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A. A. THOMAS

1,733,085

ELECTRIC THERMOSTAT

Filed June 13, 1927

FIG. 1.

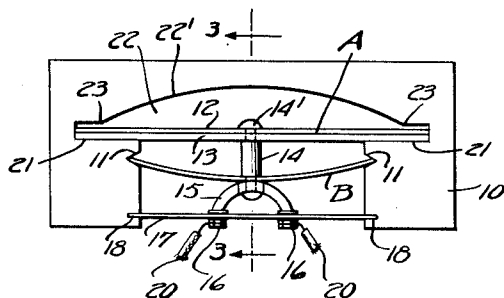


FIG. 2.

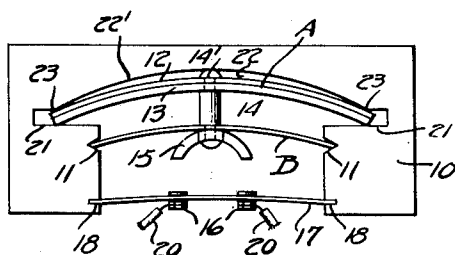


FIG. 3.

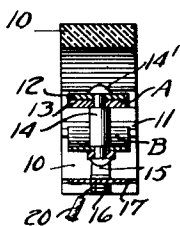
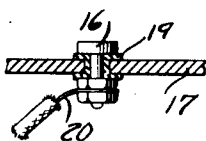


FIG. 4.



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ELECTRIC THERMOSTAT

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My invention relates to thermostats particularly adapted to open and close electric circuits at predetermined changes of temperatures, and its object is to provide a thermostat of simple compact structure capable of operating with a snap action to prevent arcing at the switch contacts.

Briefly stated, I employ a buckling spring adapted to be snapped into reverse curvature by a thermostatic element at certain high and low temperature limits. The spring carries a contact member or connecting piece, which normally engages a pair of insulated contacts mounted on a resilient support independently of the buckling spring. The circuit is closed through the contacts in series. When the spring is buckled by the thermostatic element at high temperature, the connecting member carried by the spring is quickly withdrawn from the resilient contacts and the circuit is abruptly broken at two points in series, so that no arcing occurs. Conversely, when the spring is snapped back to initial position by the cooling action of the thermostatic element, the circuit is closed by sudden engagement of the connecting member with the resilient contacts. Instead of a pair of contacts in series, I may use only a single resilient contact where the circuit load is not heavy; and then again, when circuit conditions require it, I may employ more than two contacts in series to reduce the voltage at each gap.

In a preferred form of my invention, particularly when it is necessary to have a flat construction, I connect the center of a thermostat bar to the center of a bowed spring, the ends of the bar being free to move. The parts are supported in a flat frame and arranged in the plane thereof without projecting beyond the same. The mounting of the thermostat bar is such that at predetermined high temperature it curves or arches at the center and pulls the bowed spring into reverse curvature, thereby quickly opening the electric circuit, as above explained. Since the free ends of the thermostat bar move under the action of heat, the bar readily assumes its required shape without exerting undue strain on the spring. The return of the bar to normal posi-

tion on cooling automatically closes the circuit with a snap action.

The novel features and practical advantages of my invention will be fully understood from a detailed description of the accompanying drawings, in which—

Fig. 1 shows a thermostat constructed in accordance with my invention, the parts being shown in normal circuit-closing position;

Fig. 2 is a view similar to Fig. 1, with the parts actuated to break the circuit;

Fig. 3 is a transverse cross-section on line 3—3 of Fig. 1; and

Fig. 4 is a fragmentary detail view on an enlarged scale to show one of the insulated switch contacts.

The operative parts of the instrument are mounted on a suitable base or frame 10, which may be of metal or of insulating material having the requisite strength and heat-resisting property. The frame 10 is preferably made as a single piece and need not be wider than the thermostat bar A and the buckling spring B, both of which are mounted on the frame in the plane thereof. A simple way of supporting the spring B is to insert its ends in V-shaped notches 11 on frame 10. If the spring B is in the form of a cupped diaphragm, the notches 11 will be a circular supporting groove for the periphery of the diaphragm.

The thermostat bar A is of usual bimetallic construction, comprising a brass strip 12 and an iron strip 13, or equivalent metals having different coefficients of expansion. A suitable fastening member 14, such as a bolt, rivet or the like, connects the thermostat bar A at the center to the center of buckling spring B. When I say that parts A and B are connected at the center, I do not mean at their exact center, but as near their central points as practical conditions permit.

