Feb. 16, 1937. F. KUHN ET AL 2,071,209

THERMOSTAT

Filed Nov. 5, 1934 2 Sheets-Sheet 1

Fig. 1.

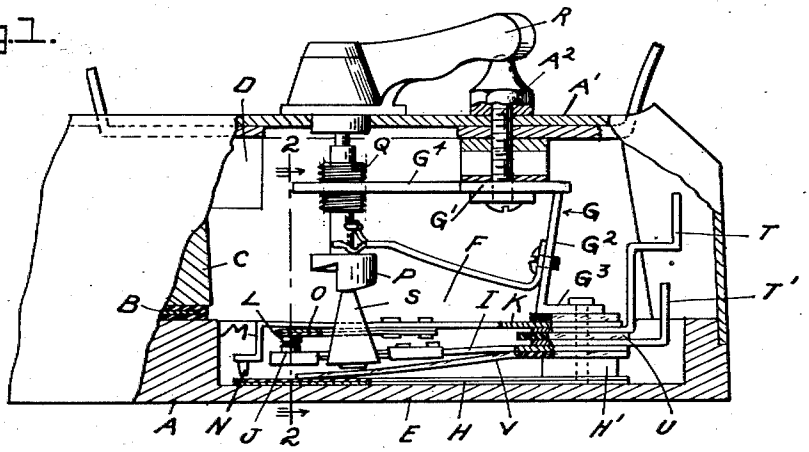
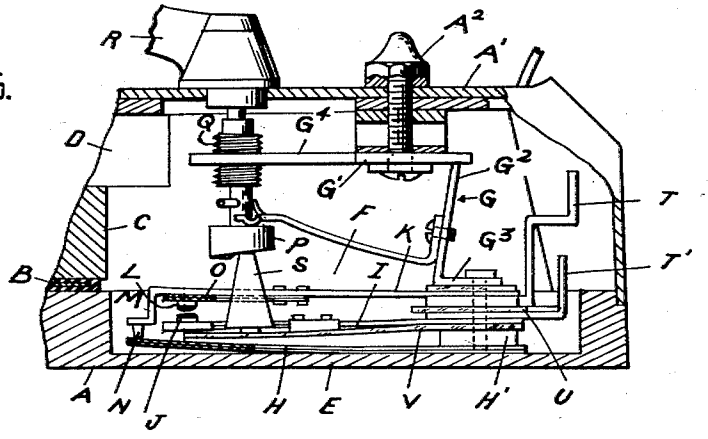


Fig. 3.



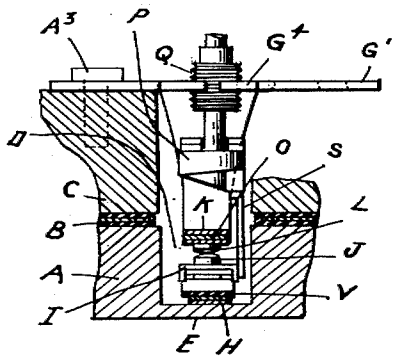


Fig. 2.

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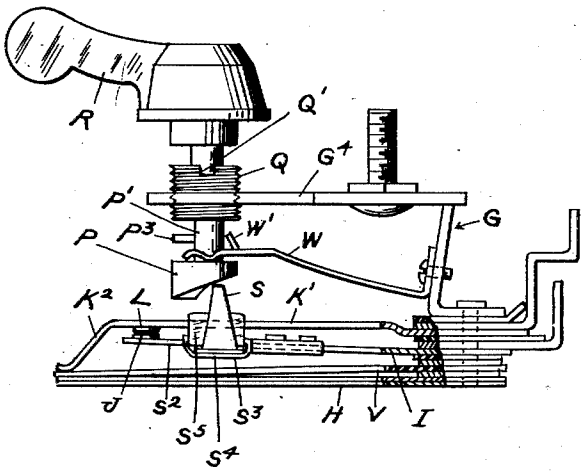

FIG. 4.

