

Jan. 21, 1958

W. H. MOKSU

2,820,870

THERMOSTATIC SWITCH

Filed July 19, 1956

3 Sheets-Sheet 1

Fig. 2.

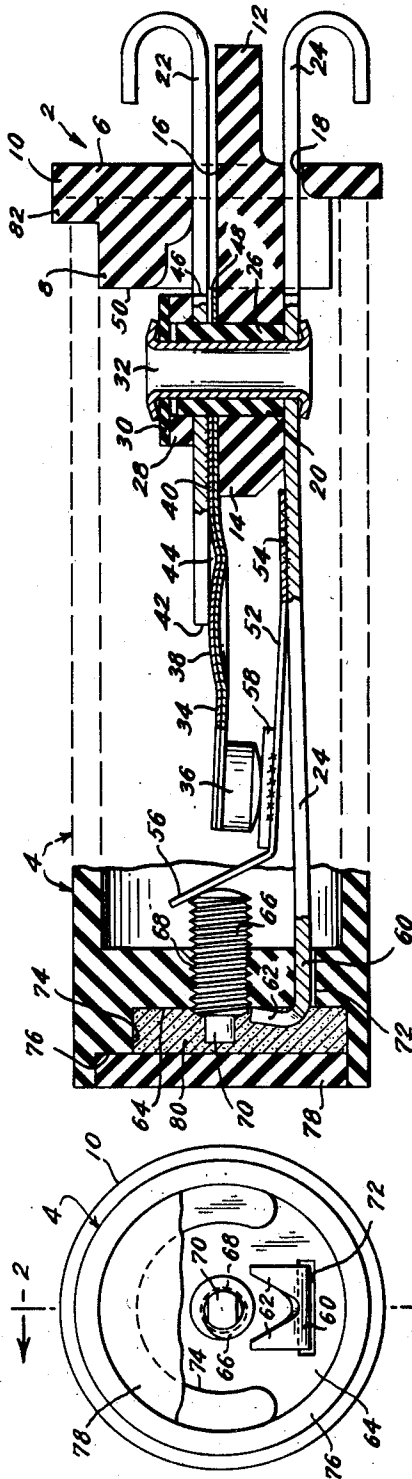
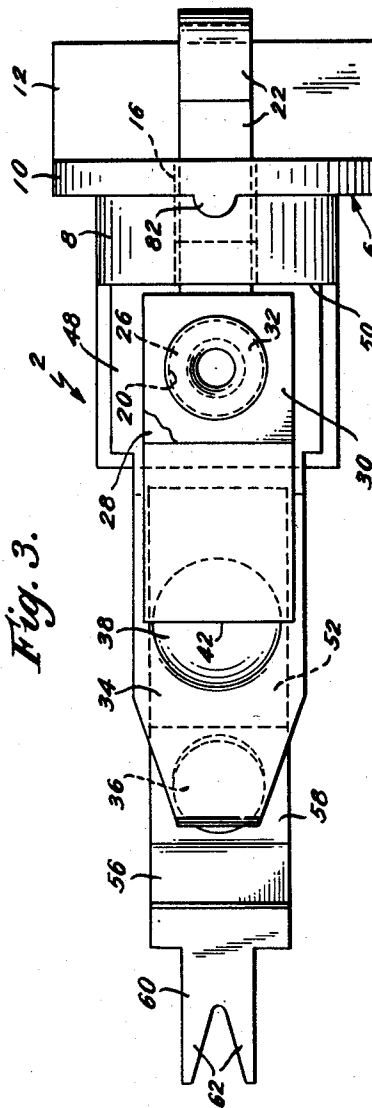


Fig. 3.



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Fig. 4.

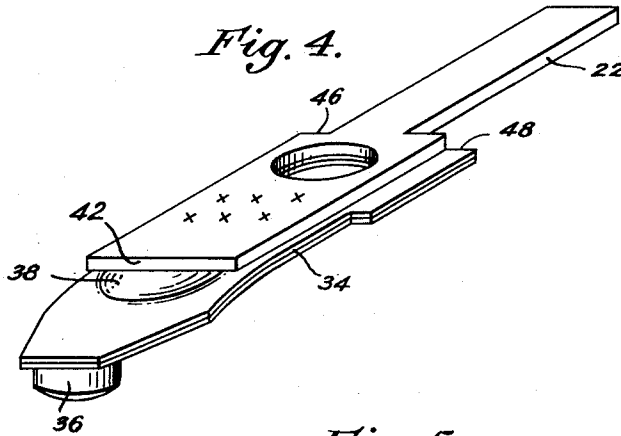


Fig. 5.

