March 18, 1941. E. S. CORNELL, JR 2,235,697

THERMOSTAT

Filed Jan. 5, 1938

Fig. 1.

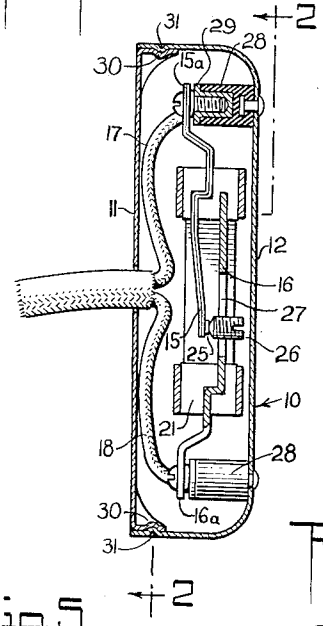


Fig. 2.

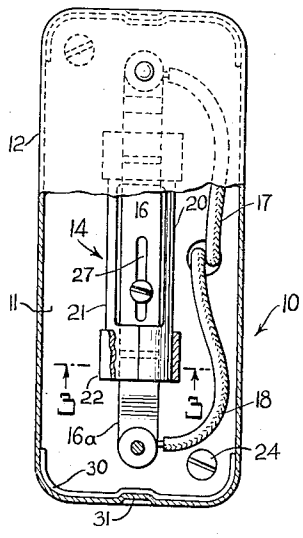


Fig. 3.

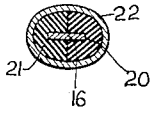


Fig. 5.

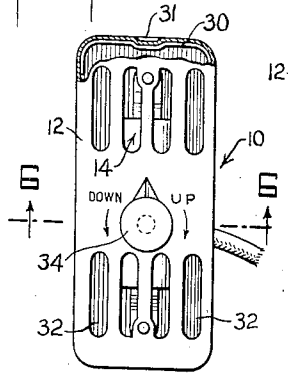


Fig. 6.

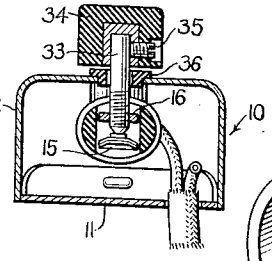


Fig. 8.

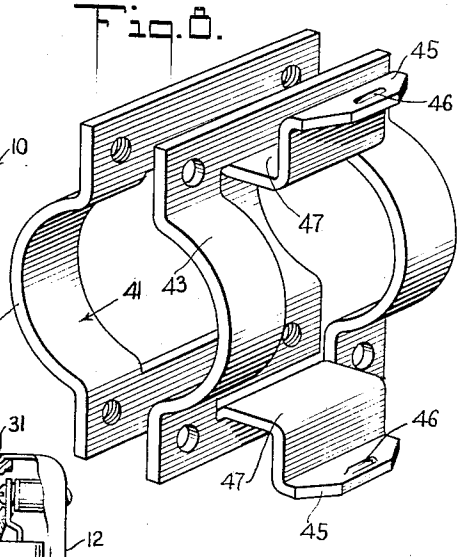


Fig. 7.

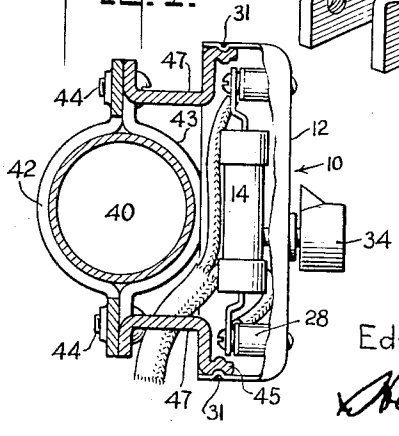
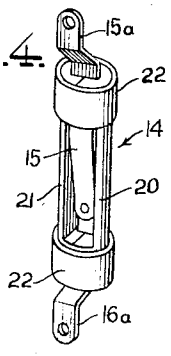


Fig. 4.



INVENTOR
Edward S. Cornell, Jr.
BY
Henry J. Lucke
HIS ATTORNEY

Patented Mar. 18, 1941

2,235,697

UNITED STATES PATENT OFFICE

2,235,697

THERMOSTAT

Edward S. Cornell, Jr., Larchmont, N. Y.

Application January 5, 1938, Serial No. 183,437

4 Claim. (Cl. 200—138)

This invention relates to thermostatic control devices.