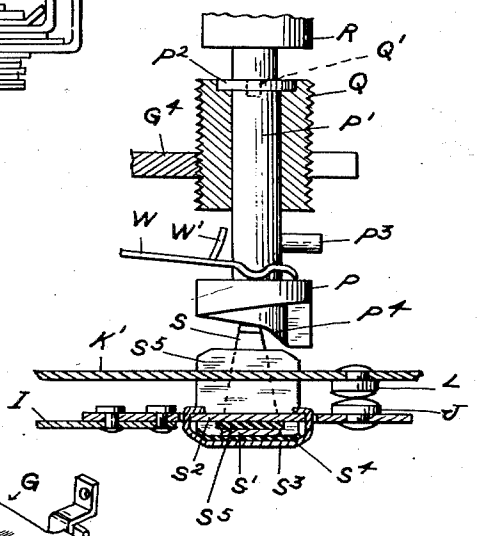

FIG. 5.

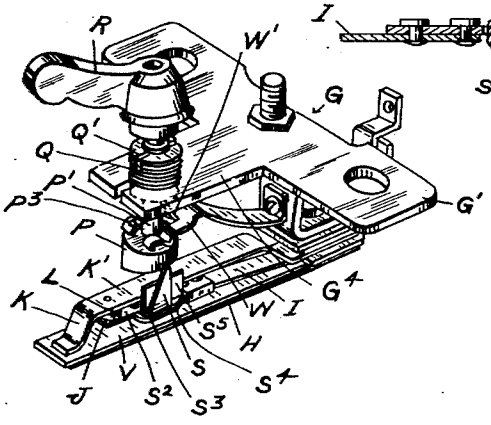

FIG. 6.

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THERMOSTAT

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Application November 5, 1934, Serial No. 751,594

14 Claims. (Cl. 200—39)

The invention relates to thermostats, and more particularly to thermostatically controlled electric switches, being a continuation in part of our pending application for patent Serial No. 593,170, filed February 15, 1932. It is the object of the invention to obtain a simple construction, the elements of which can be easily manufactured and assembled to form a unit applicable to various electrically heated devices. It is a further object to obtain a construction in which the thermostatic element is directly exposed to radiant heat from the body, the temperature of which is to be controlled, and forms a shield for protecting the other elements of the structure from said heat. Still further, it is an object to form in the single unit a thermostatically controlled and a manually operable switch, together with a single operating member for variably adjusting the temperature at which the thermostat operates and for opening the circuit independently thereof. With these and various other specific objects in view the invention consists in the construction as hereinafter set forth.

While our improved thermostatic switch may be used for various purposes, we have specifically illustrated its application to an electrically heated laundry iron and as shown in the drawings.

Fig. 1 is a longitudinal section through a portion of a laundry iron to which the thermostatic switch is applied;

Fig. 2 is a cross section on line 2—2, Fig. 1;

Fig. 3 is a view similar to Fig. 1 showing the parts in different position of adjustment;

Fig. 4 is a side elevation of a modified construction;

Fig. 5 is a perspective view thereof and

Fig. 6 is an enlarged cross section thereof.

The laundry iron to which the thermostat is applied comprises a base portion A above which is placed a heating unit B secured thereto by a heat distributing and clamping plate C. D is a recess extending through the plate C and downward in the base A, leaving only a comparatively thin bottom portion E between the same and the ironing surface. F is our improved thermostatic electric switch located within the recess D and so positioned as to receive heat for its operation through the medium of the thin bottom portion E. As this bottom portion E is not in direct contact with the heating element B, it must receive its heat from the surrounding portion of the base A. Also, by reason of the fact that its point of juncture with the surrounding portion of the base is only slightly above the ironing surface, its temperature will not be greater than that of said ironing surface which is always lower than that of the upper portion of the base. Our improved thermostatic switch is located within the recess D but is supported from the clamping plate C of the laundry iron, the specific construction being as follows:

