Jan. 23, 1968 W. W. CARDIN 3,365,558

SWITCH WITH IMPROVED MOUNTING FOR THERMOSTATIC ELEMENT

Filed Oct. 24, 1965 2 Sheets-Sheet 1

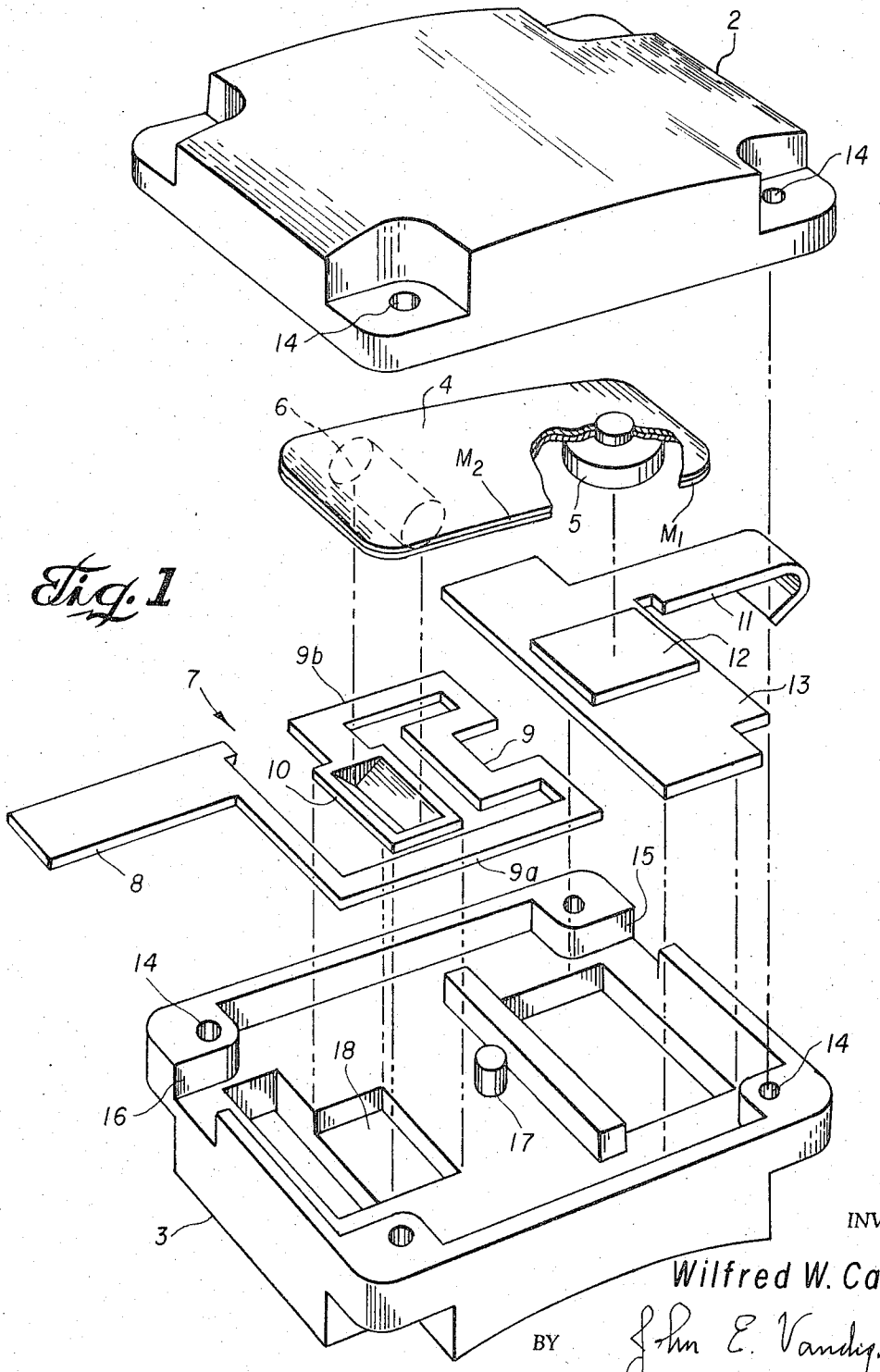


Fig. 1

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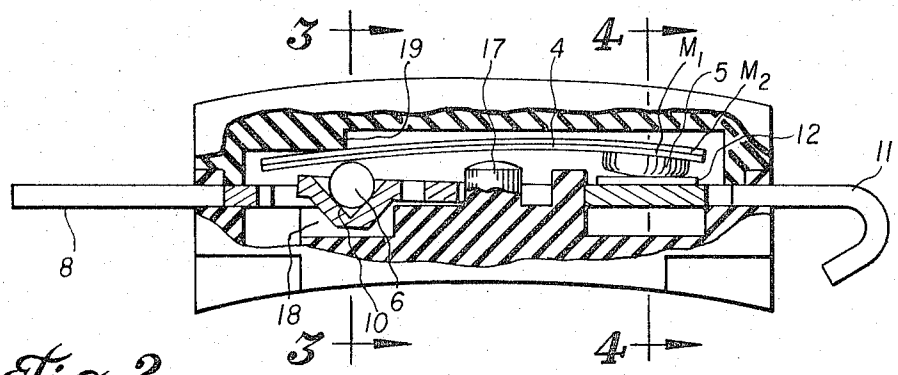


Fig. 2

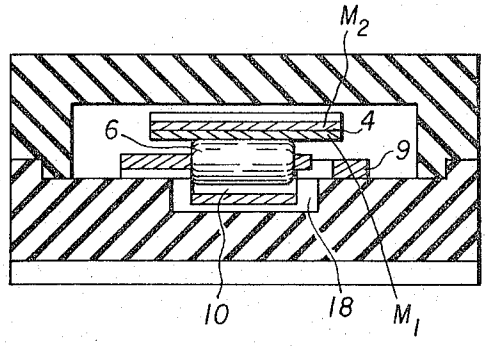


Fig. 3

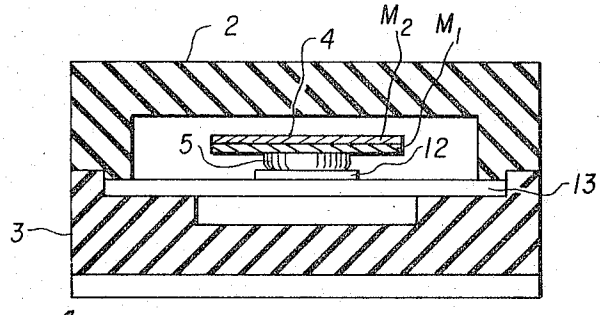


Fig. 4

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SWITCH WITH IMPROVED MOUNTING FOR THERMOSTATIC ELEMENT

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5 Claims. (Cl. 200—138)

This invention relates to thermostatic switches and more particularly to a switch having a free-floating, snap-acting bimetallic element.

In the design and manufacture of snap-acting thermostats it is necessary to design each thermostat for a specific temperature range. After the thermostat has been assembled, it is necessary to calibrate it to insure that it operates within the desired range. The calibration of each device is not only time consuming, but adds to the manufacturing costs of the switch. After a switch has been assembled, if it does not or cannot be calibrated within the desired range, the entire assembly must be discarded since the snap-acting bimetallic element is usually welded to a frame or to some part of the switch housing. A desirable feature is a snap-acting thermostatic switch in which calibration is not necessary and in which bimetallic elements may be interchanged to permit a change in the operating range of the switch.

Accordingly, an object of the invention is to provide a thermostatic switch which requires no calibration.

Another object of the invention is to provide a thermostatic switch with improved means for mounting the thermostatic element.

Another object of the invention is to provide a thermostatic switch in which the thermal element is interchangeable.

