Oct. 6, 1942. P. R. LEE 2,298,137

MOTOR THERMOSTAT

Filed Sept. 10, 1940

Fig. 1.

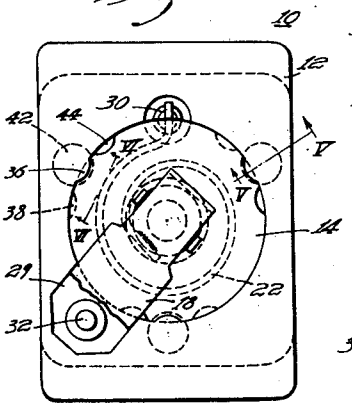


Fig. 2.

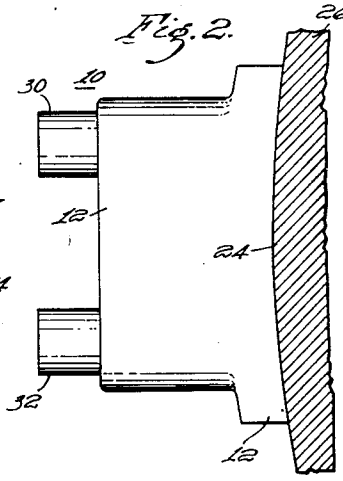
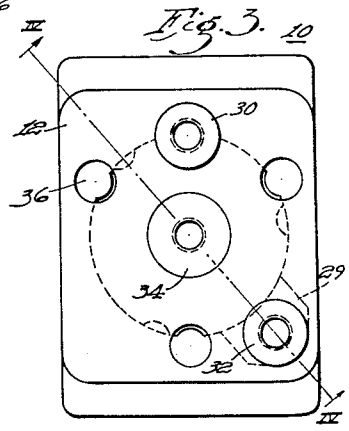


Fig. 3.



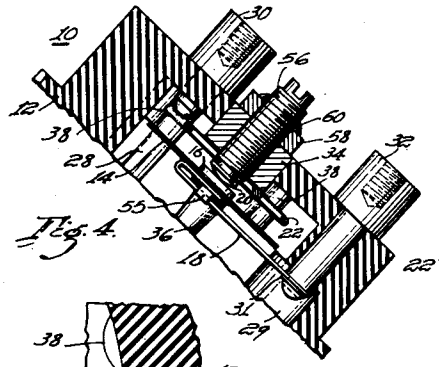


Fig. 4.

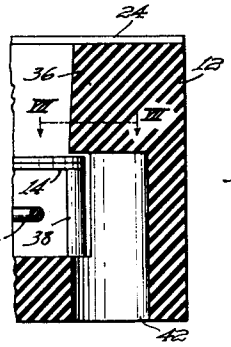


Fig. 5.

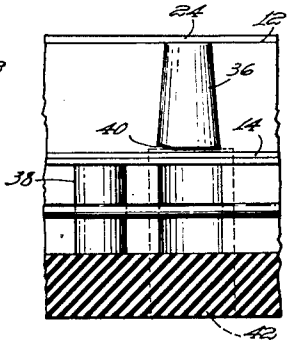


Fig. 6.

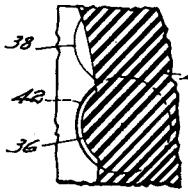


Fig. 7.

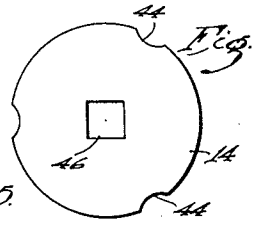


Fig. 8.



Fig. 9.

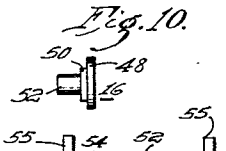


Fig. 10.

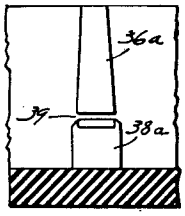


Fig. 15.