G is a bracket member of substantially Z-shaped form, this constituting a mounting for the various elements of the thermostatic switch and also the adjustment means. In plan view this bracket is preferably of a T-shaped form, the opposite arms G' of the T-head being secured to the clamping plate C by bolts A^3 and centrally to the hood A' by a bolt A^2. The Z-shaped portion of the bracket has the depending arm G^2 and at its lower end the lateral arm G^3 which extends oppositely from the arm G^4 forming the stem of the T. The thermostatic element H is preferably a bi-metallic bar mounted at one end on the portion G^3 and which is arranged to extend parallel and in close proximity to the bottom portion E, being slightly spaced therefrom to provide for slight variations in mechanical construction and also to receive its heat by radiation from said portion E. All the other elements of the structure are arranged above the thermostatic bar H so as not to interfere with the direct heat transfer from the portion E and being also themselves protected from said direct heat by said thermostatic bar. The arrangement is also such that in normal cool position the bar H is in closest proximity to the portion E while in its heated and warped position its free end bends upward away from this position. As shown in Figs. 1 to 3, the supported end of the thermostatic bar is attached to a block H' upon which is mounted the electric switch. This switch comprises a resilient strip I carrying at its outer end one of the contacts J and above the strip I and insulated therefrom is a second resilient strip K carrying at its outer end a cooperating contact L. The strip K has an extension M which is bent downward and has a mechanical contact N adjacent to the thermostatic bar H. All of these parts are clamped to and supported by the bracket arm G^2. Thus as so far described, whenever the temperature of the bar H is raised sufficiently by heat conducted thereto through the thin bottom portion E, this bar H will warp upward and through the medium of the mechanical contact N and extension M will raise the flexible strip K separating the contact L from the contact J and interrupting the electrical current.

It is desirable to prevent too frequent opening and closing of the switch or what is termed

"fluttering", as this has a tendency to burn out the contacts and also to produce disturbance in any radio apparatus in the vicinity. To accomplish this result, a second thermostat is employed, this being operated by electrical heat generated directly therein. As shown, the second thermostat is a composite bar O secured to a portion of the flexible strip K and adapted when heated by electrical current flowing therethrough to warp said strip inward so as to cause the contact L to move towards the contact J. When the iron is cool the strip O will be warped outward and the contacts L and J will not be closed until the thermostatic bar H is warped downward a sufficient distance. However, as soon as the contacts L and J are closed the bar O will be electrically heated so as to be warped in a downward direction and consequently the switch will not be open until the temperature falls somewhat lower than the temperature at which the switch was closed. This will effectually prevent "fluttering".

To regulate the temperature at which the thermostat operates, there is provided a suitable adjusting device such as the cam P having a screw threaded shank Q engaging the bracket A^2, and an operating handle R above the casing A' of the iron. This cam P forms a stop for engaging a post or finger S on the resilient strip I and by adjusting the cam the position of the stop is altered.

The electrical current is conducted to the thermostat through suitable terminal posts T and T' clamped respectively in contact with the strips I and K and insulated from each other by the intermediate insulating strip U. An insulator strip V is also preferably placed between the resilient strip I and the thermostatic bar H to avoid any accidental electrical connection between these members.

With the construction above described, the location of the thermostatic element H is such as to be shielded from all heat of the iron other than that derived from the thin bottom portion E which in turn must receive its heat by conduction from the portion of the base A which is adjacent to the ironing surface. Thus whenever the iron is being used on a wet garment which rapidly absorbs the heat from the ironing surface, the thermostatic switch will remain closed even though the temperature of the heating unit may be considerably higher than the opening temperature of the switch. In other words, the switch responds to the temperature of the ironing surface rather than to the temperature of any other part of the iron. Thus while the ironing surface is at all times protected from overheating, it is maintained at a temperature for efficiently performing its work.