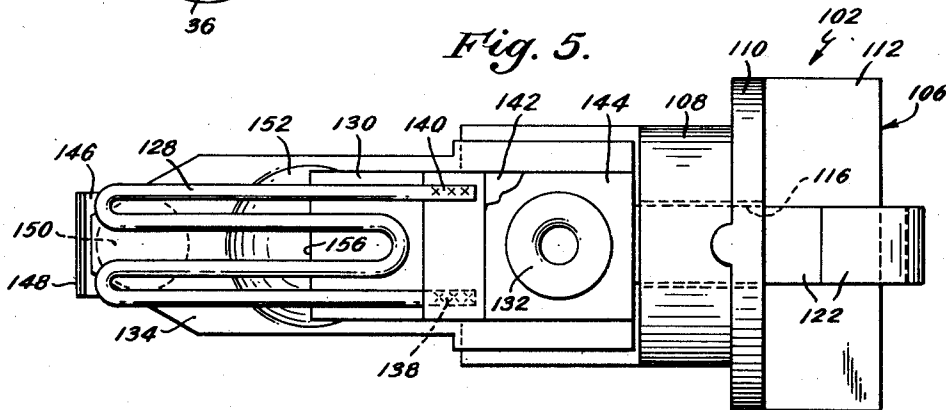
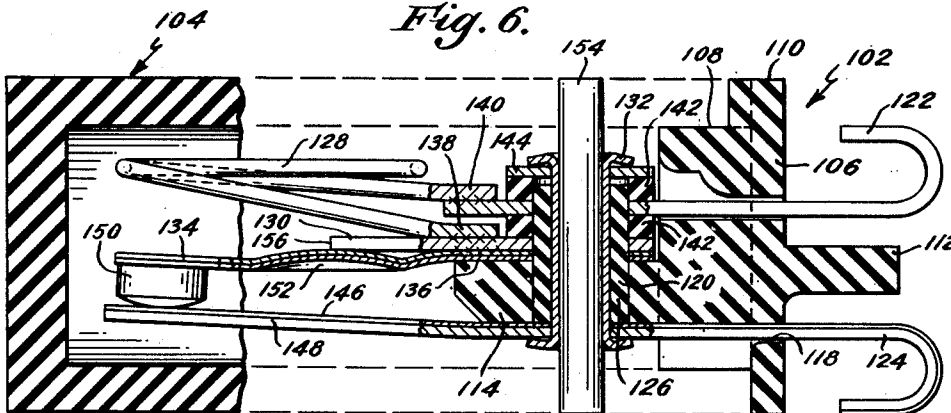


Fig. 6.



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Fig. 7.

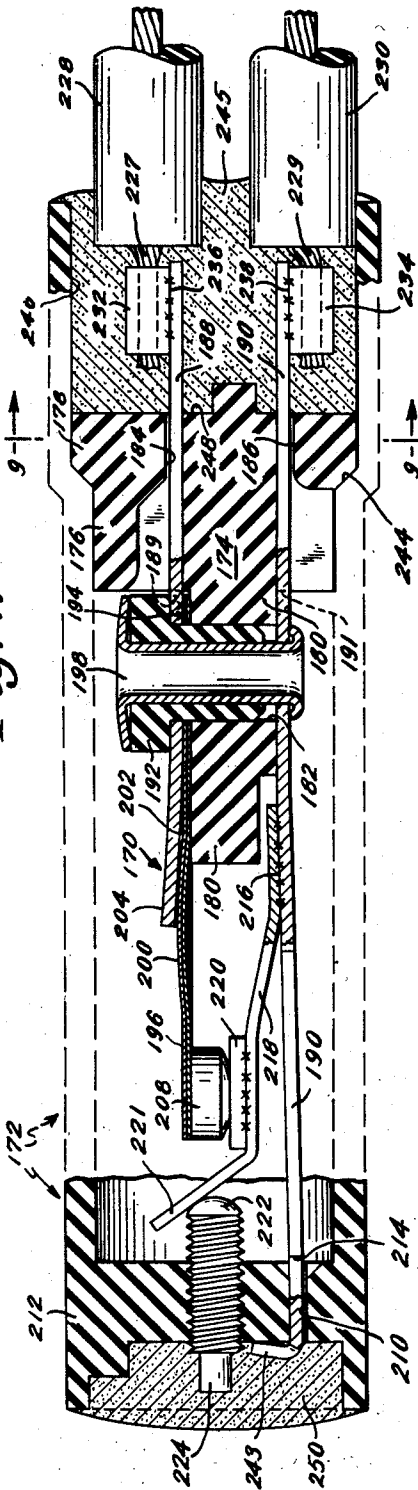


Fig. 8.

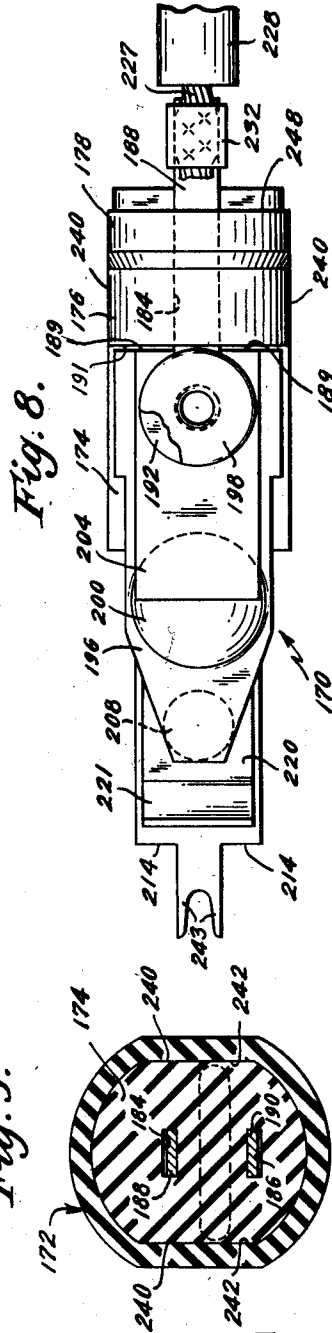
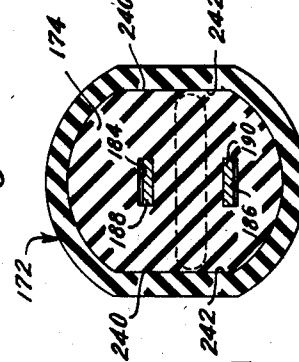


Fig. 9.