More particularly, this invention relates to electric-circuit-breaking switches or thermostats of the "bi-metallic" type, in which two electrically conductive members, one of them "bi-metallic," are brought into or out of current-conductive engagement by movement of such bi-metallic member under the influence of the unequal expansion of contraction of the metallic constituents thereof on change of ambient temperature. Advantageously, said members are provided with suitable electrical contact points, at least one being adjustable to make a greater or less movement of the bi-metallic element necessary to effect the make or break of the electrical circuit.

It is an object of the present invention to provide a thermostat having a relatively small size, compact housing or supporting structure, in which the thermally-responsive make and break device is mounted as a unitary structure, such make and break device therefore being removable, as a unit, from such supporting structure.

A feature of the invention therefore is that the temperature-sensitive circuit-breaking device may be inserted into and removed from the complete thermostat structure as a unit. Desirably, the bi-metallic and the fixed electrical conducting members are contained in a cartridge-like mounting, formed from electrically insulating material and preferably embodying spaced insulating side walls which afford ventilation of the thermostat elements and form means whereby the operator may grasp the thermostat unit during the insertion or removal thereof without exposure to electric shock.

An additional feature of this invention is that the stated electrically conductive elements of the thermally-sensitive "cartridge" project inwardly, and into suitable operative relationship with each other, from opposite ends of the stated cartridge. Suitable end extensions of such elements provide for screw-threaded attachment to insulated posts secured to the thermostat housing, advantageously to its stated cover portion; such posts thereby provide a rigid mounting for the cartridge and additionally form binding posts or equivalent points of connection to the electrical circuit. Such thermostatic unit is analagous, in facility of replacement or inspection, to the familiar cartridge fuse.

It is a further feature of the invention that the thermostat unit, when secured to a cover-portion of the thermostat structure, such cover-portion being removable with respect to a back-member or other mounting means, may be replaced or inspected without disturbing the thermostat mounting.

The thermostat structure lends itself to a variety of uses, inclusive of a wholly enclosed structure for service under outdoor or other exposed conditions, a ventilated type of thermostat for indoor use, or a thermostat useful for controlling steam or other heat-pipe temperatures, the last mentioned use contemplating a saddle or equivalent structure arranged to be clamped to the heat-pipe and further arranged to support the removable cover in a manner providing for the direction of radiated heat against the bi-metallic element.

Desirably, the adjustable contact point may comprise a screw-threaded element. Such contact point may be externally adjustable, as by manipulation of a suitable knob, or may be adjustable only after the removal of the thermostat cartridge from the cover, the last mentioned form contemplating the use of the device for outdoor or other exposed service.

In the accompanying drawing:

Fig. 1 is a vertical section taken through an electrical thermostat embodying the present invention;

Fig. 2 is a front elevation, the cover portion being partially cut away to expose the thermostat unit of the device of Fig. 1, such device representing a wholly enclosed thermostat suitable for outdoor or other exposed location;

Fig. 3 is a section taken through 3—3 of Fig. 2, illustrating a method of clamping one of the thermostat elements between electrically insulating members of the thermostat cartridge unit;

Fig. 4 is a perspective of a thermostat cartridge unit made pursuant to the present invention;

Fig. 5 is a front elevation of a thermostat having a ventilated cover member, such thermostat being particularly suitable for indoor or room-temperature control. A portion of the cover of the complete thermostat has been cut away to indicate the method of mounting such cover on a supporting back member;

Fig. 6 is a section taken through 6—6 of the thermostat of Fig. 5, particularly illustrating the temperature adjustment means thereof;

Fig. 7 illustrates the thermostat cover element, having secured thereto the unitary thermostat element, mounted in heat-control relationship to a heat-pipe; and

Fig. 8 is a perspective of the heat-pipe saddle or mounting of the structure of Fig. 7.

Referring to Figures 1, 2 and 4, the thermally-responsive electrical cut-out switch or "thermostat" 10 includes a back member or mount 11, a cover 12 arranged to be removably secured thereto, and a temperature-sensitive electrical cutout device 14, the latter comprising a pair of electrical conducting elements 15, 16, suitably secured in proper operative relationship within a housing of cartridge-like shape. In the embodiment of Fig. 1, the cut-out device 14 serves as a series connection between two electrical conductors 17, 18, of an electrical circuit.