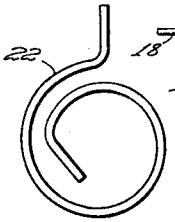


Fig. 13.

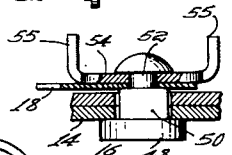


Fig. 14.

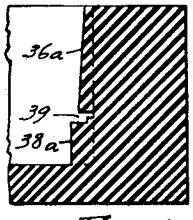


Fig. 16.

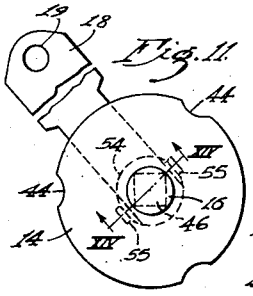


Fig. 11.

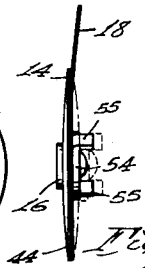


Fig. 12.

INVENTOR

Paul R. Lee.

BY

ATTORNEY

Patented Oct. 6, 1942

2,298,137

UNITED STATES PATENT OFFICE

2,298,137

MOTOR THERMOSTAT

Paul R. Lee, Mansfield, Ohio, assignor to Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa., a corporation of Pennsylvania

Application September 10, 1940, Serial No. 356,132

15 Claims. (Cl. 200—138)

My invention relates to thermostats and more particularly to fixed-temperature-operating snap-acting thermostats.

An object of my invention is to provide an inexpensive, simple, dependable snap-acting thermostat for use with an electrical motor, for example.

A further object of my invention is to provide a disc-type thermostat the bimetallic element of which is retained by simple bosses extending into a cavity in a supporting structure.

Another object of my invention is to provide a thermostat having a bimetallic element which carries a movable contact therewith which is loosely attached thereto so that such contact may move with respect to the element.

A still further object of my invention is to provide a disc-type thermostat the bimetallic element of which is retained by the cooperation of its periphery with the supporting structure.

Still another object of my invention is to provide a thermostat having a disc-type bimetallic element retained by a supporting structure with a contact loosely attached to such element in such manner as to prevent any substantial rotative movement between the supporting structure and said element.

Other objects of my invention will enther be pointed out specifically in the course of the following description of a device embodying my invention, or will be apparent from such description.

In the accompanying drawing,

Figures 1, 2 and 3 are top, side and bottom views, respectively, of a device embodying my invention;

Fig. 4 is a partial sectional view taken along the line IV—IV of Fig. 3;

Figs. 5 and 6 are enlarged views, partially in elevation and partially in section, respectively taken along the lines V—V and VI—VI of Fig. 1;

Fig. 7 is a sectional view taken along the line VII—VII of Fig. 5;

Fig. 8 is a plan view of the bimetallic element embodying my invention;

Figs. 9 and 10 are top and side views, respectively, of a contact employed in the device embodying my invention;

Figs. 11 and 12 are top and side views, respectively, of an assembly embodying my invention;

Fig. 13 is a plan view of a heating element used in the thermostat embodying my invention;

Fig. 14 is an enlarged partial sectional view taken along line XIV—XIV of Fig. 11; and

Figs. 15 and 16 are sectional views of a modified supporting structure similar to Figs. 6 and 5, respectively.

Referring to the accompanying drawing, in which like reference characters indicate like parts in the several figures, I show a thermostat 10 having a supporting structure 12, a bimetallic element 14 of the familiar disc-type, a movable contact 16 loosely attached to the element 14, a flexible current-carrying member 18 for supporting movable contact 16, a cooperating stationary contact 20 and a heating element 22.