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2,820,870

THERMOSTATIC SWITCH

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Application July 19, 1956, Serial No. 598,914

12 Claims. (Cl. 200—138)

This invention relates to thermostatic switches, and in particular to thermostatic switches of the snap-acting type.

This invention lies in the field of small, simple and economically made thermostatic switches; and particularly thermostats which are small enough to be embedded directly in the windings of small fractional horsepower motors, and small transformers, the thermostat serving to prevent such devices from overheating. In the design and manufacture of such thermostats, many problems are encountered such as providing low heat mass, adequate electrical insulation, ease yet permanence of calibration, etc. The present invention provides a simple, inexpensive, mass-producible, and easily adjustable thermostat which embodies solutions for these problems.

Among the several objects, therefore, of the invention may be noted the provision of a thermostatic switch of such simplicity as to make it feasible for mass production; the provision of a switch of the class described which has low heat mass and therefore has fast response; the provision of a switch of the class described which may be easily calibrated either before or after it is assembled in its protective casing; and the provision of a switch of the class described which provides a unique and low cost device incorporating a snap-acting thermostat.

Other objects and advantages of the invention will be in part obvious and in part pointed out hereinafter.

The invention accordingly comprises the elements and combinations of elements, features of construction, and arrangements of parts which will be exemplified in the structures hereinafter described, and the scope of the application of which will be indicated in the following claims.

In the accompanying drawings, in which several of various possible embodiments of the invention are illustrated:

Fig. 1 is an end view of one embodiment of this invention, with a part of a cover element broken away;

Fig. 2 is a sectional elevation of the Fig. 1 embodiment, taken in the direction of sight lines 2—2 thereon;

Fig. 3 is a top view of the operating structure of Figs. 1 and 2 removed from its protective casing;

Fig. 4 is a perspective view of a subassembly of thermostat element, electrical contact and mounting bracket, used in this invention;

Fig. 5 is a top view of an operating structure used in a second embodiment of this invention;

Fig. 6 is a sectional elevation of the Fig. 5 structure shown inserted in its protective casing;

Fig. 7 is a sectional elevation of a third embodiment of this invention;

Fig. 8 is a top view of the operating structure of the Fig. 7 embodiment removed from its protective casing; and

Fig. 9 is a sectional view taken in the direction of sight lines 9—9 in Fig. 7.

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Similar reference characters indicate corresponding parts throughout the several views of the drawings.

This application is a continuation-in-part of my co-pending application Serial No. 412,251 filed February, 24, 1954, now abandoned.

Referring to the drawings, and particularly to Figs. 2 and 3, there is shown a thermostat comprising a thermostat assembly indicated generally by numeral 2 and a container therefor indicated generally by numeral 4. The thermostat assembly 2 comprises a mounting plug 6 which has a cylindrical hub 8 and a flange 10 thereon. To the right (as drawn) of flange 10 is a projecting tongue 12, and to the left of the cylindrical end 8 is a projecting tongue 14. The purpose of tongue 12 is to provide electrical insulation between terminals. Tongue 14 provides a mounting member for other portions of the thermostat, as will be described below, and is pierced by a hole 20. This whole element of hub 8, flange 10, and tongues 12 and 14 is made in one piece of a moldable resin such as the phenolic resins, or other thermosetting types.

Extending through the hub 8 and the flange 10 are the two rectangular slots 16 and 18. Terminals 22 and 24 of electrically conducting sheet metal having a cross-sectional shape to fit slots 16 and 18 are provided and extend through the slots so as to lie along the top and bottom surfaces of tongue 14. Each of terminals 22 and 24 is provided with a suitable hole which will register with hole 20. A sleeve 26 of electrical insulating material and washer 28 likewise of electrical insulating material are positioned as shown, and these, in conjunction with tongue 14, electrically insulate terminal 22 from terminal 24. A metallic clamping washer 30 is provided, and by means of the tubular rivet or eyelet 32 passing through the aligned respective washers, sleeve, and holes, the aforementioned parts are securely clamped together.

Prior to clamping the parts in the positions shown in Figs. 2 and 3 a subassembly is formed comprising the terminal 22 and the snap-acting element 34, together with the electrical contact 36 which is carried by, and thus motivated by, the snap action of element 34. This is shown in Fig. 4. This subassembly, which comprises the heart of the device, readily lends itself to mass production on a continuous basis, the parts being automatically blanked out and fed into suitable welding machines at the proper times and positions.

Snap-acting element 34 comprises an elongated strip of thermostat metal having a dished area 38 provided therein as shown. Such an element is shown and described in the John A. Spencer United States Patent No. 1,448,240. A brief word of explanation at this point in regard to the operation of such a thermostat element is in order, as follows: As drawn in Fig. 2, the high expansion metal is on the bottom, that is, it is on the concave side of dished area 38. The low expansion metal is on the convex side. Provided the thickness of the thermostat element is not too great in relation to the diameter of the dished area 38 and the amount of dish thereof, upon heating this element, the dished portion 38 will reverse its curvature automatically to a position of convexity opposite to that shown at a predetermined temperature. Thereafter, on cooling the thermostat element to another predetermined critical temperature, the dished portion 38 will snap back to its original position (shown). Thus the element 34 basically is one of the so-called inherent differential kind of snap-acting thermostats, in which the portion 38 comprises a non-developable surface. The temperatures at which the element 34 will snap when heated and cooled are determined by the amount of "dish" the dished area 38 has, and the shape of the area. The deeper the dishing, the higher will be the temperature at which the device snaps.

