March 29, 1949. S. W. E. ANDERSSON 2,465,830

THERMOSTATIC SWITCH

Filed July 30, 1946 2 Sheets-Sheet 1

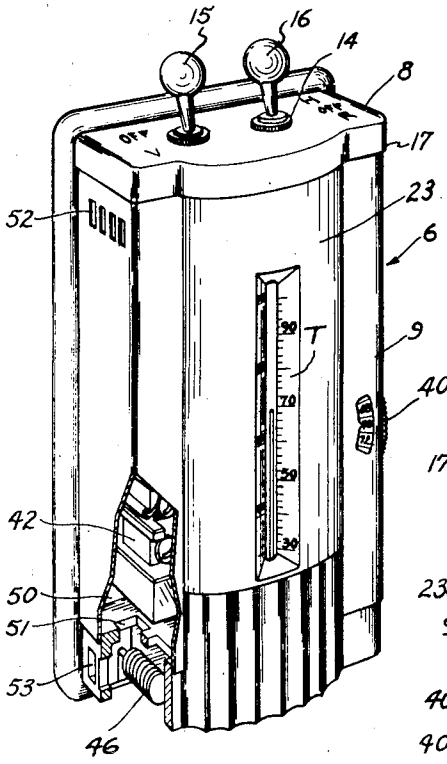


Fig. 1

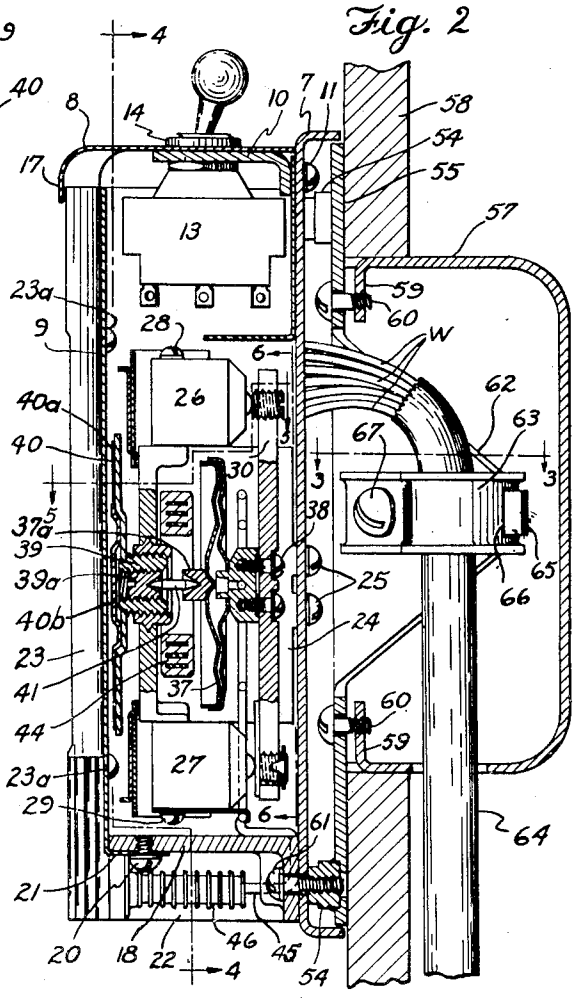


Fig. 2

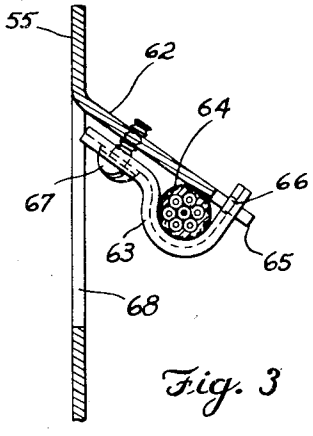


Fig. 3

INVENTOR.