As shown in Figs. 4 to 6, the construction is similar to that above described, but is formed with a single thermostatic element, viz: the bimetallic bar H. This bar has directly thereabove an insulating strip V, preferably of mica, above which are arranged the resilient strips I and K', similar to the construction previously described. Instead, however, of placing the contact L on a second thermostatic bar O, it is directly connected to the strip K', which strip has at its free end a depending portion K^2 bearing against the insulator strip V. The finger S is attached to the resilient strip I by an angle flange S' which is clamped between a strip S^2 and a clip S^3 with intervening insulating strips S^4 and S^5. The strip S^2 carries at its outer end a contact J and at its inner end is riveted or otherwise connected to the resilient strip I.

The cam P which is adjusted by the handle R has its shank P' passing through a bushing Q externally threaded for engagement with a correspondingly threaded aperture in the portion G^4 of the bracket G. The shank P' has a collar P^2 forming a thrust bearing against the upper end of the bushing Q which is held down by a resilient arm W secured at one end to the portion G^2 of the bracket G and bifurcated at its free end to embrace the shank P' and bear against the upper face of the cam P. This not only holds the collar P^2 against the bushing Q but also forms a friction device which holds the cam P in any position to which it may be adjusted by the handle R. The arm W also has a struck up lug W' which forms a stop for cooperating with a pin P^3 projecting from the shank P' so as to limit the rotary movement of the cam to slightly less than one revolution. The bushing Q has a slot Q' at its upper end by means of which it may be adjusted rotatively to raise or lower it in the bracket G, this being of utility in first adjustment after the assembly of the parts. However, after the device is once adjusted it is then only necessary to adjust the handle R to change the temperature at which the thermostat will be effective in opening the circuit.

The resilient strips I and K' are biased to move towards each other so as to normally hold the contacts J and L together when the finger S is not in engagement with the cam P. In the normal position of the bi-metallic bar H the finger S will be free from contact with the cam during the greater portion of the revolution of the latter, but during a small portion of its angular movement a more abrupt rise P^4 in the cam P will separate these contacts even where the thermostat is at normal temperature. Thus this portion of the cam is utilized for opening and closing the circuit while the remainder of the cam controls the temperature at which the thermostat will automatically operate.

It will be noted that the members H, I, K', V, W, etc., are all comparatively narrow strips which are in alignment with each other and with a cam P, which latter is of a diameter but slightly greater than said strips. This permits of inserting the whole assembly into a comparatively narrow recess in the heated member, while the bracket G forms a convenient means of mounting the unit as well as carrying the adjusting mechanism. The finger S extends in fairly close proximity to the strip K' and to avoid any danger of short-circuiting, one of the insulator strips S^5, preferably formed of mica, is bent upward to extend between the stop and the strip K'. Thus the whole structure is one so designed as to be inexpensive to manufacture, readily assembled and adjusted and effective in its operation.

What we claim as our invention is:

1. A thermostatic switch comprising a supporting bracket, a pair of cooperating spring contact members and a shielding bi-metal thermostatic bar arranged in parallelism and each mounted at one end upon said supporting bracket and insulated therefrom and from each other, the contact member farthest removed from said bar having its free end in mechanical connection therewith to be actuated thereby when the latter is warped by heat and being biased to move in a direction opposite to the direction of warping, the intermediate contact member being biased to move in the opposite direction to follow its

cooperating contact member, a finger on said intermediate contact member insulated therefrom and projecting beyond the other contact member, and an adjustable stop mounted on said bracket member for engaging and arresting movement of said finger to separate said contact members at different points in the movement of said thermostatic bar.

2. A thermostatic switch comprising a supporting bracket, a pair of cooperating spring contact members and a shielding bi-metal thermostatic bar arranged in parallelism and each mounted at one end upon said supporting bracket and insulated therefrom and from each other, the contact member farthest removed from said bar having its free end in mechanical connection therewith to be actuated thereby when the latter is warped by heat and being biased to move in a direction opposite to the direction of warping, the intermediate contact member being biased to move in the opposite direction to follow its cooperating contact member, a finger on said intermediate contact member insulated therefrom and projecting beyond the other contact member, and a rotary cam mounted on said bracket member in the path of said finger to arrest movement of the same and to separate said contact members at different points in the movement of said thermostatic bar.