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The temperature at which the device snaps back on being cooled can be varied by changing the shape. If the "dish" is not spherical, but is flattened somewhat at the center (like a saucer) the "cold" snapping temperature will be higher.

Thermostat element 34 is welded at the region 40 to the underside of terminal 22, and extends back along terminal 22 to the right as shown. The element 34 is provided with a hole in register with the hole in terminal 22, so that the element may be clamped by tubular rivet or eyelet 32 between terminal 22 and tongue 14. It will be noticed, however, that the end 42 of terminal 22 extends out to approximately the center of the dished area 38, without touching any other part of this dished area. For example, in Fig. 2, a clearance 44 is shown between terminal 22 and the edge of the dished portion 38. The purpose of this extension is to give support to the center of the dished area 38, as well as to the thermostat element as a whole, so that initial creep of the thermostat element may be eliminated and proper temperature adjustments may be made. At the free end of thermostat element 34 is fastened, preferably by welding, an electrical contact 36. Welding is preferred because of its economy, but other means of fastening contact 36 to the end of thermostat 34 may be used, if desired, such as by riveting in well-known manner.

As indicated, reference to Fig. 4 will show the thermostat element and terminal subassembly, as fastened together prior to being riveted to tongue 14. As shown, both terminal 22 and element 34 are provided with shouldered portions 46 and 48 at their rear ends, and these shouldered portions (acting in conjunction with the face 50 of cylindrical end 8) assist in preventing any rotation of the assembly on the tubular rivet 32. In the drawing, for the purpose of clarity, the shoulders 46 and 48 are not shown in snug abutment against the face 50, but in manufacture, such snug abutment is to be preferred for the reason aforesaid.

In somewhat similar manner, an assembly is made comprising the terminal 24 and a contact-carrying and adjusting member 52. Member 52 comprises an arm of electrically conducting spring material (such as Phosphor bronze or hardened beryllium-copper alloy) fastened as by welding at 54 to terminal 24. Arm 52 is bent upwards slightly from terminal 24, and is provided with the upturned or angled end 56, the purpose of which will be described below.

Mounted on arm 52, as by welding, is an electrical contact 58. Hereinafter contact 58 will be called the stationary contact, even though it is movable for purposes of adjustment. It is called stationary, because in respect to the contact 36, contact 58 remains immovable when contact 36 is snapped to and away from it.

As drawn, no electrical insulating means have been expressly provided between the end 42 and the place where it touches dished area 38. The reason for this is that the area of contact is a point area (since the dished area is domed), and also the thermostat metal has a coating of oxide on it which provides some measure of electrical insulation. The effect of these is to insure that the far greater part of the electrical current passes through the thermostat element from the welded area 54. However, if desired, electrical insulating means may be provided, as by dipping the end 42 in a ceramic or synthetic resin insulating material prior to assembly.

It will be observed that terminal 24 is elongated in length (beyond the length of terminal 22) and ends in a reduced end portion 60, which in turn is provided with the ears 62.

The container 4 comprises a molded cylindrical shell of electrical insulating material, such as one of the moldable thermosetting resins (for example, the phenolic resins, or the urea formaldehyde types), and has an inside diameter such as to provide a snug fit over the hub 8. Container 4 is closed at one end by means of a bottom 64 which is of such thickness as to support the threaded

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adjusting screw 66, the latter snugly fitting the threaded hole 68 provided therefor. Adjusting screw 66 is provided with a flattened reduced neck portion 70 thereon to provide means for turning and locking the adjusting screw in place, and has a spherical end where it touches upturned end 56. Bottom 64 is also provided with a slot 72 which is adapted to receive therethrough the reduced end portion 60 of terminal 24.

Preferably bottom 64 is located in the container a short distance in from the end so as to provide a recess 74 of depth sufficient to contain the shoulder 70 of the adjusting screw. A shoulder 76 is provided against which rests a cover plate 78 which is cemented in place after certain adjusting operations on the thermostat have been made.

After the assembly 2 of the thermostat and contact-bearing parts is completed, the assembly is inserted in the container 4 so that flange 10 rests snugly against the end of the container. It will be noted that terminal 24 has been provided in sufficient length so that the ears 62 and reduced portion 60 project through the slot 72. Ears 62 are now either bent upwardly or spread apart in order to hold the assembly 2 securely in the container 4. It will be observed from Fig. 2 that adjusting screw 66 is of such length as to touch angled end 56. Thus, by screwing adjusting screw 66 inwardly or outwardly, the spring member 52 may be moved upwardly or downwardly (with respect to thermostat element 34) due to the angulation of end 56. By this means, it is possible to adjust the operating temperature of the device after the assembly 2 has been firmly fastened into container 4. For actual adjustment, adjusting screw 66 is turned inwardly until the initial creeping of thermostat 34 has been removed, and thereafter further inward motion of screw 66 will adjust the hot snapping temperature of element 34 to a lower value. The proper temperature is selected, and thereafter adjusting screw 66 is held in position by using a sealing compound 80 to cement the screw from turning. Thereafter, cover plate 78 is cemented in place. (It will be understood, of course, that the temperature at which the thermostat element will snap back to its original position is determined by the amount and shape of the dished area 38, as stated above.)