The temperature-sensitive electrical cut-out device 14 is advantageously of the "bi-metallic" type, in which one of a pair of electrical conducting members, as 15, Fig. 1, is of laminated structure, the laminations generally being metals of dissimilar coefficients of expansion. The stated metals are welded or otherwise unitarily combined. Upon the heating or cooling of the member 15 under the influence of atmospheric temperature, for example, the unequal expansion of the metallic constituents thereof causes a warping or flexing of the member. As is well known in the art, such bi-metallic element may be employed as a thermally-responsive electrical make-and-break device by suitably positioning a free end thereof in proper relationship to a fixed member or electrical contact point, and connecting the respective fixed and bi-metallic elements in series connection in an electrical system, such for example, as the electric circuit of an oil burner motor or the like.

In the present invention, the bi-metallic member 15 and the fixed member 16, are rigidly mounted within the cartridge-like housing, the latter advantageously comprising a pair of suitably spaced walls 20, 21, of electrically non-conducting material such as "Bakelite," hard rubber, molded fibre, or the like, such walls being held together in a manner confining the thermostat elements by, for example, the tightly fitting metallic rings 22, 22, which encircle the ends of the walls. As clearly indicated in Figs. 3 and 4, the end-portions of the walls preferably abut, and grip the respective elements 15, 16 at a point intermediate the ends of such elements. Advantageously, and as illustrated in Fig. 1, the elements 15, 16, in the area of their contact with the end portions of the side walls 20, 21, are given an off-set or step formation, such formation serving to prevent lateral displacement of the members 15, 16 with respect to the confining wall members 20, 21. Obviously, the end-portions of such walls 20, 21 are suitably grooved to accommodate the stated off-sets of the members 15, 16.

As clearly illustrated in Fig. 1, the member 16 may be of a single thickness of metal, and secured by the side wall members 20, 21 both at the area intermediate its ends, and at a terminal end. Such member 16 is therefore relatively immovably mounted within the cartridge-like housing of the complete structure 14. On the other hand, the bi-metallic member 15 is secured in such manner that a free end thereof is disposed suitably intermediate the ends of the cartridge, and in suitable relationship to the fixed member 16

Advantageously, the stated elements 15, 16 are provided with electrical contact points 25, 26, of silver, stainless steel, or other material capable of readily conducting electricity, and substantially non-corrosive in character. As indicated in Fig. 1, the contact 25 may be in the form of a button rigidly secured, as by welding, to the bi-metallic member 15. Contact 26 may advantageously be a suitable screw, the end portion of which is tipped with the stated electrically conducting material or equivalent. Such screw, as indicated in Figs. 1 and 2, may pass through a slot 27 of member 16, the slot having threaded wall portions in its screw-receiving location. As will be evident, the slotted screw mounting 27 may serve the function of a lock nut, by exerting a suitable spring pressure against the sides of the screw 26.

The screw 26 provides for adjustment of the temperatures at which the "make" and "break" occurs, by establishing the amount of movement or flexing of the free end of the bimetallic element 15 necessary to make or break the electrical circuit.

As indicated in Fig. 1 and Fig. 7, the thermostat cartridge 14 is advantageously mounted within the thermostat housing 11, 12, by securement to the cover 12 thereof, such securement being effected through the agency of screwing the end-portions 15a, 16a of elements 15, 16 to insulated posts 28, 28, the latter desirably being riveted, as shown, to the cover member. The insulated posts advantageously have screw threaded metallic inserts 29, an end of which may advantageously be of area equal to that of the posts 28. Such posts 28 and inserts 29 serve a double purpose, namely, means of rigidly securing the cartridge 14 to the cover 12, and as binding posts at which the electrical connection may be completed. Fig. 1 illustrates the use of machine screws in effecting the electrical connection of the members 15, 16 with the respective conductors 17, 18 and the mechanical securement of the cartridge per se. As will be obvious, the posts 28 may incorporate projecting studs, with which nuts or insulated female threaded elements may be employed to effect the connection. A primary object is to make the thermostatic unit or cartridge 14 removable, as a unit, while additionally employing the mounting means therefor as electrical connection points.

It will be noted that the elements 15, 16 of the thermostatic unit project inwardly from opposite ends of the cartridge 14. Such arrangement, while not essential, is advantageous in that it provides for mounting the thermostat unit or cartridge at two comparatively widely separated points; the cartridge is therefore rigidly mounted, and not readily damaged by dropping or other rough handling of the assembled thermostat.

