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THERMOSTAT

Filed March 18, 1932

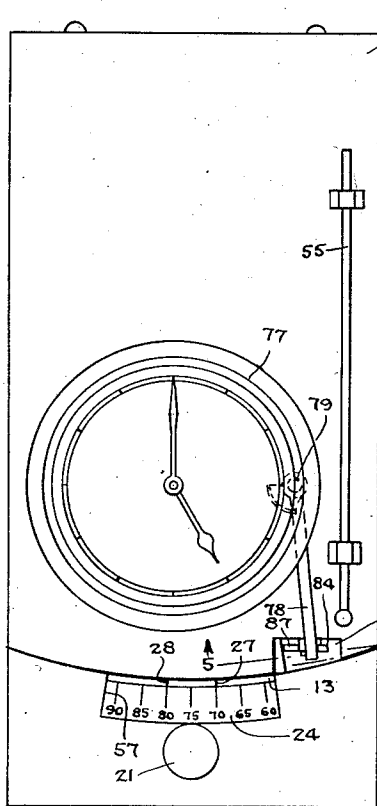


Fig-1

Switch Operating Motor
Cooling Side

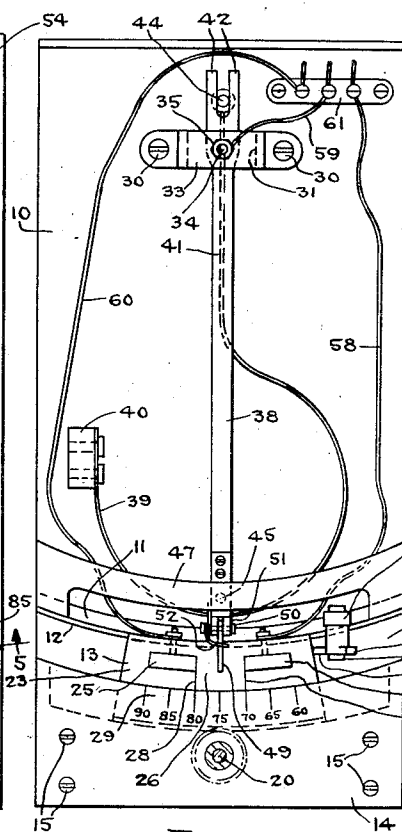


Fig-2

Switch Operating Motor
Heating Side

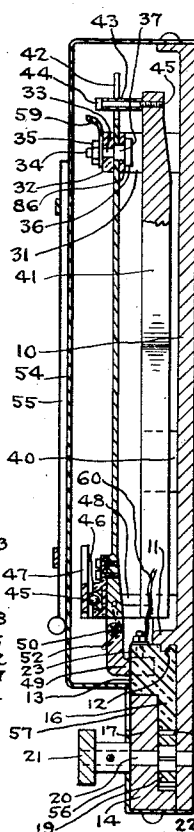


Fig-3

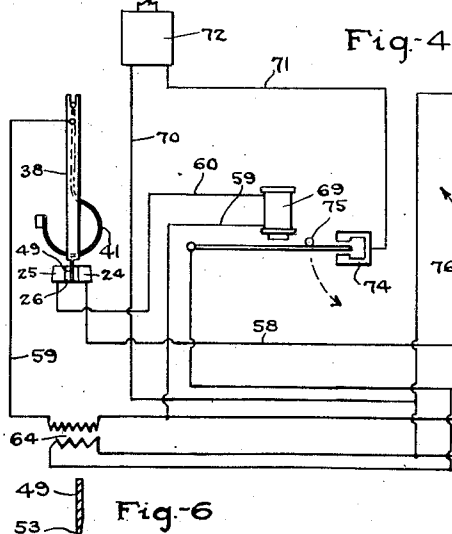


Fig-6

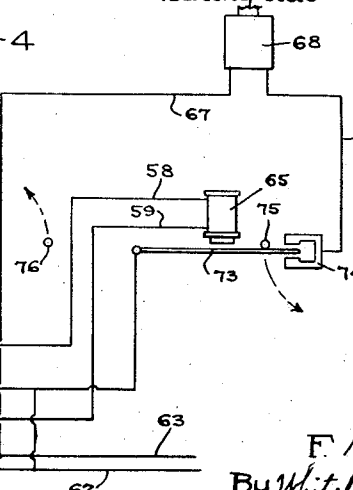
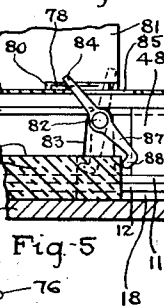


Fig-5

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THERMOSTAT

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My invention relates to thermostats and has for its object to provide a thermostat of peculiarly simple and cheap construction, wherein the heat controlled member contacts with a movable contact piece and is so held and suspended as to provide a minimum of frictional resistance, and also is extremely accurate and responsive to very small changes of temperature. This application is in some
 10 respects a continuation of my copending application, Serial No. 588,578 filed January 25, 1932.

A further object of my invention is to provide time-controlled means for automatically moving the movable contact member to adjust it for controlling temperature at a different degree from that controlled by said member as manually set, as where the member is moved at a predetermined time in the morning to raise the temperature.

The full objects and advantages of my invention will appear in connection with the detailed description thereof and its novel features are particularly pointed out in the claims.

In the drawing, illustrating an application of my invention in one form:

Fig. 1 is a front elevation of my invention, including the time-controlled pusher mechanism. Fig. 2 is a view similar to Fig. 1 with the outer case removed. Fig. 3 is a vertical section along the center line of Fig. 2, including an outer casing without the time-controlled pusher mechanism. Fig. 4 is a wiring diagram showing generally the hook-up operated by the thermostat. Fig. 5 is a fragmentary sectional elevation view on line 5—5 of Fig. 1, viewed in the direction of the arrows. Fig. 6 is a horizontal section of the movable contact member showing the right line contact edge.