The buckling spring B carries a connecting piece or contact member 15, which may conveniently be held in place by the bolt or rivet 14. The connecting piece 15 normally engages a pair of insulated contacts 16 mounted on a spring arm 17, which is supported at its ends on the frame or base 10 in any convenient way. In the present instance, the arm

17 is in the form of a flat spring blade having its ends inserted in slots 18 of frame 10. The resilient arm 17 is preferably bowed slightly toward the buckling spring B, as illustrated in Fig. 2, so that the insulated contacts 16 are pressed firmly against the connecting piece 15 during the circuit-closing position of parts A and B. The contacts 16 are insulated in any practical way, as by means of insulated sleeves or jackets 19 (see Fig. 4). The lower ends of contacts 16 may conveniently serve as binding posts for circuit conductors 20.

At normal or predetermined low temperature, the parts A and B are in the position shown in Fig. 1. That is to say, the thermostat bar A is substantially straight with its ends resting on shoulders 21 of frame 10, and the buckling spring B is curved downwardly to hold the contact member 15 in firm engagement with the insulated terminals 16. As the temperature of thermostat bar A increases, the ends of the bar brace themselves against the shoulders 21 and the center of the bar moves or tends to move upwardly. This tendency of the thermostat bar to assume a curved or arched shape is resisted by the inherent tension of spring B, so that the circuit remains closed. However, as the temperature increases, a point is reached when the upward pull or pressure exerted by the center of bar A overcomes the resisting power of spring B, whereupon the latter is suddenly snapped into reverse curvature, as shown in Fig. 2. Consequently, the connecting member 15 is quickly moved away from the contacts 16, so that the circuit is abruptly broken at two points in series. This sudden opening of the circuit at two places prevents arcing or burning of the contacts by producing two gaps in series. The effective voltage at each gap is one-half of the circuit voltage, so that the instrument is capable of controlling circuits of high wattage without danger of arcing at the moment of break.

The supporting frame 10 is provided with an arched opening 22 which gives the thermostat bar A sufficient room to assume a curved shape when the spring B is snapped into reverse curvature. This freedom of movement of bar A under the action of heat until the internal stresses have exhausted themselves to a state of equilibrium, prevents undue strains from being communicated to the buckling spring B through the rigid connection 14. If desired, the opening 22 may be so formed that the head 14' of bolt 14 strikes the edge 22' to act as a stop for the bar A. This is clear from Fig. 2.

As a curved thermostat bar A begins to cool, after the circuit has been opened, it tends to assume its normal straight position. During the cooling of the bar, the ends brace themselves against the shoulders 23 (see Fig. 2), so that the center of the bar exerts a downward pressure on the center of spring

B. This tendency of the cooling thermostat bar A to move down at the center is resisted by the spring B until the increasing pressure of the bar overcomes the opposition of the spring, whereupon the latter is snapped back to initial circuit-closing position, as illustrated in Fig. 1. As the contact piece 15 strikes the contacts 16, the spring arm 17 is slightly forced down against its own normal tension, whereby the contact members 15 and 16 are held pressed together in firm engagement. It should be noted that the yieldable arm 17 prevents the separation of bridge piece 15 and contacts 16 during the preliminary movements of spring B before the snap-over operation, so that no fluttering and arcing takes place at the contacts before the circuit is broken. In other words, the switch members 15—16 are firmly held closed until the actual buckling of spring B.

The predetermined high and low temperatures at which the parts A and B shall operate to break and make the circuit, can be determined by experiments that lie well within the skill of the artisan trained in this line. When once the proper dimensions of the thermostat bar A and the spring B have been obtained for a particular type of instrument, it is easy to calibrate the instruments for mass production.

Attention is called to the unusual simplicity and compactness of my new thermostat. The actual device can be made much smaller than the instrument represented in the drawings, which are largely diagrammatic and have been purposely enlarged for the sake of clearness. The flatness of the thermostat as a whole makes it easy to instal the same either in vertical or horizontal position in a very small space. This makes the instrument particularly adapted for use in electric flat-irons and other household heating appliances where it is necessary or advisable to prevent overheating. The few parts that comprise my new thermostat are cheap to make, easy to instal, and so rugged that they will not get out of order in ordinary use. When in the specification and claims I refer to the thermostat bar being connected to the center of the buckling spring or bowed spring member, I do not, of course, mean the mathematical center of the spring but at or near its central point.