The supporting structure 12 comprises, in this instance, an irregularly shaped member preferably formed from an insulating material such as a phenolic resin, or the like. The structure 12 has a curved surface 24 on substantially its front side for resting against the curved outer surface of a motor frame 26, for example, (see Fig. 2) so that the heat developed within the motor may aid in operating the thermostat, as hereinafter described, although this feature is not essential to my present invention. A centrally located cavity 28 having an offset cavity 29 is located substantially in the middle of the structure 12 and extends inwardly from the front surface 24. A plurality of terminals 30 and 32 are rigidly attached to or formed integrally with the supporting structure 12. The terminals 30 and 32 extend into cavity 28 to cooperate with the radiant heater 22 and flexible strap 18, as hereinafter described. A centrally located internally threaded sleeve member 34 is likewise positioned within the supporting structure 12 substantially coaxially with the cavity 28. Sleeve 34 has a threaded aperture therethrough so as to receive a suitable screw-like member which, in turn, carries the stationary contact 20, as hereinafter described.

A plurality of equidistant, preferably integral, bosses 36 and 38 (three of each being shown) extend into cavity 28 in such a manner that they retain the bimetallic element 14, as hereinafter described. The bosses 36 extend downwardly from the top surface of the supporting structure 12 to substantially the midpoint thereof. The bosses 38 are slightly displaced circumferentially from the bosses 36 and extend inwardly into the cavity 28 a distance slightly less than the bosses 36, see Fig. 7. The distance between the lower edges of the bosses 36 and the upper edges of the bosses 38 is slightly greater than the thickness of the bimetallic element 14 so that such element may be positioned therebetween, as hereinafter described. One corner of the lower surface of the top bosses 36 is slightly tapered upwardly,

see 40, Fig. 6. This facilitates rotating the bimetallic element 14 with respect to the supporting structure 12 while assembling the thermostat by guiding such element under the boss 36 as it is being rotated into its operative position, as hereinafter described. The bosses 36 and 38 are, in this instance, integrally formed with supporting structure 12. However, such bosses may be formed or attached to the structure 12 in any other suitable manner. Apertures 42 are formed within the lower portion of structure 12, substantially in line with the bosses 36 to aid in manufacturing the structure 12.

The bimetallic element 14 comprises, in this instance, a snap-acting disc (see Fig. 8) and has a diameter slightly less than the cavity 28 in the supporting structure 12, so that such element may be readily positioned therein. A plurality of notches 44, three in this instance, are positioned in the outer edges thereof substantially equidistant from each other. These notches 44 are of such depth that as bimetallic element 14 is properly positioned within the cavity 28, such notches will freely fit about the upper bosses 36 of such supporting structure. A substantially square shaped aperture 46 is positioned at the midpoint of the element 14. This aperture while being square, in this instance, may be of any other desired angular configuration, as hereinafter described.

The movable contact 16 comprises, in this instance, a member having a circular contact portion 48, a square shoulder portion 50 and a rivet-like portion 52 (see Figs. 9, 10 and 14). The square portion 50 is slightly smaller than the square aperture 46 in the bimetallic element 14 and the height thereof is somewhat greater than the thickness of the bimetallic element 14. The square portion 50 is thus capable of fitting, without turning, within the square aperture 46 of the bimetallic element 14. Therefore, the element 14 is free to rotate within a certain arc and move longitudinally with respect to the contact 16, as hereinafter described. It is to be understood that the aperture 46 may be of other well-known configurations providing the portion 50 of contact 16 has a similar but slightly smaller configuration so as to ensure relative movement therebetween while preventing the element from rotating thereabouts.

The flexible current-carrying member 18 comprises, in this instance, an elongated ribbon-like member which has an aperture 19 for effecting rigid attachment to terminal 32 at one end thereof and, after being reversely bent, to the movable contact 16 which is associated with bimetallic element 14 as already set forth (see Figs. 4 and 12). The ribbon-like member 18 is adapted to carry the current passing through the movable contact 16 to the terminal 32 as hereinafter described.