A base member 10, which may be a die casting, is provided with an outwardly-extending arcuate rib 11, having a downwardly-extended arcuate tongue 12. An arcuate

slide 13 has an arcuate groove fitting over the tongue 12, and is held in position on the base 10 by a piece 14 secured to the base 10 by screws 15. The slide 13 is formed of bakelite or other suitable electrical non-conducting material, and is provided with a downwardly-extending arcuate tongue 16 which takes under a similar upstanding arcuate tongue 17 on the piece 14. In this manner the slide 13 is held to move along an arcuate way 18 formed by the adjacent arcuate portions of rib 11 and piece 14, and is adjustable along said way by a spur gear 19 on a pintle 20 having a thumb piece 21, which gear meshes with an arcuate rack 22 on tongue 16, as shown in Fig. 3.

The slide 13 has a smooth upper contact surface 23, and set into the body of the slide so as to have their surfaces coterminous with the surface 23 and to form with it a continuous smooth and even contact surface are two metallic pieces 24 and 25 separated by a non-conducting portion 26 of surface 23, as clearly shown in Fig. 2. Pointer lines 27 and 28 mark the radial lines of separation of the conducting and non-conducting portions of surface 23, and these lines register with a temperature scale 29 on the upper surface of retainer piece 17. The thermostat is adapted to control instrumentalities for both winter and summer air-conditioning, and pointer line 27 marks, and indicates on scale 29, the maximum temperature for heat-conditioning of the air in winter, while pointer line 28 marks, and indicates on scale 29, the minimum cold-conditioning temperature in summer. These limits may each of them be adjusted simultaneously, but in effect each independently, for any desired minimum of cooling or maximum of heating.

