

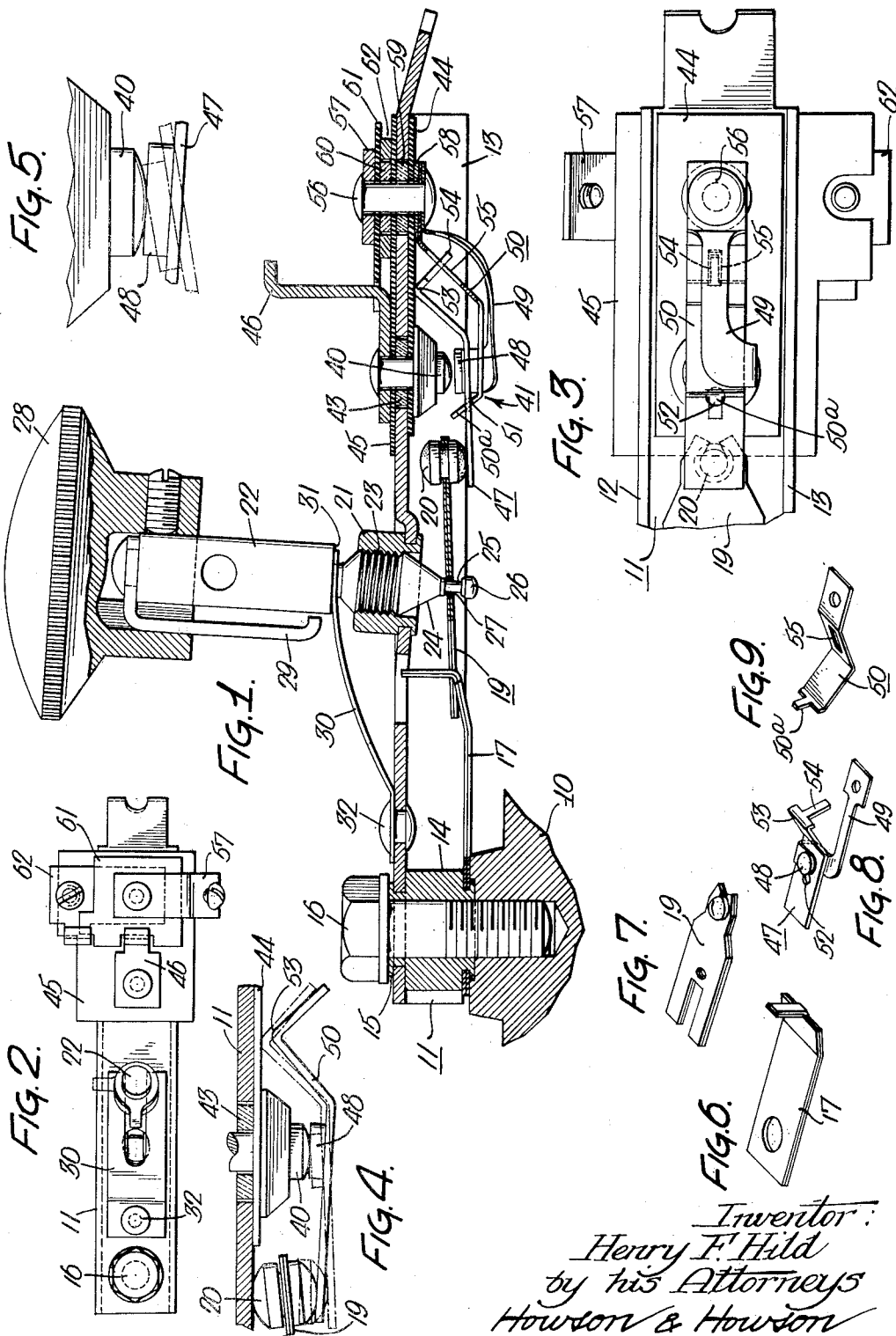
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THERMOSTATIC SWITCH

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THERMOSTATIC SWITCH

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The present invention relates to an improved contact arrangement for thermostatically operated switches.