To facilitate the correlation of the parts during the mounting of assembly 2 into casing 4, the flange 10 is provided with a protruding key 82. The end of casing 4 is provided with a matching notch so that if the key 82 and its casing notch are aligned, the ears 62 will be in position to enter slot 72. After the ears 62 are bent up, the engagement of key 82 and the casing notch prevent rotation of assembly 2 in casing 4.

In operation and, for example, in the use of the device as a motor protection device, the complete adjusted and sealed unit is buried in the windings of the motor that it is to protect. In such a place, it is responsive immediately and faithfully to the actual temperature of the motor winding. The terminals 22 and 24 are, for example, connected in series with one lead to the motor winding. Thus, if the motor should approach a temperature which is deleterious to the winding insulation, or dangerous as a fire hazard, thermostat element 34 will snap upwardly (as drawn in Fig. 2) to separate movable contact 36 from stationary contact 58, thus interrupting current to the motor. When the motor has cooled to a predetermined temperature which is a pre-selected amount below the "hot" snapping temperature, thermostat element 34 will snap back to close the circuit to the motor and thus put it in operation again.

Shown in Figs. 5 and 6 is another embodiment of this invention, in which a heating element is provided for the thermostat. Again, as in the Figs. 1-4 embodiment, a thermostat assembly 102 and container 104 are provided.

Thermostat assembly 102 comprises the mounting plug 106 having, as in the first instance, the cylindrical hub

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108, the flange 110, and the tongues 112 and 114. As before, slots 116 and 118 are provided to receive the terminals 122 and 124, and hole 120 is provided in tongue 114 to receive the insulating sleeve 126 and the tubular eyelet 132. In this instance, however, the assembly of the thermostat element and terminal 122 differs in that here a heating element 128 is provided, as follows: A mounting strip 130 is provided to which is welded the thermostat element 134 as indicated at 136, the end of the mounting strip approximately centering over the center of the dish area of the thermostat element, as described for the Figs. 1-4 embodiment. One end 138 of heating element 128 is welded to mounting strip 130, as shown, and the other end 140 is welded to the end of terminal 122, as shown. Terminals 122 and 124, as well as mounting strip 130, are provided with suitable holes adapted to register with hole 120 when assembling the respective parts. The insulating washers 142 serve to insulate (in conjunction with insulating sleeve 126) the terminal 122 from the mounting strip 130. A metallic clamping washer 144 is provided, and these parts are held together, as shown, by the headed-over tubular eyelet 132.

In this embodiment, terminal 124 is shown as comprising a two-layered composite structure having the layer 146 of electrically conductive material such as silver firmly bonded to layer 148 of a base metal such as copper, bronze or steel. As before, an electrical contact 150 is provided on the free end of thermostat element 134, element 134 having the dish area 152 and operating in the same manner as does element 34 in the Figs. 1-4 embodiment. As in the Figs. 1-4 embodiment, the mounting strip 130 touches the dish area 152 at approximately the center thereof (as indicated at end 156) to give support to the element.

Prior to insertion of the assembly 102 into the container 104, adjustment of the snapping temperature of the thermal element is made by bending the free (contact-carrying) end of terminal 124 toward or away from thermostat element 134. This bending is done until the initial creep of the element 134 is removed, and thereafter the bending is continued until the proper hot snapping temperature has been reached. As in the Figs. 1-4 embodiment, the temperature at which element 134 snaps back to its original position is determined by the amount and shape of dish area 152.

Thermostat assembly 102 is now inserted in container 104, the latter again providing a snug fit around the hub 108, and a fastening pin 154 is thrust through properly spaced holes in the side walls of the container 104 and the tubular eyelet 132 to hold the parts together.

With this assembly it will be noted that current to the device will enter, for example, terminal 122 and then pass through heating element 128 to mounting strip 130. From mounting strip 130 it passes by means of welded area 136 to thermostat element 134 and thence by contact 150 and silver layer 146 out via terminal 124. Again, as in the first instance, the device has particular usage as a thermostat to be embodied (because of the small size in which it can be made) in windings of an electrical motor, the terminals 122 and 124 being placed (in such instance) in series with one of the leads to the motor. Operation of the device is the same as the first described embodiment.

It is to be noted that, if desired, the heater construction of Figs. 5 and 6 can be provided for the Figs. 1-4 embodiment described above and for the Figs. 7-9 embodiment described below.

Referring to Figs. 7-9, a thermostat is shown which forms another embodiment falling within the scope of this invention. This embodiment is similar in many respects to the two embodiments previously described but differs therefrom as specifically pointed out hereinafter.

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The embodiment of Figs. 7-9 includes a thermostat assembly 170 and a container or casing 172 therefor. Casing 172 is formed of a suitable electrically-insulating material such as one of the customary molded plastics as described above with respect to the previously described embodiments.