Upon the upper central part of base 10 is secured by screws 30 a U-bracket 31 provided with cross-bar 32 parallel with and spaced a suitable distance from base 10, and composed of bakelite or other suitable non-conducting

material. In the cross-bar 32, at the radial center of the concentric arcs of the edges of slide 13 and its way 18, is a hole through which extends the shank 33 of a horizontal shoulder pin 34 held clamped on the cross-bar by nut 35. The pin 34 has a head 36 which lies loosely against a washer 86 surrounding the enlarged part 37 of pin 34, which forms a free suspension bearing for a vertical contact carrier 38 adapted to be swung on said suspension bearing by the heat-responsive member comprising loop 39 anchored to bracket 40 formed as part of base 10, and shank 41 which extends along the center line of the base up through the axis of pin 34 back of crossbar 33 and contact carrier 38. The contact carrier is extended above its pivotal support on part 37 of pin 34 into a yoke 42, which embraces a sleeve 43 of insulating material loose on a screw-pin 44 threaded into the upper end of shank 41, as clearly shown in Fig. 2. Lateral movements of shank 41 caused by temperature changes are thus communicated through the short-arm yoke 42 to the contact carrier 38 to swing the same on its pivoted support at 37 with greatly multiplied movement of the lower end of its depending long part.

To insure practically negligible friction the pivotal mounting on enlarged portion 37 is perfectly free, and so is the sleeve 43 between the adjacent parts of fork 42; and the contact carrier 38 is held always vertical and parallel with base 10 by a ball 45 carried by an insulating piece 46 secured to the lower end of the carrier, which ball engages the smooth vertical side surface parallel with base 10 of raised guide-piece 47 preferably supported by the arcuate rib 11 of base 10, and connected thereto by arms 48, as shown in Figs. 2 and 3. A contact toe 49 is pivotally mounted on a pin 50 between the parts of a fork 51 on the lower end of contact carrier 38. A light spring 52 on pin 50 engages the outside of toe 49 to force it with a gentle pressure against contact surface 23 which reacts to hold ball 45 always lightly in engagement with adjacent smooth plane surface of guide-piece 47. The toe 49 is formed with a right-line edge 53 (shown in Fig. 6) which is always held radially extended in the line passing through the pivotal axis of contact carrier 38 against one or the other of conducting surfaces 24 and 25 or non-conducting surface 26, so as to fall directly in the lines 27 and 28 separating these surfaces, which insures operation of the controls hereinafter described within very small limits of movement of contact toe 49 responding to like small changes in temperature. A casing 54 secured to the base 10 encloses the parts of the thermostat, and carries a thermometer 55. This casing has a depressed portion 56 at the lower end, with an opening

57 to expose the side 29 and part of slide 13 and of pointer lines 27 and 28.

Contact piece 24 is connected with wire 58, contact toe (through contact carrier 38 and shoulder pin 34) is connected with wire 59, and contact piece 25 is connected with wire 60, which wires are secured to a holder bar 61 on base 10, all as shown in Fig. 2. Electric current is furnished by lead in wire 62 and outlet wire 63, the current to the thermostat being suitably reduced by transformer 64. The circuit through wires 58 and 59 when closed by contact toe 49 energizes a relay 65, and when broken de-energizes the same relay, which through such energizing and de-energizing closes the same circuit through wires 66 and 67 to switch-operating motor 68, whereby the heating instrumentalities are controlled. In the same manner the circuit through wires 59 and 60, when closed and when broken energizes and de-energizes relay 69, which in each case closes the same circuit through wires 70 and 71 to switch-operating motor 72, whereby the cooling instrumentalities are controlled. This is effected for each relay by a relay-controlled bar 73 movable between a double contact piece 74, and swung into engagement with one contact portion when the relay is energized, and after the switch-operating motor has operated for a predetermined time mechanically pushed out of contact by means operated by the motor (not shown) and held out of contact against the force exerted by the relay, so as to drop under the influence of gravity or other suitable force to engage the other contact and close the same motor circuit when the relay is de-energized, whereupon when the motor again operates for the predetermined time the bar 73 is mechanically lifted from the second contact and held in position to be swung against the first contact when the relay again is energized. The mechanical means for moving the bar may be a pair of diametrically opposed pins, indicated diagrammatically at 75 and 76. Pin 75 is carried and moved by suitable means and connections to the motor (not shown), moved directly to engage and push the bar 73 out of engagement with the first contact, and pin 76 is similarly moved, operating through an intermediate lever system (not shown) to lift the bar 73, all as shown and described in detail in my said copending application.