When assembling the bimetallic element 14, movable contact member 16 (as shown in Fig. 10) and flexible current-carrying member 18, the square portion 50 of contact 16 is positioned within the square aperture 46 located within element 14. One end of the ribbon-like flexible member 18 is then placed upon the rivet-line portion 52 of contact 16 and rests against the upper surface of the square portion 50 of such contact (see Fig. 14). A suitable light washer 54 having up-turned fingers 55 is then positioned upon the member 18 whereupon the upper end of rivet portion 52 is spun over tightly thereagainst, as shown in Fig. 14. The contact member 16 is thus rigidly attached to the end of ribbon-like member 18 which rests tightly against the upper surface of the square portion 50 thereof. Inasmuch as the square portion 50 is longer than the thickness of the bimetallic element 14, and inasmuch as such portion is smaller in diameter than the aperture 46, as previously noted, it follows that the movable contact member 16 and the flexible current-carrying member 18 may freely move with respect to the bimetallic element 14. However, the cooperation between the square aperture 46 and the slightly smaller square portion 50 of contact 16 prevents total rotative movement between the contact 16 and bimetallic element 14. The stationary contact 20 constitutes, in this instance, one end of a suitable screw-like member 56 which is threadedly engaged with the insert member 34 centrally located within the supporting structure 12. The position of such a stationary contact 20 may thus be factory-set by running the screw member 56 in or out, as required, in order to obtain the desired opening temperature of the bimetallic disc 14, it being understood that the preliminary heat treatment of the bimetallic element determines the closing temperature thereof. This setting of the opening temperature of the bimetallic element 14 is determined once and for all at the factory, during the assembly of the device, whereupon a suitable lock nut 58 is positioned upon the outer portion of the screw 56 and tightened against the outer surface of the inset 34. In addition, suitable soldering, spot welding, cementing, or the like, is employed to rigidly attach the lock nut 58 to the screw 56 so as to prevent the opening temperature of the thermostat from being changed after the device leaves the assembly line in the factory.

A suitable radiant heating element 22 (Fig. 13) is spiraled so as to fit within the cavity 28 in supporting structure 12. Such heating element has, in this instance, a fraction more than a single loop and is adapted to be attached at one end thereof to the terminal 30 and by means of the other end thereof to the insert bushing 34, as shown in Fig. 1. The electrical path to the stationary contact 20, is thus through terminal 30, heating element 22, insert 34, and screw 56 to the stationary contact 20, which is integral therewith.

When assembling the thermostat embodying my invention, the bimetallic element 14, movable contact member 16 and flexible current-carrying member 18 are attached together as a separate preliminary structure, as hereinabove described. The flexible member 18 is then bent slightly upward so as to permit the element 14 to freely drop down within the cavity 28. However, such dropping action takes place only when the notches 44 located within the periphery of element 14 line up with the upper bosses 36 positioned about the upper surface of cavity 28. After so aligning the bimetallic element 14, such element is then lowered within the cavity 28 until it rests upon the upper surfaces of the lower bosses 38 which are peripherally displaced with respect to the bosses 36. The ribbon 18 is then grasped by an operator and slightly rotated, preferably clockwise, that is, towards the tapered edges 40 of upper bosses 36, thus facilitating the rotative movement of the bimetallic element 14 by guiding such element under the upper bosses. The element 14 is rotated until the flexible current-carrying member 18 is substantially in line

with terminal 32 and the irregularly shaped aperture portion 29. The free end of ribbon 18 is then bent downwardly into the irregularly shaped aperture 29 so that aperture 19 located within the free end of member 18 freely engages the inner edge of the terminal 32. The end of terminal 32 is then spun over or riveted upon a washer 31 positioned against the member 18, (see Fig. 4), so as to rigidly attach such member to the terminal 32.