Thermostat assembly 170 includes a mounting plug 174 having a hub 176 and flange 178 integral therewith. Mounting plug 174 is formed of a suitable insulating material such as one of the phenolic resins or other thermosetting types and further includes a projecting tongue or mounting member 180. An aperture 182 is provided through mounting member 180 for a purpose later to become apparent. Mounting plug 174 provides two slots 184 and 186, respectively, within each of which is provided a terminal 188 and 190, respectively. Terminals 188 and 190 are formed of a suitable electrically-conducting material.

Disposed within aperture 182 is a hollow, flanged sleeve 192 which is formed of a suitable insulating material. Welded to the underside of terminal 188 at 194 is a thermostatic, snap-acting element 196. Terminals 188 and 190 and thermostatic element 196 are provided with an aperture in registry with aperture 182 provided by mounting member 180. A tubular rivet or eyelet 198 passes through the respective apertures in flanged sleeve 192, terminal 188, mounting member 180 and terminal 190, and holds these parts in securely clamped relationship whereby terminals 188 and 190, and mounting member 180 are disposed in substantially aligned relationship. Shoulders 189, 189 provided by terminal 188 acting in conjunction with the adjacent face of hub 174, assist in preventing any rotation of this terminal about rivet 198. It will be noted that mounting member 180, along with headed sleeve 192, electrically insulates terminals 188 and 190 from each other.

Snap-acting element 196 comprises an elongated strip of thermostat metal having a deformed portion 200 provided therein as shown. This thermostatic element may be identical to that of either of the previously described embodiments. As with each of the previously described embodiments, the deformed portion of the thermostatic element is shown as being dish-shaped although it will be obvious to those with only ordinary skill in the art that this portion may be otherwise deformed to render the thermostatic element snap-acting.

End portion 204 of terminal 188 forms a restraining member which extends out to approximately the center of deformed portion 200 without touching any other part of the deformed area. As in the previously described embodiments, restraining member 204 gives support to the center of dish area 200, as well as to the thermostatic element as a whole, so that initial creep of the thermostat element may be counteracted. However, it has been found that, particularly with thermostatic elements of comparatively small thickness, the support provided by restraining member 204 may not be sufficient adequately to eliminate the creep of the thermostatic element. In order that creep of the thermostatic element 196 be further counteracted, mounting member 180 is extended to the left as viewed in Figs. 7 and 8. Thereby, the mounting member extends along a portion of deformed part 200 and presses against the thermostatic element at the margin of the deformed portion. Contrary to what might be expected, this construction does not substantially change the calibration of the thermostatic element from one (such as that incorporated in the previously described embodiments) in which the mounting member does not extend along the deformed portion of the thermostatic element. Rather, the calibration of the thermostatic element is not substantially affected while the initial creep of the thermostatic element is further counteracted. Since the mounting member 180 presses against thermostatic element 196 at the margin of deformed portion 200, the clearance between these parts at 202 will be less than the clearance

44 of the embodiment shown in Figs. 1-4. Although the dimensions of certain of the parts (such, for example, as thermostatic elements 34, 134 and 196) have been exaggerated for purposes of clarity of illustration, and although the dimensions of individual switches of each embodiment will vary, the comparative difference between clearances 44 and 202 as depicted in Figs. 2 and 7, respectively, indicates, to some extent, the effect of extending the mounting member along a part of the deformed portion of the thermostatic element as described above with respect to Figs. 7-9.

Beyond deformed portion 200, an electrical contact 208 is mounted on the thermostatic element by suitable means such as welding.

Terminal 190 extends through a slot 210 provided by the end portion 212 of casing 172. Welded to terminal 190 at 216 is a contact-carrying and adjusting arm 218 to which an electrical contact 220 is secured as by welding. Arm 218 includes an extension 221 which cooperates with an adjusting screw 222 to adjust the temperature of the thermostatic device after assembly of its parts. Adjusting screw 222 is disposed in threaded engagement with casing or container 172 and is provided with a flattened reduced neck portion 224 by means of which the screw may be rotated and thereby adjusted with respect to extension 221.

Terminals 188 and 190 may be electrically connected to the bared ends 227 and 229 of insulation-covered leads 228 and 230 in the manner depicted in Fig. 7. In this regard, sleeves or U-shaped members 232 and 234 which are formed of electrically-conducting material are respectively clamped about leads 228 and 230, and members 232 and 234 are then secured to the respective terminals as by welding at 236 and 238.

After the parts of thermostatic assembly 170 have been secured together by means of rivet or eyelet 198, and leads 228 and 230 have been electrically connected to terminals 188 and 190, respectively, the thermostatic assembly is then disposed within the interior of casing 172 as shown in Fig. 7. It will be noted that hub 176 has flat sides 240, 240 which mate with the flat internal surfaces 242, 242 provided by casing 172 to align assembly 170 with the casing. Flange 178 of hub 176 engages shoulder 244 provided by casing 172 to limit the extent of insertion of assembly 170 into the casing. Terminal 190 may be provided with shoulders 214, 214 for cooperation with the portion of the casing adjacent slot 210 further to ensure the proper extent of insertion of assembly 170 into the casing. As in the embodiment shown in Figs. 1-4, ears 243 provided at the end of terminal 190 are bent up as shown in Fig. 7 or spread apart to hold assembly 170 in container 172.

With the parts in the assembled position shown in Fig. 7, a well is formed by internal surface 246 of casing 172 and the end surface 248 of mounting plug 174. As shown in Fig. 7, the ends of terminal 188 and 190, and the bared lead ends 227 and 229 to which they are respectively connected, are disposed within this well. A suitable, conventional, electrically-insulating, thermosetting sealing compound indicated at 245 is deposited to fill this well whereby assembly 170 is secured to casing 172 and the electrical connections between each of terminals 188, 190 and their respective leads are sealed from each other and from the outside of the casing.