3. A thermostatic switch comprising a supporting bracket, a pair of cooperating spring contact members and a shielding bi-metal thermostatic bar arranged in parallelism and each mounted at one end upon said supporting bracket and insulated therefrom and from each other, the contact member farthest removed from said bar having its free end in mechanical connection therewith to be actuated thereby when the latter is warped by heat and being biased to move in a direction opposite to the direction of warping, the intermediate contact member being biased to move in the opposite direction to follow its cooperating contact member, a finger on said intermediate contact member insulated therefrom and projecting beyond the other contact member, a rotary cam mounted on said bracket member in the path of said finger to arrest movement of the same and to separate said contact members at different points in the movement of said thermostatic bar, a handle for rotating said cam and a spring arm mounted on said bracket frictionally engaging said cam to hold the same in different positions of adjustment.

4. A thermostatic switch comprising a supporting bracket, a pair of cooperating spring contact members and a shielding bi-metal thermostatic bar arranged in parallelism and each mounted at one end upon said supporting bracket and insulated therefrom and from each other, the contact member farthest removed from said bar having its free end in mechanical connection therewith to be actuated thereby when the latter is warped by heat and being biased to move in a direction opposite to the direction of warping, the intermediate contact member being biased to move in the opposite direction to follow its cooperating contact member, a finger on said intermediate contact member insulated therefrom and projecting beyond the other contact member, a rotary cam in the path of said finger and provided with an operating shank, a bushing threadedly engaging said bracket member forming a journal for said shank, a collar on said shank having a thrust bearing on said bushing, a spring arm mounted on said bracket having a bifurcated free end embracing said shank and bearing on said cam to hold said collar in engagement with said bushing and to frictionally resist rotation of the cam, cooperating projections on said spring arm and said shank adapted to limit the rotation of the latter to slightly less than one revolution, and a handle at the end of said shank for operating the same.

5. A thermostatic switch comprising a bracket member, a pair of parallelly arranged cooperating spring contact members and an actuating bi-metal thermostatic bar, each mounted at one end on said bracket member and insulated therefrom and from each other, an adjustable stop mounted on said bracket member and a finger projecting from one of said spring contact members in the path of said stop, all of said members being confined within narrow space limits in registration with each other, and said thermostatic bar being at the outer end of the series on the opposite side of said spring contact members from said adjustable stop whereby in use it is directly exposed to heat and forms a heat shield for the other members.

6. A thermostatic switch comprising a bi-metal thermostatic bar, cooperating spring contact members above said bar, an extension on the upper contact member mechanically engaging said thermostatic bar whereby the warping of the latter will raise said contact and separate the same from the cooperating contact, a second thermostatic bar on one of said spring contact members and included in the electric circuit when said contacts are closed to be heated by the current passing therethrough, said bar being warped when heated to move its contact towards the cooperating contact member whereby the breaking of the circuit and cooling of said bar will move the same away from the cooperating contact.

7. A thermostatic switch comprising a bi-metal thermostatic bar adapted when heated to be warped upward, a pair of cooperating spring contact members above said thermostatic bar, the upper ends of said spring contact members being provided with an extension arranged in the path of the warping movement of said thermostatic bar, a second thermostatic bar on said upper spring contact member included in the electric circuit to be heated thereby when said cooperating contact members are closed and being warped when heated in a direction towards its cooperating contact member, and adjustable means for positioning the lower spring contact member whereby a predetermined heat will warp said first mentioned thermostatic bar to separate said spring contact members and the cooling of said second thermostatic bar on the breaking of the circuit will further separate said contact members.

