and therefore closing the circuit to the apparatus. The upper temperature limit at which the element 12 will deform is determined by the upper operating temperature limit of the apparatus. The range within which the element operates is determined by the particular metals of which the element is composed as well as its calibration as previously described. As may be noted from the drawing, the size of the switch is compatible with the size of the bimetallic

element 12. Therefore, the size of the switch depends upon the size of the element.

Since the switch is made up of only four parts which may be easily assembled, a relatively inexpensive switch may be produced. The present invention provides a thermostatic switch comprising individual parts which can be mass-produced, quickly and inexpensively assembled into operative relation and hence capable of miniaturization.

Although the present invention has been shown and illustrated in terms of a specific preferred embodiment, it will be apparent that changes and modifications are possible without departing from the spirit and scope of the invention as defined in the appended claims.

What is claimed is:

1. A thermostatic switch comprising in combination a metallic support member, generally U-shaped with a free end portion forming the support member provided with an elevated mounting and calibrating platform capable of being bent to adjust for snap action operation, a contact member bonded to and insulated from the support member by an adhesive coated resinous insulating material, the contact member having an inlay portion of silver alloy conductive material, bimetallic snap-acting thermostatic element having two opposite ends, one end cantilever mounted on the elevated platform, a single contact attached to the other end of the element movement for into and out of engagement with the inlay portion on the contact member, and a stop bracket having a portion overlaying said thermostatic element to adjust the reset temperature of the element and to limit its upward motion of said heat.

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