Although I have shown and described a specific construction, I wish to be understood that my invention is not limited to the details set forth. It may be assumed that changes and modifications will occur to the experienced thermostat builder without departing from the scope of the invention as expressed in the following claims.

I claim as my invention:

1. An electric thermostat comprising a bowed spring adapted to snap into reverse curvature by external pressure at the center,

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a thermostat bar secured centrally to the center of said spring, the ends of said bar being free to move, stops arranged to engage the free ends of said bar to compel movement of the latter at the center under predetermined changes of temperature, whereby said spring is suddenly snapped into reverse curvature, a stationary contact supported independently of said spring and said bar, and a contact connected to said spring and normally engaging said stationary contact to close an electric circuit, the abrupt reversing movements of said spring by said bar causing quick opening and closing of the circuit.

2. An electric thermostat comprising a bowed spring adapted to snap into reverse curvature by external pressure at the center, a thermostat bar secured centrally to the center of said spring, the ends of said bar being free to move, stops arranged to engage the free ends of said bar to compel movement of the latter at the center under predetermined changes of temperature, whereby said spring is suddenly snapped into reverse curvature, a contact resiliently mounted independently of said spring and said bar, and a contact connected to the center of said spring and normally engaging said resiliently mounted contact to close an electric circuit, the abrupt reversing movements of said spring by said bar causing quick opening and closing of the circuit.

3. An electric thermostat comprising a bowed spring adapted to reverse its curvature abruptly by external pressure, a thermostat bar connected to said spring for snapping the same into reverse curvature at predetermined high and low temperatures, a pair of insulated contacts resiliently mounted independently of said spring and said bar, and a connecting piece secured to said spring and normally engaging said contacts to close an electric circuit in series through said contacts, the abrupt reversing movements of said spring by said bar causing quick opening and closing of the circuit at two points in series.

4. An electric thermostat comprising a frame, a buckling spring mounted on said frame, a thermostat bar connected to said spring for snapping the same into reverse curvature at predetermined high and low temperatures, a resilient arm mounted on said frame and carrying a pair of insulated contacts, and contact means connected to said spring for normally engaging said resiliently mounted contacts to close an electric circuit in series through said contacts, the abrupt reversing movements of said spring by said bar causing quick opening and closing of the circuit at two points in series.

5. An electric thermostat comprising a bowed spring adapted to snap into reverse curvature by external pressure at the center, a thermostat bar secured centrally to the center of said spring, the ends of said bar

being free to move, stops arranged to engage the free ends of said bar to compel movement of the latter at the center under predetermined changes of temperature, whereby said spring is suddenly snapped into reverse curvature, a pair of insulated contacts supported independently of said spring and said bar, and connecting means movable with said spring and normally engaging said contacts to close an electric circuit in series through said contacts, the abrupt reversing movements of said spring by said bar causing quick opening and closing of the circuit at two points in series.

6. An electric thermostat comprising a supporting frame, a bowed spring mounted on said frame and adapted to snap into reverse curvature by external pressure at the center, a thermostat bar secured centrally to the center of said spring, the ends of said bar being free to move, stops on said frame for engaging the free ends of said bar to compel movement of the latter at the center under predetermined changes of temperature, whereby said spring is suddenly snapped into reverse curvature, a resilient arm mounted on said frame and carrying contact means, and a contact member connected to said spring and normally engaging said contact means to close an electric circuit, the abrupt reversing movements of said spring by said bar causing quick opening and closing of the circuit.

7. An electric thermostat comprising a supporting frame, a bowed spring mounted on said frame and adapted to reverse its curvature abruptly by external pressure, a thermostat bar connected to said spring for snapping the same into reverse curvature at predetermined high and low temperatures, a resilient arm supported at its ends on said frame and carrying a pair of insulated contacts adapted to be connected in circuit, and a contact member connected to said spring and normally engaging said contacts to close the circuit, the abrupt reversing movements of said spring by said bar causing quick opening and closing of the circuit at two points in series.

8. An electric thermostat comprising a flat supporting frame, a bowed spring mounted on said frame and adapted to reverse its curvature abruptly by external pressure, a thermostat bar rigidly connected to said spring for snapping the same into reverse curvature at predetermined high and low temperatures, said spring and said bar being arranged in the plane of said supporting frame to produce a flat construction, a resilient arm supported on said flat frame in the plane thereof and carrying contact means, and a contact member secured to said spring and normally engaging said contact means to close an electric circuit, the abrupt reversing movements of said spring by said

bar causing quick opening and closing of the circuit.