Still another object of the invention is to provide a reliable, easily manufactured thermostatic switch.

Another object of the invention is a small thermostatic switch made of a minimum number of parts.

A feature of the invention is the small compact thermostatic switch which may be installed within the apparatus to protect the apparatus against overheating and overcurrents.

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 drawings, in which like reference numerals designate like parts throughout the figures thereof, and in which:

FIGURE 1 is an exploded view of the switch of the present invention showing the individual parts of the switch.

FIGURE 2 is a cross-sectional view in section of the switch showing the relative position of the parts when assembled.

FIGURE 3 is a cross-sectional view taken along section line 3—3 as shown in FIGURE 2.

FIGURE 4 is a cross-sectional and view of the switch taken along section line 4—4 of FIGURE 2.

Referring to the drawings, the basic elements of the switch are shown in FIGURE 1, and the assembled elements are shown in FIGURE 2. The switch is mounted upon base 3 and enclosed by top 2, both of which may be, for example, of a molded plastic or Bakelite. The thermostatic element, which may be for example a snap-acting bimetallic plate, is plate 4 which is composed of two or more layers of metals bonded together, each having a different coefficient of expansion for reasons explained hereafter. The thermostatic element 4 makes electrical contact with the two terminal elements 8 and 11 which are mounted upon the base 3.

The base part 3 of the switch enclosure is molded so that the various parts will fit therein. There is a rectangular aperture 18 down in the face of the base so that the prismatically or V-shaped socket 10 of terminal assembly 7 fits into the aperture. On each end of the base part 3 there is an opening 15 and 16 for electrical terminals to pass from within the housing to the outside thereof to permit electrical connection to the switch. There is a post 17 which limits the downward travel of the bimetallic element 4. On each of the corners there is a hole 14 through a portion of the base which mates with corresponding holes in the top part 2 of the enclosure to facilitate the securing of the top to the base by screws or rivets.

One of the terminal assemblies has many functions other than merely a contact terminal. Terminal assembly 7 has an elongated portion 8 which extends through the opening 16 in the base member 3 to provide contact to the thermostatic plate 4 of the switch. As part of terminal 8 is a series of portions 9, 9*a* and 9*b* which makes electrical contact with the socket 10, portions 9, 9*a* and 9*b* forming a resistance path which may be used as a resistive element for purposes described hereinafter.

The socket 10, fitting into the recess 18 in the base, provides one contact to the bimetallic switch element 4. The other contact to the element is provided by parts 11, 12 and 13 as constituent parts of a single element. The part 13 fits on the end of base 3 opposite the end of 7, with the part 11 extending out through the opening 15 to provide a second external terminal for the switch. Contact member 12 rests upon and is attached to the part 13 and engages the contact 5 of the bimetallic element 4.

The bimetallic element 4 is made up of three parts: namely, the bimetallic element 4, a cylindrical mounting element 6 and contact 5. The bimetallic element is usually attached to one of the terminals within the switch, but in the case of the present invention the element is not attached to a terminal. Cylindrical mounting member 6 is attached to element 4 and rests in socket 10 of contact element 7. Socket 10 and cylindrical element 6 are so designed that element 6 will fit into the socket and rotate freely, permitting the bimetallic plate 4 to rock in order to allow free movement thereof when actuated by heat. When the switch is in the closed position and the temperature environment of the switch does not exceed a temperature which actuates the thermal element 4, the cylindrical element 6 rests in the socket 10 and contact 5 is in electrical engagement with the contact member 12, mounted on part 13.

The top member 2 shown in FIGURES 1 and 2, fits down over the terminal members and the bimetallic element comprising the switch. It should be noted from FIGURE 2 that the top member 2 has a stepped extension 19 which bears down upon the thermal element 4 to hold cylindrical element 6 in socket 10 and that socket 10 is bent up so that said socket is above the plane of the terminal element 8. In this manner a spring action pushes upward against the bimetallic element 4 and the stepped extension 19 pushes down, holding the cylindrical element in good electrical contact with socket 10. Since the relative motion between cylindrical element 6 and socket 10 is rotational, the exertion of a force downward by extension 19 and upward by socket 10 does not restrict the desired motion of the bimetallic element 4.