As indicated in the drawing, the structure is compact in design, Figs. 5 and 7 being approximately full-scale illustrations of a preferred commercial embodiment of the invention. The dimensions of the completed thermostat will depend, in large degree, upon the current-carrying capacity of the unit, and in any event, should be of sufficient size to permit the insertion of the wires 17, 18, with a portion of their common covering, as shown in Fig. 1, into the housing with sufficient slack of the stated wires to permit the ready positioning or removal of the cover portion 12.

It is a feature of this invention that the structure is adaptable to a variety of uses and purposes. For example, the structure disclosed in Figs. 1 and 2 has particular adaptability for use in exposed locations, such as in the open air, in refrigerating rooms, steam rooms, etc.; in con-

formity with such service, the cover 12 may be imperforate and tightly fitting with respect to the mount or back member 11. As indicated in Fig. 1, the cover 12 may be secured to the mount 11 by clipping the same over suitable spring clip members 30 of the mount, the members 30 having a depression adaptable to engage and retain suitable beaded portions 31 of the cover. In the embodiment shown, the base 11 may be secured to a wall or the like by means of screws 24. It is within the contemplation of this invention to have the posts 28 secured to the stated mount 11, thus making it feasible to secure the cover 12 to the mount by a screw threaded connection therewith. Such construction would find particular aptitude in a thermostat for use in extremely exposed or damp locations. Generally, the structure of Fig. 1 meets requirements for normal service.

Referring now to Figs. 5 and 6 an embodiment of the invention is illustrated as having its cover provided with ventilations 32, thus exposing the cartridge 14 to the free play of surrounding air, and making the bi-metallic element 15 more quickly responsive to ambient temperature changes. Such construction renders the thermostat particularly useful in sheltered locations in which it is desirable to hold temperature variation within comparatively close limits. The embodiment of Fig. 5 therefore, is well adapted for control of room temperature in residences, buildings, or the like.

As indicated in Fig. 6, adjustable contact of the thermostatic unit may comprise a screw threaded member, as previously described, having an extended shank, 33, projecting through the cover of the thermostat unit and being provided with a suitable insulated knob 34, the latter being removably secured to the shank 33 as by the set screw 35. As is also indicated in Fig. 6, the cover is advantageously provided with a bushing 36 of insulating material, to obviate the possibility of a short circuit between the stated contact screw and the thermostat cover. As shown in Fig. 5, the cover may be marked with a suitable legend to indicate the correct direction in which the contact screw must be turned to effect the desired temperature adjustment. It will be clearly understood that the marking on the cover of the embodiment of Fig. 5, is purely representative. The direction of revolution of the screw is a function of the arrangement of the laminae of the member 15, and their respective coefficients of expansion. Also, such marking and such arrangement of laminae may depend upon the ultimate service of the thermostat: for example, a thermostat the function of which is to make an electrical contact on decreasing temperature may be structurally different, as represents the lamination of the bi-metallic element 15, from one in which the contact is to be made on rising temperature. Such arrangements are well known in the art, and per se form no part of the present invention.

Referring now to Figs. 7 and 8, there is illustrated a form of thermostat particularly suitable for use as an "aquastat" or similar device for starting or stopping oil burners, automatic fuel burners, or the like, in response to the temperatures of hot water, steam, or other heating medium generated by such heat source. Structurally, the thermostatic unit may be similar to the embodiment of Fig. 5, in that an external setting device is provided. For mounting the thermostat on or against a heat pipe, 40, Fig. 7, there is employed a novel saddle or other mounting device 41. Such saddle may comprise two elements 42, 43, advantageously stamped from sheet metal of suitable gage. The stated elements, as illustrated in Figs. 7 and 8, are suitably configurated to be clamped tightly about the walls of the pipe 40, through the agency of suitable nuts and bolts 44. The member 43 of the clamp 41 is provided with outwardly extending structures 45, advantageously provided with tongues having recesses 46 for the reception of and engagement with beading 31 on the cover member 12 of the thermostat. Such an arrangement is in conformity with the general object of the invention of having the thermostat structure include a mounting member and a cover member removably secured thereto.

It is a feature of the clamp 41 that the structures 45 thereof are formed with horizontally extending portions 47, such portions 47 combining with the side walls of the cover 12 to form a substantially box like structure which shields the thermostatic cartridge 14 from outside temperature influences, while serving to direct the radiant heat flow from the pipe 40 against the bi-metallic element 15. Such effect may be enhanced by the use of conventional pipe insulation, such as plastic asbestos, or the like, to completely close remaining side wall openings of the assembled structure.