BY Sven W. E. Andersson

Oliver S. Titcomb

his ATTORNEY

March 29, 1949. S. W. E. ANDERSSON 2,465,830

THERMOSTATIC SWITCH

Filed July 30, 1946 2 Sheets-Sheet 2

Fig. 4

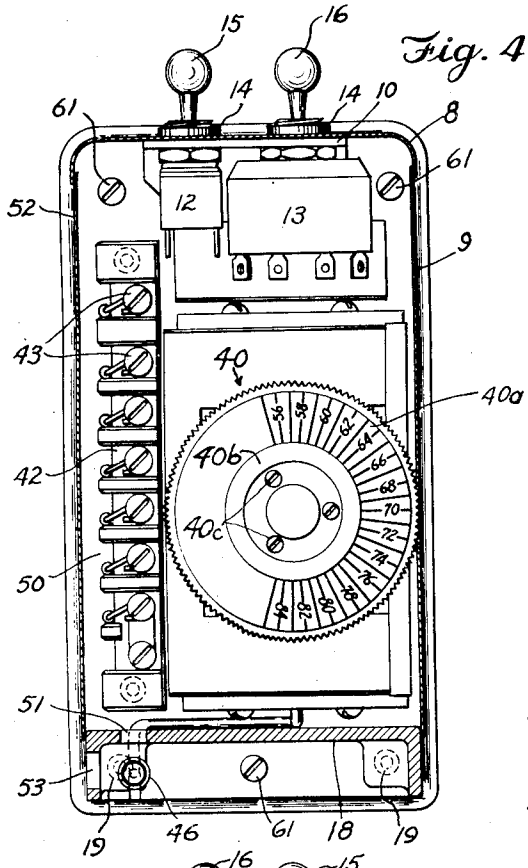


Fig. 5

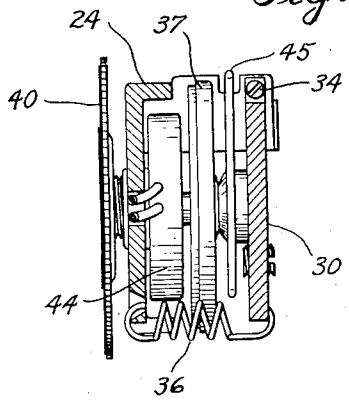
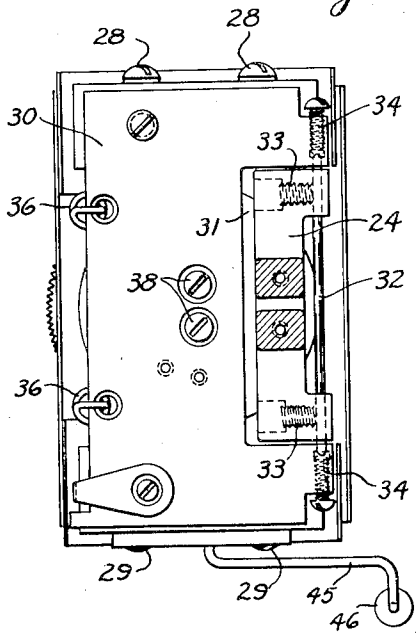


Fig. 6



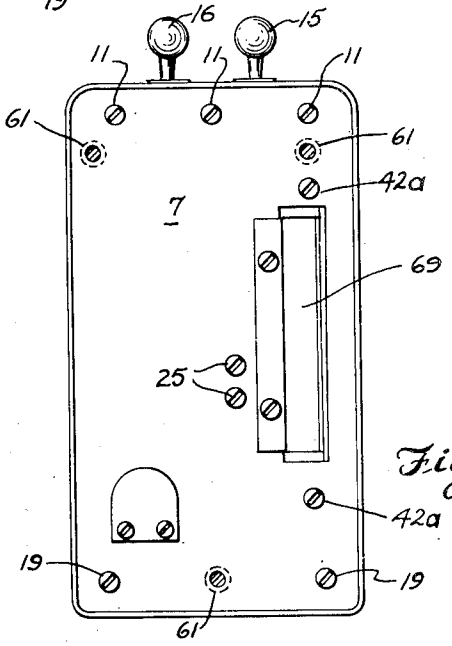


Fig. 7

INVENTOR.
Sven W. E. Andersson
BY
Oliver S. Titsworth
his ATTORNEY

Patented Mar. 29, 1949

2,465,830

UNITED STATES PATENT OFFICE

2,465,830

THERMOSTATIC SWITCH

Sven W. E. Andersson, Evansville, Ind., assignor to Servel, Inc., New York, N. Y., a corporation of Delaware

Application July 30, 1946, Serial No. 687,167

5 Claims. (Cl. 200—140)

1

This invention relates to a controller for an air conditioner, or what is generally called a wall thermostat, and more particularly this invention is a better instrument of the type described in my Patent No. 2,338,563, entitled Thermostatic element, granted January 4, 1946.