FIGURES 3 and 4 are sections taken through the cylindrical part 6 and contact 5, respectively, to illustrate the position of certain of the parts when the switch is closed. FIGURE 3 illustrates how the socket 10 fits down into recess 18, and FIGURE 4 illustrates how contact plate 13 is held in place by the enclosure member 2, positioning

contact 12 so that it will engage with contact 5 when the switch is in the closed position.

The operation of the switch depends upon the characteristics of the bimetallic plate 4, which is composed of a sheet made up of two or more metals having different thermal coefficients of expansion, so that changes in temperature will cause unequal expansion and contraction of the opposite faces of the sheet. The sheet is shaped to have a cupped portion or nondevelopable surface projected into one face of the sheet. In the embodiment shown in the drawings, the lower metal M_1 has a higher coefficient of expansion than the upper metal M_2. If the thermostatic element 4 is shaped and constructed as above described it will be found that, upon raising the temperature, the unequal expansion of the metals will cause the tension to flatten the curved surface until, at a predetermined temperature, a sudden curving of the nondevelopable surface in the opposite direction occurs, a reversal of shape that will be maintained until the temperature has been substantially lowered. Thereafter, upon reaching a substantially predetermined lower temperature, the sheet will suddenly return to its initial shape. In both of these movements the reversal of the curvature is exceedingly abrupt and is caused by the expansion and contraction of the metals M_1 and M_2 of which the thermostatic plate 4 is composed.

The application of the quick breaking effect of the plate 4 may be used to open and close electrical circuits. When, for example, current is flowing through contact 8, element 9, 9*a* and 9*b*, socket 10 through cylindrical element 6, plate 4 out contacts 5 and 12, through plate 12 to external lead 11, an electrical circuit may be energized; and as long as the contact element 4 is closed, contacts 5 and 12 are in engagement and current will flow in either direction through the switch. However, upon the temperature environment of the switch rising above a predetermined point, the sheet 4 will reverse in curvature, moving contact 5 away from contact 12, opening the switch. When plate 4 reverses curvature, it will strike post 17 and will, in effect, aid in holding contact 5 away from contact plate 12. The free movement of cylindrical member 6 allows the flexure of plate 4 to move contact 5 upward.

Current flowing through parts 9, 9*a* and 9*b* will heat the region within the enclosure and thus aid the environmental temperature to raise the temperature of the bimetallic plate 4 above its point of flexure. In this manner the switch may not only be current-responsive but also heat-responsive. The heating helps to make for a longer off time to allow the motor or other apparatus in which the switch is installed to adequately cool since there is a time lag between the heat within the apparatus and the heat about the bimetallic plate 4.

An important feature of the invention is the rotatable association of cylindrical member 6 with socket 10. By using such a connection the time consuming and expensive feature of having to calibrate the switch is eliminated. The reason for this is as follows: Each bimetallic plate (such as plate 4) has what is called a free disc temperature. This is a temperature at which the plate will change from one position to the other and change back again when the plate is not attached to any other structure. Normally when bimetallic plates are welded to a frame or other parts of a switch, the temperature at which the abrupt curvature occurs is changed, due to the bonding of one end of the plate to a rigid frame. However, in the present invention, since the bimetallic plate 4 is free to move and rotate upon the socket 10, the free disc temperature is not substantially altered. Therefore, the free disc temperature of the plate 4 with its contact 5 free to slide over the surface of contact 12 and with its other end attached to cylindrical member 6, is essentially the temperature at which the switch will operate. Hence any bimetallic plate may be used in the switch which has the desired operating characteristics. The bimetallic plate may be interchanged if it is desirable to change the operating range of the switch. Calibration will then be only a matter of putting a bimetallic plate in the enclosure with a free disc temperature corresponding to that of the desired range of operation of the switch.