Its specific purpose is to provide a contact arrangement that will (a) provide contact wipe during normal cyclic operation, (b) provide a substantial amount of contact scrubbing during the adjustment of the thermostat at different operating levels, (c) in a situation where the contacts fail, as by a build-up of an oxide film, the deenergization of the device will cause the thermomotive member to cool and in so doing will institute a substantial amount of contact scrubbing or wipe and thereby act to clear the contacts of such film and reestablish circuit connections.

The preferred embodiment of the invention is shown in the accompanying drawing as an adaptation of the thermostatic control mechanism disclosed and claimed in the patent of Joseph W. Myers, No. 2,546,471, issued March 27, 1951. As illustrated, the invention is applied to the control of a device such as a flatiron, but it is to be understood that the invention is applicable to any use for which it may be suitable.

In the drawing:

Fig. 1 is a longitudinal sectional view of the thermostatic control mechanism including the switch structure of the present invention;

Fig. 2 is a smaller scale plan view of the mechanism;

Fig. 3 is a partial bottom view of the portion including the novel switch structure;

Fig. 4 is a partial side view showing the switch contacts and the action thereof;

Fig. 5 is a similar enlarged view for better illustration of the contact scrubbing action; and

Figs. 6 to 9 are perspective views of certain parts of the mechanism.

Referring to the drawings, the thermostatic control mechanism is shown in Fig. 1 in association with a portion of a body 10 to be heated which may be regarded as a portion of the sole plate in an electrically heated flatiron. The thermostatic control mechanism is constructed and assembled as a unit, the parts of which are carried by an elongate rigid support member 11 which is preferably of inverted channel shape having depending side flanges 12 and 13. At one end of the support member 11 there is provided a depending hollow support element 14 which is riveted over at 15 to secure the same to the support member. The entire thermostatic control unit is attachable to the body 10 by means of a screw 16 passing through the hollow element 14.

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Secured to the lower end of element 14 is a main or primary thermomotive element 17 which may be in the form of a bimetal strip. The bimetal strip 17 is disposed so as to be in good heat conductivity relation with the body 10 adjacent the root portion of said bimetal, receiving a greater portion of its heat from the contact of its root with the body 10, and is arranged to flex upward under an increase in temperature.

A compensating thermomotive element 19, which may also be a bimetal strip, extends from the free end of the main thermomotive strip 17 substantially in horizontal alignment therewith. One end of the strip 19 is loosely pivotally engaged by the free end of the strip 17 (see Figs. 1, 6 and 7). The other end of the compensator bimetal 19 is bifurcated to receive a porcelain button 20, and is arranged to actuate the switch mechanism to be described presently. Intermediate the ends of the compensating bimetal strip 19 there is provided a suspension fulcrum for said strip. As may be seen in Fig. 1, a hollow internally threaded support element 21 is mounted on the rigid support member 11. The element 21 supports a spindle 22 having a threaded portion 23 threadedly engaging the element 21. Below the threaded portion 23 the spindle 22 is tapered at 24 and terminates in a pin-like end 25 having an enlarged head 26. The pin-like portion extends loosely through an aperture 27 provided in the bimetal strip 19, thus providing a loose fulcrum mounting for the strip 19.

At the upper portion of spindle 22 is provided an arrangement for mounting a control knob 28, which includes a factory adjustment element 29, as described at length in the aforementioned copending application. A spring member 30, having a bifurcated end for engaging a shoulder 31 on the spindle 22, is riveted at 32 to the elongate member 11 and acts to bias the spindle so that any lost motion in the threaded portion 23 is taken up in one direction against the corresponding threaded portion in the hollow member 21.

The mechanism thus far described is substantially similar to the device disclosed in the aforementioned copending application. The improvements provided by this invention reside in the contact arrangement now to be described.