It is to be noted from Figs. 2 and 4 that the side wall members 20, 21 of the cartridge 14 are suitably spaced to provide for free play of the bi-metallic element 15 and for the complete ventilation of the respective elements 15 and 16. Such ventilation is effective to dissipate any heat formed by the passage of electricity through the respective elements 15, 16, while attaining a primary desideratum of exposing all faces of the sensitive element 15 to contact with the heat-containing medium, such as atmospheric air or the like, under the temperature influence of which the movement of such element occurs. The side walls 20, 21 of the cartridge unit 14 serve to shield the element 15 from the adverse influence of cooling drafts or the like, and serve as electrically insulated members which may be grasped by an operator in effecting removal or insertion of such cartridge. Desirably the members 15, 16 are of appreciably greater current-carrying capacity than they will normally be called upon to handle, thus keeping the heating effect of such current passage at a minimum.

Whereas I have described my invention by reference to specific forms thereof, it will be understood that many changes and modifications may be made without departing from the spirit of the invention.

I claim:

1. A thermostat, comprising the combination with a supporting structure, of a thermally responsive electrical switch unit removably secured thereto; said unit including a plurality of wall-forming elements of electrical insulation material arranged to form a substantially quadrilateral housing in which abutting end walls and spaced side walls of said elements define an opening; a plurality of electricity conducting elements disposed within said opening and secured therein by engagement of such housing end walls with said electricity conducting elements; one of said elements being bi-metallic and having a free end portion freely movable within said housing and arranged to make or break electrical contact with another of said elements under the

influence of changes in ambient temperature; said electricity conducting elements projecting from the ends of said housing to afford means for effecting connection with an electrical circuit and additionally serving as means for mounting said thermostat switch unit on said supporting structure.

2. A thermostat, comprising the combination with mounting means and removable cover means for said mounting, of a temperature-sensitive electric switch unit removably secured to said cover means, said switch comprising a housing composed of electrical insulation material and having closed end walls and spaced apart side walls to afford a longitudinally extending open space defined by walls of insulation material, an electricity conducting element extending longitudinally of said housing within said space and secured against longitudinal displacement therein by engagement with said end walls, the said element in the zone of its engagement with one of said housing end walls being characterized by an offset configuration affording engagement with said end wall in a plurality of planes, a temperature-sensitive bi-metallic electricity conducting element extending longitudinally of said housing in spaced relation with the side walls thereof and having a free end disposed in operative relation to said first-mentioned conducting element for electrical contact therewith, said bi-metallic element, further, having an offset configuration intermediate its ends whereby it may be secured against longitudinal displacement within said housing by a multiplanar engagement with an end wall thereof, means operatively associated with one of said conductor elements to vary the extent of travel of said bi-metallic element before electrically contacting its operatively associated element, each of said conducting elements extending, as an integral structure, through and beyond an end wall of said housing to provide for connection of said conducting elements into an electric circuit and affording means for securing said switch unit to said cover means.

3. An electric thermostat as set forth in claim 2, the said supporting structure comprising a saddle arranged for clamping against a heat source, said saddle having temperature-sensitive switch supporting wall structures for shielding said temperature-sensitive switch from heating or cooling effect external of said heat source while directing radiant heat from said heat source to the temperature responsive element of said switch.

4. A thermostat, comprising the combination with a mounting, of a temperature-sensitive electrical switch unit removably secured thereto, said switch including a housing structure composed of electrical insulation material and having closed end walls and spaced apart side walls to afford a longitudinally extending open space defined by walls of insulation material, an electricity conducting element extending longitudinally of said housing within said space from end wall to end wall and secured against displacement therein by engagement with said end walls, and a temperature-sensitive bi-metallic electricity conducting element extending longitudinally of said housing in spaced relation with the side walls thereof and having a free end disposed in operative relation to said first-mentioned conducting element for electrical contact therewith, said temperature-sensitive element being secured against longitudinal displacement within said housing by engagement of an integral portion thereof with an end wall of said housing, each of said electricity conducting elements extending, as an integral structure, through and beyond an associated end wall of said housing to provide for connection of said conducting elements into an electric circuit and affording means for securing said switch to said mounting.

EDWARD S. CORNELL, JR.