Although for many purposes no automatic or time-controlled means to adjust the contact slide 13 is required and the thermostat may be finished as in Fig. 3, for certain domestic and other uses such means is desirable, as when for controlling the heat-conditioning of air it is desired to fix a low minimum night temperature of say 60 degrees Fahrenheit and have the control automatically raise the temperature at a predetermined time, say to 70

degrees at five or six o'clock in the morning. It is usual in such cases to employ well known clock and alarm mechanism to effect this adjustment. Means cooperating with such clockwork to move the slide 13 for desired temperature shift is shown in Figs. 1, 2 and 5. On the casing 54 is mounted a clock 77, having well known time-controlled mechanism (not shown), such as ordinary time-clock alarm mechanism which is adapted to rock in a vertical plane an arm 78 fast on a pivot post indicated in dotted lines at 79 and which arm is projected through a slot 80 in the wall 81 of the clock. Centrally pivoted on a horizontal pin 82 on a stand 83 formed in conjunction with rib 11 so as to swing in a horizontal plane is a lever having its outer end 84 extended through an opening 85 in casing 54 in position to be engaged by the lower end of arm 78, as shown in Figs. 1 and 3. The inner end 87 of the lever is provided with toe 88 which engages the end of contact slide 13 within way 18. When the slide 13 is set for a low temperature, say 60 degrees, the parts are in the full-line position of Fig. 5. At the time set, the clockwork will cause the arm 78 to be rocked outwardly moving the lever from the full-line to the dotted line position of Fig. 5. Through toe 88 engaging the end of slide 13, the slide is pushed along until its end occupies the dotted-line position of Fig. 5, advancing the temperature limit line 27 from the point where it marks, say, 60 degrees to the point where it marks, say, 70 degrees. This will close the thermostat circuit through wires 58 and 59 and cause the motor 68 to put the heat-conditioning instrumentalities into operation. These will continue to operate while the contact toe 49, moved by the heat-controlled member 39, 41, remains in contact with conducting contact surface 24, and until it is moved therefrom to non-conducting contact surface 26, which will be at almost the exact instant that the temperature reaches 70 degrees. The limits 60 degrees and 70 degrees here mentioned are only exemplary, as any limits and any desired and practical degree of separation of such limits are contemplated by and are within the scope of my invention.

The improved thermostat of my invention may be constructed exceptionally cheaply and economically. All supporting parts and the base may, if desired, be formed of a single die-casting. Assembly of parts is effected easily, and after assembly there are no delicate adjustments and nothing that can get out of order. The supports for the thermostat member and the swinging contact carrier are fixed and require no adjustments after assembly. This eliminates a cause of inaccuracy of operation. The swinging contact carrier is mounted to be moved with negligible friction, yet the contact toe always engages the contact surface with a clinging

easy pressure that ensures perfect electrical conduction contact. And finally the movement of the contact member is not only exceptionally responsive and accurate but because of its knife-like contact edge operates within exceedingly narrow temperature limits—within half of a degree where other thermostats require temperature changes of two or three degrees or more—an extremely important feature where forced air movement is employed and marked temperature changes bring considerable discomfort.

I claim:

1. A thermostat, comprising a contact piece having a plane surface formed with limits comprising segments of concentric circles, means to move said piece in the arcs of said circles to adjust temperature limits, a swinging arm pivoted at the center of said circles, a contact member pivoted to said arm to move transversely to the plane of movement of the arm, a spring holding said contact member in constant yielding engagement with the surface of the piece, and a thermostatic member supported independently of the arm to move the arm.