No matter how perfect an air conditioner may be, it will, just like any other contrivance, afford no greater convenience than the nicety of its control. Furthermore, particularly in household appliances, stability and ease of installation are features of importance to the customer and contractor alike. It is, therefore, the object of my invention to provide a more sturdy control unit of the subject type which is easier to install, and which, when used with a proper air conditioner, enhances comfort by maintaining a steadier temperature in the premises served by the air conditioner.

This objective is achieved by quickening flow of room air in contact with a temperature sensing element having a large thin wall so that when a change from the desired temperature starts to take place, it is more quickly felt and countered by the control unit, and the unit itself is fastened on an outlet box in the wall so that the ends of the wires of an electric cable securely clamped in the outlet box can be simply directed into the control unit as it is placed on the outlet and the wires secured to the connectors without imposing any strain on the control unit.

The objective and manner of achievement are more fully set forth in the following description in connection with the accompanying drawings in which like reference characters denote like parts throughout the several views. The drawings, of course, are only for the purpose of illustration and do not define the invention, reference being had for this purpose to the claims at the end of this specification. In the drawings:

Fig. 1 is a perspective view of a thermostatic control unit incorporating the novel features of the present invention and showing the flue at the side of the casing for continuously circulating air over the thermal responsive element.

Fig. 2 is a longitudinal sectional view of the thermostatic control unit showing the adapter plate for mounting the unit on an outlet box in the wall of a room or enclosure;

Fig. 3 is a sectional plan view on line 3—3 of Fig. 2 showing the clamp on the adapter plate for supporting the cable adjacent the unit;

Fig. 4 is a sectional view on line 4—4 of Fig. 3 showing the openings in the casing forming the flue and the arrangement of the parts of the unit;

2

Fig. 5 is a sectional plan view on line 5—5 of Fig. 2 showing the swinging lever for operating the control elements and the bellows and springs for actuating the lever in opposite directions;

Fig. 6 is a sectional view on line 6—6 of Fig. 2 showing the pivotal mounting for the operating lever; and

Fig. 7 is a rear elevational view of the thermostatic control unit showing the slot through which the cable wires are drawn and the means for fastening it to the adapter plate.

The thermostatic control unit 6 is generally similar to that illustrated and described in my prior Patent No. 2,338,563 referred to above, and comprises a casing including a back plate or frame 7 and cooperating casing parts 8 and 9. The upper casing part 8 is supported on and overlies a bracket 10 connected to the back plate 7 by means of screws 11, see Fig. 2. A pair of depending selector switches 12 and 13 are also mounted on the bracket 10 and the switches and casing part 8 are secured in place on opposite sides to the bracket by means of threaded sleeves extending upwardly from the switches through holes in the bracket and casing part and nuts 14 screwed onto the threaded sleeves. Push lever or handles 15 and 16 for the switches 12 and 13 extend upwardly from the casing part 8 for manual operation. As illustrated in Figs. 1 and 2 the casing part 8 has a depending skirt 17 at its front and sides.

The casing part 9 is of channel shape with its upper edge underlying the depending skirt 17 of the casing part 8 and depending down to a bracket 18 attached to the back plate 7 adjacent its lower end by means of screws 19, see Fig. 4. The bracket 18 preferably is made of a suitable plastic and constitutes a wall or closure for the bottom of the casing and the casing part 9 is attached thereby by a screw 20 extending through an inwardly directed lip 21 on the casing part and screwed into the bottom of the bracket, see Fig. 2. Thus, the back plate 7, casing parts 8 and 9 and lower bracket 18 are connected to each other to provide a unitary enclosed casing. A plastic front panel 23 is attached to the casing part 9 by means of screws 23a and mounts a thermometer T. As illustrated in Figs. 1 and 2, the bracket 18 has depending walls and together with the lower end of the plastic front panel 23 form a chamber 22 below and outside of the enclosing casing.