Since the bimetallic plate is not welded in position, the device is easily assembled, the prefabricated parts being merely assembled within the enclosure and then sealed.

Although the present invention has been shown and illustrated in terms of specific preferred embodiments, 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. It will be understood that this construction advantageously permits control of the contact gap which permits longer contact life without deleterious wear.

What is claimed is:

1. A thermostatic switch comprising in combination:
   (a) a housing base having apertures and at least two openings in two ends thereof;
   (b) a socket terminal comprising an irregular shaped member having a tab on one end an a socket on the other end fitted into one of said apertures, said socket end being sprung upward above the plane of said tab to bias said socket in an upward direction and said tab extending out of one of said openings at the end of said housing base;
   (c) a contact terminal having a contact plate on one surface thereof fitted into another of said apertures and having a portion of said terminal extending out through another of said openings at the end opposite said tab;
   (d) an elongated thermostatic element having a cylindrical member secured at one end and a contact on the other end, said cylindrical member resting in said socket and said contact on the other end of said thermostatic element engaging said contact plate when the switch is closed; and
   (e) a top housing member having a stepped extension across one end, said top housing member enclosing said socket terminal, said contact terminal and said thermostatic element upon said housing base, said stepped extension exerting a force on said thermostatic element adjacent said cylindrical element in opposition to the upward bias of said socket to maintain constant contact between said cylindrical element and said socket, thereby to permit a free rotation of said cylindrical element in said socket and a free movement of the said thermostatic element in said housing.

2. A thermostatic switch comprising in combination:
   (a) a base having apertures therein and openings on at least two ends thereof;
   (b) a first terminal member having a tab and an irregularly shaped heater portion and a socket, said first terminal member resting in one of said apertures with said tab extending out of one of said openings in one end of said base, said heater portion connecting said tab to said socket;
   (c) a second terminal member having a flat area with a contact plate thereon and a tab extending out of another of said openings in the end of said base and opposite said first mentioned tab;
   (d) a heat sensitive element having an electrical contact on one end and a cylindrical member attached thereto at the other end, said cylindrical member resting in said socket and being freely rotatable therein, and said electrical contact engaging said contact plate when said switch is closed; and
   (e) a top cover having a stepped extension therein mating with said base to enclose said terminals and heat sensitive element, said stepped extension pressing down upon said heat sensitive element on the opposite side of said element from said cylindrical member to hold said cylindrical member into engagement with said socket to permit rotation of said cylindrical member in said socket.

3. The thermostatic switch as defined in claim 2 wherein said heat sensitive element is a snap-acting bimetallic plate which reverses curvature when said plate opens due to the temperature thereof being raised above a predetermined level.

4. A thermostatic switch comprising:

(a) a base,

(b) first and second terminals fixedly mounted in spaced relation on the base,

(c) a generally V-shaped socket mounted on the first terminal in resilient relation to the base and biased away from the base,

(d) a thermostatic element having a contact open and contact closed configuration,

(e) a cylindrical mounting member and a contact secured in spaced relation on the thermostatic element, the mounting member rotatably positioned in the socket and the contact located so that the contact can move into and out of engagement with the second terminal when the thermostatic element is in the contact closed and open configurations respectively, and

(f) cover means provided with an extension, the cover

mounted on the base so that the extension urges the thermostatic element and mounting member into the socket and the socket toward the base to permit thereby free rotation of the cylindrical member in the socket and free movement of the thermostatic element in the base.

5. A switch according to claim 4 including a post positioned on the base intermediate the socket and the second terminal so that the post limits the movement of the thermostatic element preventing the contact from engaging the second terminal when the thermostatic element is in the contacts open configuration.

References Cited

UNITED STATES PATENTS

2,979,585	4/1961	Werr	200—138
3,143,619	3/1964	Hummel	200—138
3,221,115	11/1965	Feher	200—166

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