By having the flexible member 18 located within the irregularly shaped aperture 29, the attachment of such member to the terminal 32 prevents the accidental rotation of the bimetallic element 14 which might cause such element to work free from the cavity 28 of supporting structure 12. It is, therefore, obvious that such element, while being free to rotate with respect to the supporting structure 12 to the extent permitted by the cooperation of aperture 46 in element 14 and square portion 50 of contact 16, is retained from movement normal to the element 14 by the bosses 36 and 38 and, after attachment of the flexible member 18 to the terminal 32, is prevented from rotating beyond said extent by the movable contact and ribbon-like member.

With the bimetallic element, movable contact member 16 and flexible current-carrying member 18 mounted within and attached to the supporting structure 12, as hereinabove described, the movable contact 16 is substantially in line with the stationary contact 20 attached to the supporting structure, as hereinabove described. When the bimetallic element is in a normal or closed position, as illustrated in Fig. 4, the movable contact 16 will thus be in engagement with the stationary contact 20. Passage of current through the thermostat 10, when such thermostat is connected in say, the circuit of a motor, is substantially as follows: from, say, terminal 30 to radiant heating element 22, insert member 34, screw 56, stationary contact 20, movable contact 16, and flexible current-carrying member 18 to the other terminal 32 of the thermostat. It is, therefore, obvious that no current passes through the bimetallic element 14.

As the current passes through the heating element 22, the resultant heat causes bimetallic element 14 to heat up and, in addition, any heat which may come from, say, the motor frame 26 further heats the bimetallic element. The element may thus increase in temperature to its disengaging or opening value at which time it will flex to a concave position, illustrated by dotted lines in Fig. 12, in accordance with familiar principles. The movable contact 16 will thus be carried by the bimetallic element 14 so as to become disengaged from the stationary contact 20 and interrupt passage of current therethrough. The passage of current through the heater 22 is thus also interrupted. When the heater and bimetallic element 14 cool to the closing temperature of the element, it snaps back to the illustrated closed position to cause reengagement of the cooperating contacts 16 and 20.

It is to be understood that as the bimetallic element 14 first starts to move the movable contact member 16 being unattached and, therefore, movable relative thereto, momentarily remains in its occupied position, this being true for both the closing and opening operation of such thermostat.

It will be seen, therefore, that I have provided a thermostat having a disc-type bimetallic element which is retained by means of its periphery and which has a movable contact which is capable of being moved by the bimetallic element as such element flexes from one position to another.

Referring to Figs. 15 and 16 I show a modified arrangement of bosses for guiding and retaining the element 14 within the cavity 28. In this instance the bosses 36*a* and 38*a* are formed integral with the supporting structure. An inwardly extending slot 39, having the irregular shape shown in Fig. 16, is then machined within the combined bosses, defining a space for retaining the bimetallic element 14. It will be understood that the bosses 36*a* and 38*a* function in a similar manner to bosses 36 and 38 so as to support the element 14. However it will be noted that boss 38*a* is slightly larger than 36*a* so as to temporarily support the element while the notches 44 are aligned with bosses 38*a*.

In this case also rotation of the bimetallic element 14 is utilized in assembly, so that solid portions of disc 14 rest on top of bosses 38*a* in the final position of the disc, as determined by the positions of contact 16 and current-carrying strip 18.

It is to be understood that, if desired, any other suitable arrangement, such as molded in wire clips, for example, may be used to freely support the bimetallic element in a manner hereinabove described.

While I have shown my invention in but two forms, it will be obvious to those skilled in the art that it is not so limited, but is susceptible of various other changes and modifications without departing from the spirit and scope thereof, and I desire, therefore, that only such limitations shall be imposed thereupon as are specifically set forth in the appended claims.

I claim as my invention:

1. A thermostat comprising, in combination, a supporting structure, a bimetallic relatively flat element retained by such supporting structure so that its periphery is free to move relative thereto in one direction to a certain extent and is loosely confined by said structure in a second direction, the flat midpoint area of said element being capable of flexing from one position to another in response to changes in temperature thereof, a movable contact loosely attached directly to the relatively flat midpoint area of the bimetallic element so as to be capable of a degree of movement relative to such element and to thereafter move with such element as it moves from one position to another in response to the changes in temperature thereof, and means associated with the movable contact for preventing relative movement between the element and supporting structure in said one direction.