An intermediate bracket 24 is attached to the

back plate 7 by means of screws 25 and the bracket mounts the operating parts of the thermostatic control unit. The control elements comprise a pair of switches 26 and 27 mounted on the bracket 24 by means of screws 28 and 29. While the switches may be of any suitable type they are preferably of the type known as "micro" snap switches operable upon very small increments of movement. The switches 26 to 27 are arranged to be operated sequentially by an actuator in the form of a lever 30 mounted to swing about a vertical axis, see Figs. 2, 5 and 6. As illustrated in Fig. 6 the lever 30 is of generally rectangular form with a recess 31 at its rearward edge to adapt it to straddle a portion of the bracket 24. The lever 30 is mounted for swinging movement on a pintle 32 fixedly mounted in a portion of the bracket 24 by means of set screws 33. Adjustable bearings 34 on the lever 30 engage the opposite projecting ends of the pintle 32 to mount the lever 30 for swinging movement.

The lever 30 is swung in one direction or toward the switches 26 and 27, see Figs. 2 and 5, by springs 36, and is swung in the opposite direction against the action of the springs by an expansible and contractable element or bellows 37. The bellows 37 is mounted directly on the lever 30 by means of screws 38 and the bellows is positioned between the lever and an adjusting means on the bracket 24. The adjusting means comprises a screw 39 having a threaded engagement with a portion of the intermediate bracket 24 and a manually operable dial 40 mounted fast on the screw. Preferably, the screw 39 includes a second adjusting screw 39*a* rotatable therein and a pin 41 extends between the latter and a block 37*a* on the bellows 37. The pin 41 has tapered ends projecting into conical recesses in the screw 39*a* and block 37*a* to retain the pin in position. Dial 40 also includes an annular indicator card 40*a* of a suitable plastic material and marked on its outer periphery with indicia to indicate the temperature at which the lever 30 will operate the switch 26. The annular indicating card is clamped at its inner periphery between the dial and a smaller disk 40*b* covering the inner screw 39*a*. As shown in Fig. 4 the disks 40 and 40*b* are attached by means of screws 40*c*. Rotation of the dial 40 and screw 39 connected thereto will cause the latter to be moved axially and operating through a pin 41, will move the lever 30 and bellows 37 mounted thereon with respect to the switches 26 and 27. The apparatus is initially adjusted by means of the screw 39*a* and the annular indicator card 40*a* may be turned relative to the dial 40 by loosening the screws 40*c* to adjust the dial to correspond with the temperature at which the switches 26 and 27 are operated.

An electric terminal block 42, see Fig. 4, is attached to the back plate or frame 7 by screws 42*a*, see Fig. 7, and is spaced from one side of the casing to adapt wires W of a cable of wires to be drawn in and attached to binding posts 43 on the front of the block. An electric heating element 44 is also provided in the casing for continuously heating the interior thereof and the element is shown as of doughnut shaped form and positioned between the bellows 37 and forward part of the bracket 24 and surrounding the pin 41 and screw 39. The heating element may be of any suitable construction but preferably comprises an electrical resistance wire embedded in the doughnut shaped element composed of a suitable insulating plastic. While not shown, it will be understood that the terminals of the switches 12, 13 and 26, 27 and the heating element 44 are interconnected with the binding posts 43 at the rearward side of the terminal block 42 to provide electric control circuits for the apparatus to be controlled.

The bellows 37 is connected by a capillary tube 45 to a thermal responsive element or bulb 46 in the chamber 22 below and outside of the enclosing casing. The bulb 46 contains a volatile liquid, such as methyl chloride, and being subjected to the ambient air produces a vapor pressure in the bulb 46, capillary tube 45 and bellows 37 corresponding to the temperature of the ambient.

In accordance with the present invention the bulb 46 consists of a closed generally cylindrical container having a metal wall of minimum thickness to facilitate the transfer of heat to the liquid therein and thereby increase the responsiveness of the thermostat to a maximum. In order to further increase the responsiveness of the thermostat the wall of the bulb 46 is corrugated to increase the heat transfer surface and also increase the resistance to deformation so that the wall may have a minimum thickness.