The switch members which are in substantial horizontal alignment with the compensating bimetal 19 and the primary bimetal 17 comprise a stationary contact 40 fixed to the support member 11 and a movable contact assembly 41 secured to the support 11. The stationary contact 40 is electrically isolated from the support 11 by means of a porcelain washer 43 and mica insulating

members 44 and 45, and secures a collector type terminal member 46 to the top of the support by riveting over the end of said contact. The movable contact assembly 41 includes a lever 47 having a contact 48 fixed thereto, a flexible connector 49 held between the contact member 48 and the lever 47 (see Fig. 8), and a flat spring member 50 engaging the lever 47 at 51 and urging the same upward. As shown in Fig. 8, the lever 47 is a relatively stiff or rigid member which includes, besides the contact 48 and the flexible connector 49 attached thereto, a hole 52 through which a finger 50a on the spring 50 extends (Fig. 1) and a V-shaped fulcrumming portion 53 through which the lever 47 engages the surface of the insulating member 44 at the lower side of the support member 11. The lever is provided with an extension finger 54 for insertion in a cooperative slot 55 in the spring member 50. The purpose of this arrangement is to enable the lever 47 to move relative to the spring member 50 as hereinafter described, while at the same time the spring member supports and locates the lever.

The flexible connector 49, preferably of high conductivity material such as silver, is L-shaped and has two holes at its respective ends for attachment below the contact 48 and for attachment to a rivet member 56 which is insulated from the support member and connected mechanically and electrically to a second terminal member 57. As assembled, the greater part of the connector lies below and parallel to the spring member 49; however, in the vicinity of the finger 54 the connector is looped to avoid interference with the operation of the contacts.

The spring member 50 is secured between the fixed end of connector 49 and a bearing washer 58 by the rivet member 56. The clearance between the finger 50a of the spring member 50 and the cooperating hole 52 of the lever member 47 avoids any interference or binding of the members while still providing a rather close fit for transmitting motion between these two members.

Rivet 56 is insulated from the support member 11 by means of insulating bushings 59 and 60, made preferably of porcelain, and by mica members 44, 45 and 61. The terminal member 57 is held below the riveted end of member 56. Rivet 56 also secures, but is insulated from, a second collector type terminal member 62. Terminal members 46 and 57 are connected in series with the heating element of the flatiron and the supply line, so that operation of the switch contacts controls the current to said heating element. Terminal 62 connects one end of the heating element to one end of the supply line.

The operation of the primary and compensating thermostatic elements 17 and 19 for the control of the heated body through operation of the contacts 40 and 48 has been explained at length in the aforementioned copending application. Briefly, increase in temperature of the primary bimetal 17 will cause its free end to flex upward imparting a rocking movement to the compensating bimetal 19 with corresponding downward movement of the movable contact 48. Temperature rise of the compensator 19 will cause concave upward flexure and result in a corresponding decrease in total deflection transmitted to the contact 48.

Consideration will now be given to that part of the operation concerning the novel contact wipe arrangement, with particular reference to Figs. 4 and 5.

First, contact wipe or scrubbing takes place when the control knob 28 is rotated from its "off" position, with the flatiron cold, to one of the "on" positions. The position of the thermostat members in their cold state with the control knob in its "off" position is shown in Fig. 1. It will be observed that during the movement from "off" position the porcelain button 20 at the end of the compensator will be moved upward. The spring member 50 will cause a slight clockwise rotation of lever member 47 and a sliding movement of this member at the button 20 contacting area and at the area of engagement of the lever fulcrum 53 with the mica surface 44. This prevails until engagement is made between the flat face of contact 48 and the arcuate face of stationary contact 40. At this instant the lever fulcrum 53 leaves the mica surface, and as motion of the button 20 continues upward, the flat contact 48 slides and rotates along the surface of the contact 40. The action of the spring member 50 is to bias the lever 47 upward urging it against the button 20 and to cause it to rotate and its contact 48 to slide over the stationary contact 40. Coaction between finger 50a and adjacent shoulders of spring member 50 through hole 52 of lever 47 restrains sideward motion of this lever and causes scrubbing action between the spherical and flat seats of surfaces of the contact members 40 and 48.

A second scrubbing action takes place during normal cyclic opening and closing of the contacts 40 and 48. It is well known to those skilled in the art that due to the thermal inertial characteristics of a thermostat and the device being controlled there is an inherent over and under shoot after each opening and closing operation of the contacts respectively. Thus after the contacts have once engaged, the thermostat system continues to lose heat and to decrease in temperature for a short interval of time, and during this time the thermostat system continues to operate in a direction of further contact closure. Similarly on contact opening, the bimetal system continues to gain heat for a short period thereby effecting greater opening of the contacts before the mass being heated cools sufficiently for the temperature of the bimetal to decline and effect consequent making of the contacts. It is during the undershoot of the contact-make period of the present thermomotive system that scrubbing action between the contacts can be observed, for there is a measure of such action during movement of the bimetal to its coolest position and a further scrubbing action during heating of this bimetal until contact separation is had.