2. A thermostat comprising, in combination, a supporting structure, a bimetallic disc-shaped relatively flat element retained by such supporting structure through substantially the periphery of such disc-shaped element so as to be free to rotate to a degree relative thereto and is loosely confined by said structure at the periphery normal thereto, the relatively flat central portion of said element being capable of snapping from one position to another in response to changes in temperature thereof, and a movable contact loosely attached to said relatively flat central portion of the bimetallic disc-shaped element so as to be capable of a degree of movement relative to such element and to thereafter move with such element as it moves from one position to

another in response to the changes in temperature thereof, and means disposed between said supporting structure and the movable contact for preventing the element from rotating relative to the supporting structure when such element is in its normal operating position.

3. A thermostat comprising, in combination, a supporting structure having a cavity therein and a plurality of bosses extending into such cavity to correspondingly reduce an effective dimension thereof, a bimetallic element having portions of reduced dimension for permitting initial passage thereof along said bosses into final position, said element being retained in said position by ends of such bosses within the cavity in the supporting structure so that its periphery is free to move with respect thereto in one direction to a certain extent and to be substantially void of movement in a second direction, said element being capable of flexing from one position to another within the cavity in response to changes in the temperature thereof.

4. A thermostat comprising, in combination, a supporting structure having a cavity therein and a plurality of endwise spaced bosses extending in opposite directions into such cavity to correspondingly reduce an effective dimension thereof, a bimetallic element retained in such space by the ends of such bosses within the cavity in the supporting structure so that its periphery is free to move with respect thereto in one direction to a certain extent and to be substantially void of movement in a second direction, said element being capable of flexing from one position to another within the cavity in response to changes in the temperature thereof.

5. A thermostat comprising, in combination, a supporting structure having a substantially cylindrical cavity therein with a plurality of endwise spaced bosses extending in opposite directions into such cavity to correspondingly reduce the effective diameter thereof, the space between such bosses being of full diameter, a bimetallic disc-shaped element retained within said full-diameter spaces by such bosses so as to be free to rotate relative to the supporting structure to a certain extent and to be substantially void of movement along said bosses, said element being capable of snapping from one position to another in response to changes in temperature thereof.

6. A thermostat comprising, in combination, a supporting structure having a substantially cylindrical cavity therein with a plurality of endwise-spaced bosses extending in opposite directions into such cavity to correspondingly reduce the effective diameter thereof, the space between such bosses being of full diameter, a bimetallic disc-shaped element retained within said full-diameter spaces by such bosses so as to be free to rotate relative to the supporting structure to a certain extent and to be substantially void of movement along said bosses, said element being capable of snapping from one position to another in response to changes in temperature thereof, and means associated with the element and supporting structure for preventing rotative movement of said element.

7. A thermostat comprising, in combination, a supporting structure having a substantially cylindrical cavity therein with a plurality of endwise spaced bosses extending into such cavity to correspondingly reduce the effective diameter thereof, the space between such bosses being of full diameter, a bimetallic disc-shaped element retained within said full-diameter spaces by such bosses so as to be free to rotate relative to the supporting structure to a certain extent and to be substantially void of movement along said bosses, said element being capable of snapping from one position to another in response to changes in temperature thereof, and a movable contact loosely attached to the bimetallic element so as to be capable of a degree of movement relative to such element and to thereafter move with such element as it moves from one position to another in response to the changes in temperature thereof.