To further increase the responsiveness of the thermostat, the ambient air in the room or enclosure is continuously circulated over the bulb 46. For this purpose a flue 50 is provided in the casing 6 directly above the bulb 46. As illustrated in Figs. 1 and 4 the flue 50 is formed by openings 51 in the bottom wall or bracket 18 of the casing 6 directly above the thermostatic bulb 46 and openings 52 in the casing part 9 adjacent its top. Thus, the flue 50 comprises the interior of the casing and includes an unrestricted path of flow between the side of the terminal block 42 and the wall of the casing. Also the side of the casing 6 adjacent the bulb 46 has openings 53 to supply ambient air to the flue 50 through the side as well as the open bottom of the chamber 22. As the air in the casing 6 is heated by the heating element 44 it will rise and cause a continuous circulation of air through the flue 50 and around the bulb 46. Thus, ambient air continuously circulates around the bulb 46 to render it immediately responsive to changes in the ambient temperature.

The present invention also includes an adapter plate 55 to facilitate the mounting of the thermostatic unit 6 on an outlet box 57 of usual construction in the wall 58 of a room or enclosure. The adapter plate 55 is connected to brackets 59 in the outlet box by means of screws 60, and the back plate 7 of the unit 6 is attached to the adapter plate by means of screws 61, see Figs. 2, 4 and 7, threaded spacer bushings 54 being permanently attached to the front of the plate in any suitable manner to properly position the unit with respect to the wall 58. As illustrated in Figs. 2 and 3 the adapter plate 55 is cut and a triangular portion 62 of the plate folded back at an angle to the plane of the plate to project into the outlet box 57.

A clamp 63 cooperates with the angular portion 62 of the adapter plate 55 to hold an electric cable 64 adjacent the thermostatic control unit to relieve the wires W of the cable from any strain on the binding posts 43, see Figs. 2 and 3. In the illustrated embodiment of the invention the end of the folded angular portion of the adapter plate 55 has a narrow tongue 65 which projects through a slot 66 in the clamp 63 to provide a hinged connection at one end and the clamp is tightened against the cable 64 by means of a screw 67. The slot 68 formed by the folded back portion 62 of

the adapter plate 55 together with a slot 69 in the back plate 7 of the unit, see Fig. 7, provide an opening through which the wires W of the cable 64 may be drawn from the outlet box 57 into the interior of the casing of the unit 6. One form of the invention having now been described in detail, the manner of mounting the thermostatic unit and the operation of the unit is explained as follows.

It will be understood that when the parts of the thermostatic control unit 6 are assembled the terminals of the switches 12, 13, 26 and 27 and the heating element 44 will be connected by suitable conductors to the binding posts 43 at the rearward side of the terminal block 42. To mount the thermostatic control unit 6 the adapter plate 55 is first connected to the front of the outlet box 57 by inserting screws 60 through holes in the plate and screwing them into tapped holes in brackets 59 in the outlet box until the heads of the screws are tightened against the front of the plate. The cable 64 is then positioned between the folded back portion 62 of the adapter plate 55 and the clamp 63 and the screw 67 tightened to clamp the cable in position.

The thermostatic control unit 6 is then mounted on the adapter plate 55 by inserting screws 61 through the back plate 7 and screwing them into the threaded bushings 54. The ends of the wires W of the cable 64, previously drawn from the outlet box 57 into the casing of the unit through the aligned openings or slots 68 and 69 in the adapter plate 55 and back plate 7 of the unit, are attached to the binding posts 43. The casing part 9 is then positioned in place and attached to the bottom wall or bracket 18 of the unit. The dial 40 is turned manually by engaging the edge portion extending from the side of the casing with the finger to adjust the thermostat to the desired temperature.

The heating element 44 being energized causes a thermosyphon circulation of the air in the room or enclosure through the flue 50 in the casing of the unit 6. As the openings 51 in the bottom wall or bracket 18, constituting part of the flue, are positioned directly over the thermal responsive bulb 46 the latter will be continuously subjected to a flow of ambient air and to any changes in the temperature of the air. Furthermore, because of the surface area of the bulb 46 and the minimum thickness of the wall of the bulb, due to the corrugated construction, the volatile liquid in the bulb is immediately responsive to changes in the temperature of the ambient. As the temperature of the ambient air increases the vapor pressure of the volatile liquid in the bulb increases and when the temperature of the ambient air decreases the vapor pressure of the volatile liquid decreases. Such changes in the pressure in the bulb 46 are transmitted through the capillary tube 45 to the interior of the bellows 37. Upon an increase in pressure the bellows 37 expands to rock the lever 30 counterclockwise as viewed in Fig. 5 against the action of the springs 36 and upon a decrease in pressure in the bellows 37 the lever is rocked in a clockwise direction by the springs. Such movement of the lever 30 operates the switches 26 and 27 sequentially to control circuits through the wires W of the cable 64 as connected by the selector switches 12 and 13. By turning the dial 40 the rotary motion is converted to axial movement by the screw 39 and transmitted through the pin 41 to initially set the bellows 37 and lever 30 on

which it is mounted with respect to the control switches 26 and 27 to increase or decrease the expansion of the bellows necessary to operate the switches.