9. An electric thermostat comprising a flat supporting frame made in one piece, a buckling spring mounted at its ends on said frame, a thermostat bar connected to the center of said spring for snapping the same into reverse curvature at predetermined high and low temperatures, a pair of spaced lugs on said frame, a spring arm supported at its ends by said lugs, said spring and bar and arm being all arranged in the plane of said frame to produce a flat construction, a pair of insulated contacts carried by said spring arm, and a connecting piece secured to the center of said spring for normally engaging said contacts to close an electric circuit in series through said contacts, the abrupt reversing movements of said spring by said bar causing quick opening and closing of the circuit at two points in series.

10. An electric thermostat comprising a flat supporting frame, a bowed spring mounted on said frame and adapted to snap into reverse curvature by external pressure at the center, a thermostat bar secured centrally to the center of said spring, the ends of said bar being free to move, said spring and said bar being arranged in the plane of said supporting frame to produce a flat construction, stops on said frame for engaging the free ends of said bar to compel movement of the latter at the center under predetermined changes of temperature, whereby said spring is suddenly snapped into reverse curvature, a resilient arm supported at its ends on said frame in the plane thereof, a pair of insulated contacts carried by said arm and adapted to be connected in circuit, and a contact member secured to said spring and normally engaging said insulated contacts, the abrupt reversing movements of said spring by said bar causing quick opening and closing of the circuit at two points in series.

11. An electric thermostat comprising a bowed spring member, a pair of insulated contacts resiliently mounted independently of said spring member, contact means carried by said spring member for normally engaging said resilient contacts to close an electric circuit, and a thermostat bar connected to the center of said spring member for snapping the same into reverse curvature at predetermined high and low temperatures.

12. An electric thermostat comprising a support, a buckling spring mounted at its ends on said support, a resilient arm also mounted at its ends on said support independently of said spring, a pair of insulated contacts carried by said arm, a bridge piece carried by said buckling spring and normally in pressure engagement with said contacts to close an electric circuit, and thermostatic means secured to the center of said spring to snap the same into reverse curvature at

predetermined high and low temperatures.

13. An electric thermostat comprising a bowed spring member, a thermostat bar rigidly connected to the center of said spring member to snap the same into reverse curvature at predetermined high and low temperatures, contact means secured to said spring member, and stationary contact means normally engaged by said movable contact means to close an electric circuit, said movable contact means being abruptly carried out of and into engagement with said stationary contact means during the snap-over action of said spring member.

14. An electric thermostat comprising a bowed spring member, a thermostat bar rigidly connected to the center of said spring member to snap the same into reverse curvature at predetermined high and low temperatures, contact means secured to said spring member, stationary contact means normally engaged by said movable contact means to close an electric circuit, said movable contact means being abruptly carried out of and into engagement with said stationary contact means during the snap-over action of said spring member, and resilient means whereby said contact means remain in circuit-closing position during the preliminary movements of said spring member and thermostat bar prior to the snap-over operation.

15. An electric thermostat comprising a bowed spring member, a thermostat bar rigidly connected to the center of said spring member to snap the same into reverse curvature at predetermined high and low temperatures, a resilient arm carrying contact means, and contact means carried by said spring member and normally engaging said resilient contact means to close an electric circuit, said resilient arm permitting preliminary movement of said spring member and said thermostat bar prior to the snap-over operation at high temperature without separation of said contact means.

16. An electric thermostat comprising a bowed spring member, thermostatic means for snapping said member into reverse curvature at predetermined high and low temperatures, contact means secured to said spring member, and stationary contact means normally engaged by said movable contact means to close an electric circuit, said movable contact means being abruptly carried out of and into engagement with said stationary contact means during the snap-over action of said spring member, said movable and stationary contact means opening the circuit at a plurality of airgaps in series.

17. An electric thermostat comprising a bowed spring member, thermostatic means for snapping said member into reverse curvature at predetermined high and low temperatures, a resilient arm carrying contact means, and contact means carried by said spring

member and normally engaging said resilient contact means to close an electric circuit, said resilient arm permitting preliminary movement of said spring member prior to the snap-over operation at high temperature without separation of said contact means.

18. An electric thermostat comprising the combination of a buckling spring supported at its ends, a thermostat bar operatively connected to said spring and adapted to snap the same into reverse curvature at predetermined high and low temperature limits, the center of said bar being substantially in line with the center of said spring, switch contacts opened and closed abruptly by the buckling movements of said spring, and means whereby the preliminary movements of said thermostat bar do not affect said contacts.

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