8. A thermostat comprising, in combination, a supporting structure having a substantially cylindrical cavity therein with a plurality of endwise spaced bosses extending into such cavity to correspondingly reduce the effective diameter thereof, the space between such bosses being of fuel diameter, a bimetallic disc-shaped element retained within said full-diameter spaces by such bosses so as to be free to rotate relative to the supporting structure to a certain extent and to be substantially void of movement along said bosses, said element being capable of snapping from one position to another in response to changes in temperature thereof, a stationary contact attached to the supporting structure, and a movable contact loosely attached to the bimetallic element so as to be capable of a degree of movement relative to such element and to thereafter move with such element as it moves from one position to another in response to the changes in temperature thereof for engagement with the stationary contact in one of said positions.

9. A thermostat comprising, in combination, a supporting structure having a cavity therein with a plurality of bosses extending into such cavity, a bimetallic disc-shaped element retained within the cavity by such bosses so as to be free to rotate relative to the supporting structure to a certain extent and to be substantially void of movement along said bosses, said element being capable of snapping from one position to another in response to changes in temperature thereof, and a movable contact loosely attached to the bimetallic element so as to be capable of a degree of movement relative to such element and to thereafter move with such element as it moves from one position to another in response to the changes in temperature thereof, and conducting means attached to the movable contact and supporting structure for preventing rotative movement of said element.

10. A thermostat comprising, in combination, a supporting structure having a cavity therein with a plurality of bosses extending into such cavity, a bimetallic disc-shaped element retained within the cavity by such bosses so as to be free to rotate relative to the supporting structure to a certain extent and to be substantially void of movement along said bosses, said element being capable of snapping from one position to another in response to changes in temperature thereof, a stationary contact attached to the supporting structure, and a movable contact loosely attached to the bimetallic element so as to be capable of a degree of movement relative to such element and to thereafter move with such element as it moves from one position to another in response to the changes in temperature thereof, for engagement with the stationary contact in one of said positions, and means comprising a flexible current-carrying member rigidly attached to said movable contact and rigidly attached to

the supporting structure for preventing the rotative movement of said element.

11. In combination, a bimetallic element having an opening having a given configuration therein, a contact member having a portion passing through and beyond an end of said opening and an enlarged head located at the opposite end of the opening, and a current carrying member attached to the portion of said contact member passing through the element, said portion of the contact member passing through the element having a configuration similar to, though slightly smaller than, said opening in the element to permit a limited degree of rotation of the element with respect to the contact member and current-carrying member.

12. A thermostat comprising, in combination, a supporting structure having a cavity therein, a plurality of bosses extending into such cavity, a second plurality of bosses extending into such cavity peripherally displaced from the first plurality of bosses, a bimetallic element retained by and between said bosses within the cavity so that its periphery is free to move with respect thereto in one direction to a certain extent and to be substantially void of movement in a second direction, said element being capable of flexing from one position to another within the cavity in response to changes in the temperature thereof.

13. A thermostat comprising, in combination, a supporting structure having a cavity therein, a plurality of bosses extending into such cavity, a second plurality of bosses extending into such cavity substantially in line with the first plurality of bosses, a bimetallic element retained by and between said bosses within the cavity so that its periphery is free to move with respect thereto in one direction to a certain extent and to be substantially void of movement in a second direction, said element being capable of flexing from one position to another within the cavity in response to changes in the temperature thereof.

14. A thermostat comprising, in combination, a supporting structure, a bimetallic element retained by such supporting structure so that its periphery is free to move in a rotative direction relative to said structure and is loosely confined by said structure at the periphery normal thereto, said element being capable of flexing from one position to another in response to changes in temperature thereof, a movable contact attached to the central portion of said element, and means attached to said movable contact for preventing relative movement between the element and supporting structure in said rotative direction.

15. A thermostat comprising, in combination, a supporting structure, a bimetallic element retained by such supporting structure so that its periphery is free to move in a rotative direction relative to said structure and is loosely confined by said structure at the periphery normal thereto, said element being capable of flexing from one position to another in response to changes in temperature thereof, a movable contact attached to the central portion of said element, and means attached to said movable contact for preventing relative movement between the element and supporting structure in said rotative direction and for connecting said movable contact in circuit.

PAUL R. LEE.