It will now be observed that the present invention provides an improved construction and arrangement of elements in a thermostatic control unit. It will also be observed that the present invention improves the responsiveness of the thermostatic control unit by corrugating the heat transfer wall of the thermal responsive element and continuously circulating ambient air over the element. It will still further be observed that the present invention facilitates the mounting of the thermostatic control unit on the wall of the room or enclosure to be conditioned and supports the electric cable adjacent the unit.

While only a single embodiment of the invention is illustrated and described it will be understood that changes may be made in the construction and arrangement of elements without departing from the spirit or scope of the invention. For example, the thermal responsive element may be positioned in the casing directly above the flue opening instead of outside and below the flue opening or the thermal element may be in a chamber separated from the heating element but enclosed in the casing. Therefore, without limiting myself in this respect the invention is defined by the appended claims:

What is claimed is:

1. Apparatus of the type indicated comprising a thermostatic control unit having an enclosed casing, an electric outlet box, an electric cable of individual conductor wires extending into the outlet box, and an adapter plate for connecting the casing of the unit to the outlet box and having an opening through which the wires of the cable may be drawn from the outlet box into the casing.

2. Apparatus of the type indicated comprising a thermostatic control unit having an enclosed casing, electrical control means in the casing, a terminal block in the casing and spaced from one side thereof, an electric outlet box, a cable of individual conductor wires extending into the outlet box, and an adapter plate for connecting the casing of the unit to the outlet box and having an opening through which the wires of the cable may be drawn from the outlet box into the casing and attached to the terminal block.

3. Apparatus of the type indicated comprising a thermostatic control unit having an enclosed casing, electrical control means in the casing, a terminal block in the casing and spaced from one side thereof, an electric outlet box, a cable of individual conductor wires extending into the outlet box, an adapter plate for connecting the casing of the unit to the outlet box and having an opening through which the wires of the cable may be drawn from the outlet box into the casing and attached to the terminal block, and a clamp on the adapter plate for holding the cable to prevent any strain on the connecting wires of the cable.

4. Apparatus of the type indicated comprising a thermostatic control unit having an enclosed casing, electrical control means in the casing, a terminal block in the casing spaced from one side thereof, an electric outlet box, a cable of individual conductor wires extending into the outlet box, an adapter plate for connecting the casing of the unit to the outlet box, said casing having an opening in the rearward wall thereof, and said adapter plate having a flap folded out-

wardly from the adapter plate to form a slot therein through which the wires of the cable may be drawn from the outlet box into the casing and attached to the terminal block, and a clamp on the folded flap of the adapter plate for holding the cable.

5. Apparatus of the type indicated comprising a thermostatic control unit having an enclosed casing, an electrical outlet box, a cable of individual wires extending into the outlet box, an adapter plate detachably fastened on the outlet box, said adapter plate having a flap folded outwardly therefrom to form a slot therein, a clamp cooperating with the flap to hold the cable, means for detachably mounting the thermostatic control unit on the adapter plate, and said casing having an opening adjacent the slot in the adapter plate to permit the wires of the cable to be drawn from the outlet box into the casing.

SVEN W. E. ANDERSSON.

REFERENCES CITED

The following references are of record in the file of this patent:

UNITED STATES PATENTS

Number	Name	Date
1,544,106	Scott	June 30, 1925
1,610,479	Scott	Dec. 14, 1926
1,656,949	Miller et al.	Jan. 24, 1928
1,931,464	Dicke	Oct. 17, 1933
2,103,113	Hornung	Dec. 21, 1937
2,144,576	Payne	Jan. 17, 1939
2,160,740	Hutchins	May 30, 1939
2,338,563	Andersson	Jan. 4, 1944