June 19, 1923.

1,458,924

H. F. BANAN

THERMOSTAT

Filed Jan. 20, 1920

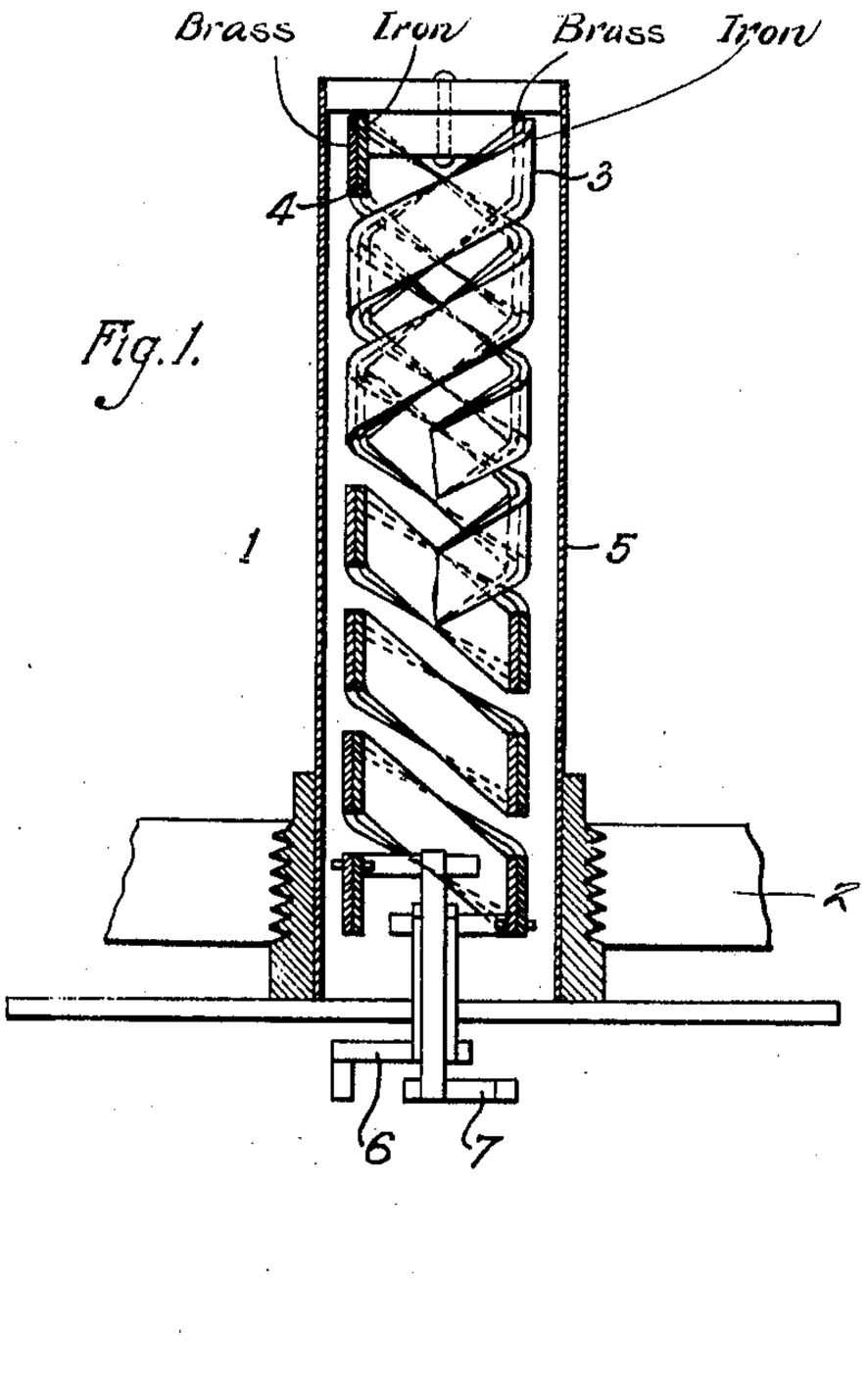

Fig. 1.

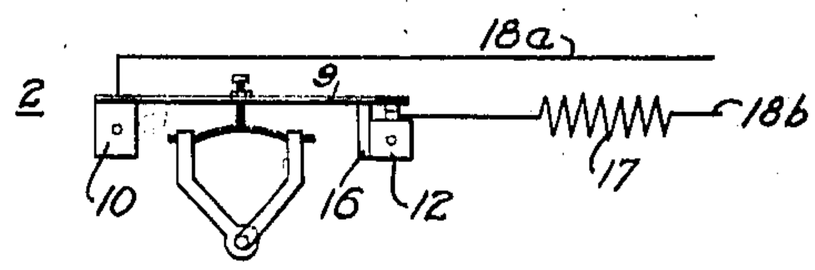

Fig. 3.