Adjusting screw 222 is adjusted in the manner and for the purposes set forth above with respect to the embodiment shown in Figs. 1-4. As best shown in Fig. 7, a well is provided at the end of the casing at which the adjusting screw is located. After screw 222 is adjusted, a sealing compound similar to that described above, is deposited in this well as indicated at 250. With the well filled with this sealant, adjusting screw 222 is prevented from unintentional rotation and the end of terminal 190 disposed in the well is sealed from the outside of the casing. Also, it will be clear that with sealing compound

filling the opposite ends of casing 172, the interior of the casing is closed off from outside the casing.

Throughout this description, mention has been made of the small size in which both these embodiments can be made. As an example of this, the overall length of the Figs. 1-4 embodiment has been made approximately 1 inch, with the outside diameter of the container 4 equal to approximately 0.3 inch. The thermostatic element 34, in this instance, was approximately 0.5 inch long by 0.188 inch wide by .003 inch thick. The dished area 38 was approximately 0.188 inch in diameter, and located approximately .265 inch from the mounting hole of the thermostatic element. Similarly, in the Figs. 5-6 embodiment, the overall length is made approximately 0.95 inch, with an outside diameter of approximately 0.3 inch. The thermostatic element 134 was approximately the same size as that given above for element 34.

In view of the above, it will be seen that the several objects of the invention are achieved and other advantageous results attained.

As many changes could be made in the above constructions without departing from the scope of the invention, it is intended that all matter contained in the above description or shown in the accompanying drawings, shall be interpreted as illustrative and not in a limiting sense.

I claim:

1. A snap-acting thermostatic switch including a mounting member; an elongated thermostatic element in strip form lying along one side of said member with one end thereof overhanging said member and having a part thereof dished to provide a snap-acting portion, said dished part lying beyond the end of said mounting member; a restraining member lying on top of said element and extending over a portion of the dished area of said element; a movable first contact carried by the overhanging end of said element beyond said dished portion; a flexible contact arm supported from the other side of said mounting member and extending beyond its end; a second contact carried by said contact arm and positioned to engage said first contact when said thermostatic element is in one of its positions; and means holding said thermostatic element, restraining member, flexible contact arm, and mounting member together in substantial alignment.

2. The snap-acting switch of claim 1, in which said mounting member comprises an elongated plug having a circular flange portion, a flat sided extension on one side of said flange, a second flat sided extension on the other side of said flange in alignment with said first flat sided extension; a pair of slots piercing said flange, one of said slots being on each side of said extensions; and in which said restraining member passes through one of said slots and terminates in a terminal structure adapted to receive an electrical wire for connection thereto; and in which said flexible contact arm comprises a relatively short flexible arm welded to a longer flexible arm, said longer flexible arm having one end passing through the other of said slots and terminating in a terminal structure adapted to receive an electrical wire for connection thereto.

3. A snap-acting thermostatic switch including a mounting member; an elongated thermostatic element in strip form lying along one side of said member with one end thereof overhanging said member and having a part thereof dished to provide a snap-acting portion, said dished part lying beyond the end of said mounting member; a restraining member lying on top of said element and extending over a portion of the dished area of said element; a movable first contact carried by the overhanging end of said element beyond said dished portion; a flexible contact arm supported from the other side of said mounting member and extending beyond its end; a second contact carried by said contact arm and positioned to engage said first contact when said thermo-

static element is in one of its positions; means holding said thermostatic element, restraining member, flexible contact arm, and mounting member together in substantial alignment; and adjusting means acting on said flexible arm whereby the position of said arm with respect to said thermostatic element may be varied.

4. A snap-acting thermostatic switch including a mounting member of electrical insulating material; an elongated thermostat element in strip form fastened to said mounting member by one end and having the other end free, said free end extending beyond said mounting member and being provided with a dished portion comprising a non-developable surface portion capable of snapping under the influence of heat from one position of concavity to a position of opposite concavity; an elongated restraining member mounted on top of said thermostat element and extending over the central portion of said dished portion in contact therewith; a movable first contact carried by the free end of said thermal element beyond said dished portion; an elongated flexible contact arm supported from said mounting member and having one end free, said one end lying in a plane approximately parallel to the plane of the free end of the thermal element but spaced therefrom; a second contact carried by the free end of said flexible arm and engaging said first contact to make and break an electrical circuit; and adjusting means actuable on said flexible arm to force the second contact against the first contact in a direction opposed by the restraining force of said restraining member, thus to calibrate the temperature at which said thermal element snaps when heated.

5. A snap-acting thermostatic switch including an elongated mounting plug of electrical insulating material with two oppositely disposed sides; a thermostat element in strip form having one end portion mounted along one of said sides with a free end portion extending beyond the end of said plug, said free end portion being provided with a snap-acting dished part capable of assuming two positions of opposite concavity under the influence of heat; an elongated restraining member mounted on top of said thermal element and having a free end overlying approximately the center of said dished part and in contact therewith; said restraining element being welded to said thermal element at a place outside but adjacent to said dished part; a first contact carried by the free end of said thermal element beyond said dished part; an elongated flexible contact arm supported from the other of said sides of the plug and extending in a direction parallel to said thermal element with a free end portion thereof overhanging said plug in spaced relation to the free end portion of said thermal element; a second contact carried by the free end of the flexible arm and engaging said first contact to make and break an electrical circuit; and tubular covering means into which said mounting plug and attached thermal element and contact arm are held.