2. A thermostat, comprising a movable contact piece, a swinging arm having a pivoted toe for engaging the piece, a keeper at one side of the arm, an anti-friction device on the arm, a spring for holding the toe against the piece and the anti-friction device against the keeper with a steady pressure, and thermostatic means to move the arm.

3. A thermostat, comprising a base, a U-piece thereon, a swinging arm having its pivot intermediate its ends and on the underside of said U-piece, said pivot leaving a clear space between it and the base, the end of the arm above the U-piece comprising a fork, a heat responsive member anchored at one end to the base and having a part lying in the vertical plane of the swinging arm, said part extended through said space between the pivot and the base, and a finger on said part engaging within said fork, whereby the arcs of movement of said engaging portions will be about center on the same sides of said arcs.

4. A thermostat, comprising a base, a U-piece thereon, a swinging arm having its pivot intermediate its ends and on the underside of said U-piece, said pivot spaced from the base, a table formed in an arc having said pivot as a center, said table member having its under face in the plane of the under face of the U-piece and adapted to be engaged by an outer part of said arm, and a heat-responsive member anchored at one end to the base and having a part lying in the vertical plane of the swinging arm and extended between its pivot and the base and having connection with the arm above the pivot to move the arm.

5. A thermostat, comprising a contact piece movable in the arc of circle to adjust

temperature limits, a swinging arm pivoted at the center of said circle, and means holding said arm to move always in a vertical plane, including a contact toe pivoted to move transversely to said plane and spring-pressed against said contact piece.

6. A thermostat, comprising a contact piece movable in the arc of a circle to adjust temperature limits, a swinging arm pivoted at the center of said circle, and a contact toe pivoted said arm and spring held against said contact piece, the contacting portion of said toe being a right line edge extending radially with respect to said center in all positions of said arm and said piece.

7. A thermostat, comprising an arcuate contact piece movable to adjust temperature limits and having a limit line thereon, an arcuate temperature scale in cooperative relation thereto, so the lines thereof will register with and form extensions of said limit line, and means to move the contact piece to set the temperature limit desired as indicated on said scale by said limit line.

8. A thermostat, comprising a contact piece movable to adjust temperature limits and having thereon two limit lines spaced apart and with a non-conducting contact surface between them, one marking the maximum heating limit and the other the minimum cooling limit, a temperature scale in cooperative relation thereto, and means to move the contact piece to set either temperature limit as indicated on said scale by said limit lines.

9. A thermostat, comprising a contact piece movable to adjust temperature limits having conducting and non-conducting surface portion, a circuit making and breaking member constantly engaging said piece and moved by temperature changes from one to the other of said surface portions, manual means to move the piece, and time-controlled means to move the piece.

10. A thermostat, comprising a contact piece movable to adjust temperature limits having conducting and non-conducting surface portions, a circuit making and breaking member constantly engaging said piece and moved by temperature changes from one to the other of said surface portions, manual means to move the piece to control a fixed temperature for a desired period, and time-controlled means to move the piece to cause the temperature to be changed.

11. A thermostat, comprising a contact piece movable to adjust temperature limits, a circuit making and breaking member constantly engaging said piece and moved by temperature changes along its surface, manual means to move the piece, a lever engaging the piece, and a clock and time-controlled means operated thereby to rock the lever and move the piece to cause the temperature to be changed.

12. A thermostat having a base and an arcuate member thereon having a table portion with a face adjacent the base which is parallel thereto, a contact piece supported to move along said arcuate member, a pivoted arm having a portion movable between said base and face, an antifriction element on said arm engageable with said face, a pivoted member upon the arm spring held against the contact piece, and heat-controlled means to move the arm.

In testimony whereof I hereunto affix my signature.

FRANK A. WHITELEY.