A third and rather important wipe creating condition results from the failure of the contact surfaces due to oxide build-up thereon. This circumstance may arise during cyclic opening and closing of the contacts where the level of oxide build-up on the contacts becomes so great that no circuit will be established between the contacts 40 and 48 even though cooling of the thermostat will permit the contacts to engage. It is during this instant that the thermostat continues to cool and approach its cold position. This causes an extremely large stroke of the porcelain button 20 with a large relative movement between the lever member 47 and fixed contact 48 caused by the spring member 50, with a resulting breaking of the film of oxide and reestablishing of the electrical circuit.

The application and advantages of the novel contact arrangement have been described with

reference to a flatiron thermostat. However, it will be obvious to those skilled in the art that this invention is capable of variations and other fields of application than shown herein.

I claim:

1. In an adjustable thermostat control mechanism for controlling the operation of a heating device at any one of a plurality of temperature levels, a fixed contact, a movable rigid lever, a second contact on said lever engageable with said fixed contact, means providing a surface adjacent said lever in fixed relation to said first contact, said lever being arranged to engage and to fulcrum on said surface to effect separation of said contacts, means engaging said lever for moving the same in response to temperature change and also in response to change by manual adjustment, and means for locating said lever and for biasing the same whereby movement of the lever-engaging means results in a relative sliding motion between the movable and fixed contacts when the fulcrum portion of the lever leaves the fixed surface.

2. In an adjustable thermostat control mechanism for controlling the operation of a heating device at any one of a plurality of temperature levels, a fixed contact, a movable rigid lever, a second contact on said lever engageable with said fixed contact, the surface of one of said contacts being arcuate in profile, means providing a surface adjacent said lever in fixed relation to said first contact, said lever being arranged to engage and to fulcrum on said surface to effect separation of said contacts, means engaging said lever for moving the same in response to temperature change and also in response to change by manual adjustment, and means for locating said lever and for biasing the same whereby movement of the lever-engaging means results in a relative sliding motion between the movable and fixed contacts when the fulcrum portion of the lever leaves the fixed surface.

3. In an adjustable thermostat control mechanism for controlling the operation of a heating device at any one of a plurality of temperature levels, a fixed contact, a movable rigid lever, a second contact on said lever engageable with said fixed contact, means providing a surface ad-

jacent said lever in fixed relation to said first contact, said lever being arranged to engage and to fulcrum on said surface to effect separation of said contacts, primary and secondary thermostatic elements, the latter being adjustable and engaging said lever for moving the same in response to temperature change and also in response to change by manual adjustment, and means for locating said lever and for biasing the same whereby movement of the secondary thermostatic element results in a relative sliding motion between the movable and fixed contacts when the fulcrum portion of the lever leaves the fixed surface.

4. In an adjustable thermostat control mechanism for controlling the operation of a heating device at any one of a plurality of temperature levels, a fixed contact, a movable rigid lever, a second contact on said lever engageable with said fixed contact, means providing a surface adjacent said lever in fixed relation to said first contact, said lever being arranged to engage and to fulcrum on said surface to effect separation of said contacts, means engaging said lever for moving the same in response to temperature change and also in response to change by manual adjustment, and a spring member arranged to locate and bias said lever whereby movement of the lever-engaging means results in a relative sliding motion between the movable and fixed contacts when the fulcrum portion of the lever leaves the fixed surface.

5. In a thermostatic switch, a fixed contact, means providing a surface adjacent said contact and in fixed relation thereto, a rigid lever having a fulcrum portion engageable with said surface and also movable therefrom, a contact on said lever engageable with said fixed contact, a spring member pivotally engaging said lever and urging it in a direction to close said contacts, and a thermostatic element engaging said lever and serving to control the movement thereof, the movement of said lever in opposite directions causing the contact thereon to slide on said fixed contact.

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No references cited.