8. A thermostatic switch comprising a bi-metal thermostatic bar, a spacer above one end of said thermostatic bar, a pair of spring members mounted above said spacer and insulated therefrom, cooperating contacts at the free ends of said spring members, an extension from the upper spring member arranged in the path of the free end of said thermostatic bar to be actuated thereby when the bar is warped, a second thermostatic bar on the upper spring member included in the electric circuit when said contacts are closed and heated thereby to be warped in a direction towards the cooperating contact member, a post extending upward from the lower spring member, an adjustable stop for contact-

ing with said post and thereby positioning the lower contact for the purpose described.

9. A thermostatic switch comprising a supporting bracket, a pair of cooperating spring contact members and a shielding bi-metal thermostatic bar arranged in parallelism and each mounted at one end upon said supporting bracket and insulated therefrom and from each other, the contact member farthest removed from said bar having its free end in mechanical connection therewith to be actuated thereby when the latter is warped by heat and being biased to move in a direction opposite to the direction of warping, the intermediate contact member being biased to move in the opposite direction to follow its cooperating contact member, a finger on said intermediate contact member insulated therefrom and projecting beyond the other contact member, a rotary cam mounted on said bracket member in the path of said finger to arrest movement of the same, said cam having a gradually rising portion for separating said contact members at different points in the movement of said thermostatic bar and a more abruptly rising portion for separating said contacts when said thermostatic bar is at normal temperature.

10. A thermostatic switch comprising a thermostatic bar supported at one end and adapted to have one side exposed to heat, said thermostatic bar being adapted to move in a direction away from said exposed side during increasing temperature, a contact operatively connected to said thermostatic bar to move therewith, a member on the opposite side of said thermostatic bar from said exposed side and having resilient means for following the movement of said contact, a second contact carried by said member and adapted to cooperate with the first mentioned contact and a stop for engaging said member to separate said contacts after a predetermined movement of said thermostatic bar.

11. A thermostatic switch comprising a thermostatic bar supported at one end and adapted to have one side exposed to heat, said thermostatic bar being adapted to move in a direction away from said exposed side during increasing temperature, a pair of members on the opposite side of said thermostatic bar from said exposed side, means for moving one of said members with said thermostatic bar, the other of said members having resilient means for following the movement of said first member, cooperating contacts operatively connected to the respective members aforesaid to be movable thereby and a stop for engaging said second member to separate said contacts after a predetermined movement of said thermostatic bar.

12. A thermostatic switch comprising a thermostatic bar supported at one end and adapted to have the free end thereof move in a direction transverse to the direction of its length under changing temperature conditions, a contact operatively connected to said thermostatic bar to move therewith, a member on one side of said thermostatic bar having resilient means for following the movement of said contact, a second contact carried by said member and adapted to cooperate with the first mentioned contact and a stop on the same side of said thermostatic bar as said member and on the opposite side of said member from said thermostatic bar, said stop being in the path of movement of said member and adapted to engage the same to separate said contacts after a predetermined movement of said thermostatic bar.

13. A thermostatic switch comprising a thermostatic bar supported at one end and adapted to have the free end thereof move laterally under temperature changes, a contact operatively connected to said thermostatic bar to be moved thereby, a second cooperating contact, means for urging said second contact into engagement with said first contact, a rotatable cam, a cam-engaging member operatively connected to said second cooperating contact, said cam having a gradually rising active surface and having an abruptly rising surface adjacent thereto and a handle operatively connected to said cam for rotating the same to bring the gradually rising portion and the abruptly rising portion into successive engagement with said cam follower.

14. A thermostatic switch comprising a thermostatic bar supported at one end and adapted to have the free end thereof move laterally under temperature changes, a contact operatively connected to said thermostatic bar to be moved thereby, a second cooperating contact, means for urging said second contact into engagement with said first contact, a rotatable handle, means operatively connected to said rotatable handle forming a variable stop for said second contact thereby regulating the temperature at which said contacts automatically separate in accordance with the position of said handle, said variable stop being formed with a gradually rising cam surface for varying the temperature setting of said thermostatic switch, and said variable stop being provided with an abruptly rising cam surface to positively separate said contacts and prevent automatic closing of the same under any normal temperature.

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