6. A snap-acting thermostatic switch including an elongated mounting plug of electrical insulating material with two oppositely disposed sides; a thermostat element in strip form having one end portion mounted along one of said sides with a free end portion extending beyond the end of said plug, said free end portion being provided with a snap-acting dished part capable of assuming two positions of opposite concavity under the influence of heat; an elongated restraining member mounted on top of said thermal element and having a free end overlying approximately the center of said dished part and in contact therewith; said restraining element being welded to said thermal element at a place outside but adjacent to said dished part; a first contact carried by the free end of said thermal element beyond said dished part; an elongated flexible contact arm supported from the other of said sides of the plug with said arm having a free end portion extending beyond the end of said plug in spaced relation to the free end portion

of said thermal element; a second contact carried by the free end of the flexible arm and engaging said first contact to make and break an electrical circuit; tubular covering means into which said mounting plug and attached thermal element and contact arm fit; and adjusting means carried by one end of said covering means and acting on said flexible arm to force it and the second contact toward said thermal element against the restraint of said restraining member, thus to calibrate the switch.

7. The device of claim 6, including a key provided integrally in a molded part of said plug; a notch provided in the rim of the open end of said tubular covering means; and, as means for fastening said contact arm to the plug, an elongated metal strip member fastened to said flexible contact arm and to said other of said sides of the plug and extending in substantially parallel relationship to but spaced apart from said thermal element on the side of said flexible contact arm remote from said thermal element; a slot in the closed end of said tubular covering means into which the end of said strip member fits, said slot, notch, and key being positionally related so that engagement of said notch by said key brings said strip member into alignment with said slot.

8. A snap-acting thermostatic switch including an elongated mounting plug of electrical insulating material with two oppositely disposed sides; a thermostat element in strip form having one end portion mounted along one of said sides with a free end portion extending beyond the end of said plug, said free end portion being provided with a snap-acting dished part capable of assuming two positions of opposite concavity under the influence of heat; an elongated restraining member mounted on top of said thermal element and having a free end overlying approximately the center of said dished part and in contact therewith; said restraining element being welded to said thermal element at a place outside but adjacent to said dished part; a first contact carried by the free end of said thermal element beyond said dished part; a terminal member in strip form mounted on top of said restraining member with insulating means between said terminal and restraining members; an electrical heater extending from the ends of said last-named members; an elongated flexible contact arm attached to the other of said sides of the plug and having one end spaced from said dished part but adjacent thereto and having its other end extend beyond said plug to act as a terminal member; electrical contact material carried by the free end of said flexible arm and engaging said first contact to make and break an electrical circuit; and tubular covering means into which said mounting plug and attached thermal element and contact arm fit.

9. A snap-acting thermostatic switch including a mounting member; an elongated, inherently thermally responsive element formed of composite material; said element being in strip form, lying along one side of said member with one end thereof overhanging said member and having a part thereof deformed into a non-developable surface to provide a snap-acting portion, at least a portion of said element lying beyond the end of said mounting member; a restraining member lying on top of said element, said restraining member extending over and engaging a portion of the deformed part of said inherently thermally responsive element; a movable first contact carried by the overhanging end of said element; a contact arm supported by said mounting member; a second contact carried by said contact arm and positioned to engage said first contact when said element is in one of its positions; and means holding said element, restraining member, contact arm and mounting member together in substantial alignment.

10. The snap-acting thermostatic switch as set forth in claim 9 including a hollow casing within which said thermostatic element, restraining member, flexible contact arm and mounting member are disposed; the interior

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of said hollow casing being closed off by thermosetting, electrically-insulating sealing compound.

11. A snap-acting thermostatic switch including a mounting member, two elongated terminals carried in spaced relationship by said mounting member, an elongated thermostatic element in strip form lying along one side of said mounting member with one end thereof overhanging said mounting member, said thermostatic element having a part thereof secured to said mounting member and having another part thereof deformed to provide a snap-acting portion, at least a portion of said deformed part lying beyond the end of said mounting member, a portion of one of said terminals forming a restraining member lying on top of said thermostatic element, said restraining member extending over and engaging a portion of the deformed part of said thermostatic element; a movable first contact carried by the overhanging end of said element, a contact arm electrically connected to the other of said terminals, a second contact carried by said contact arm and positioned to engage said first contact when said thermostatic element is in one of its positions; and means holding said thermostatic element, terminals, contact arm and mounting member together in substantial alignment.

12. A snap-acting thermostatic switch including a

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first member; an elongated, inherently thermally responsive element formed of composite material; said element being in strip form, lying along one side of said first member with one end thereof overhanging said first member, and having a part thereof deformed into a non-developable surface to provide a snap-acting portion; at least a portion of said element lying beyond the end of said first member; a restraining member lying on top of said element, said restraining member extending over and engaging a portion of said non-developable surface; a movable first contact carried by the overhanging end of said element; a first terminal electrically connected to said element; a second contact positioned to engage said first contact when said element is in one of its positions; a second terminal electrically connected to said second contact; and means holding said element, restraining member, second contact and first member together in substantial alignment.

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