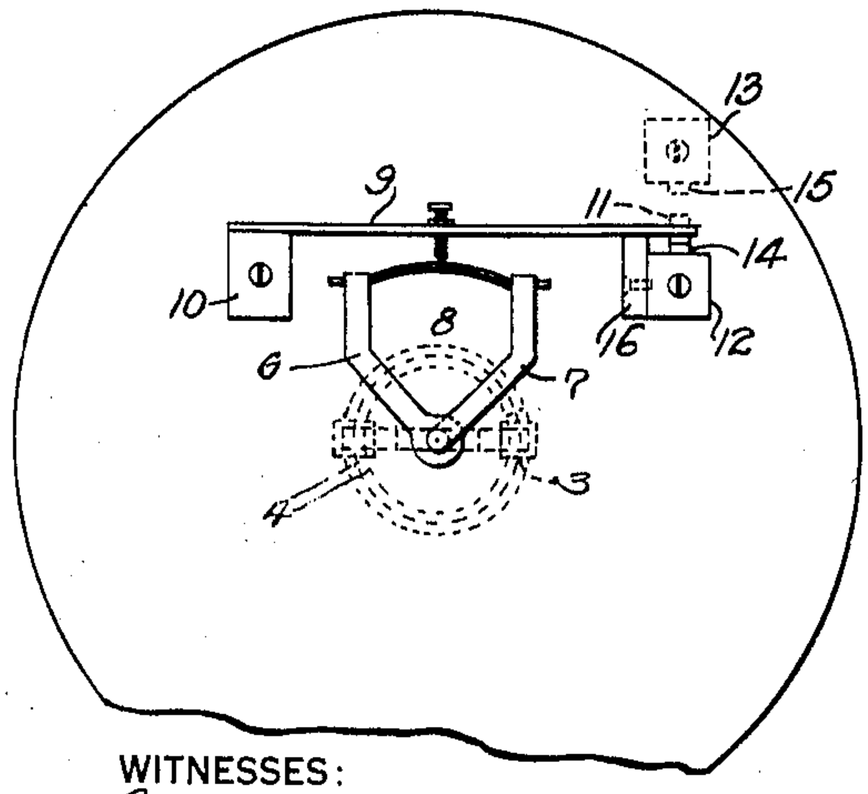

Fig. 2.

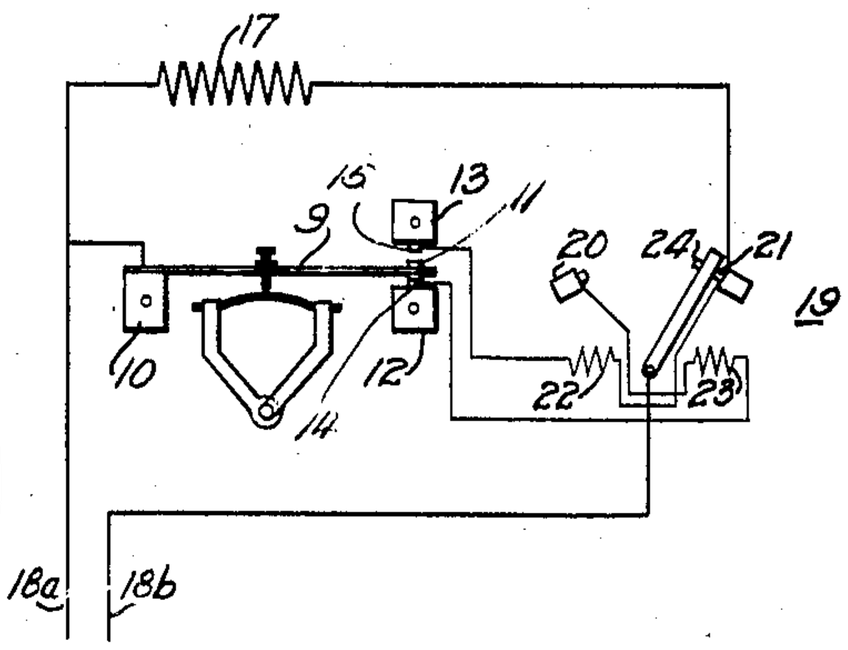

Fig. 4.

WITNESSES:

Geo. L. Barrett.

J. E. Foster

INVENTOR

Horace F. Banan.

BY

Wesley G. Carr

ATTORNEY

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UNITED STATES PATENT OFFICE.

HORACE F. BANAN, OF WILKINSBURG, PENNSYLVANIA, ASSIGNOR TO WESTINGHOUSE ELECTRIC & MANUFACTURING COMPANY, A CORPORATION OF PENNSYLVANIA.

THERMOSTAT.

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To all whom it may concern:

Be it known that I, HORACE F. BANAN, a citizen of the United States, and a resident of Wilkinsburg, in the county of Allegheny and State of Pennsylvania, have invented a new and useful Improvement in Thermostats, of which the following is a specification.

My invention relates to thermostats and particularly to thermostats of the bi-metallic type.

One object of my invention is to provide a thermostat whereby the temperature of a heat-storage device may be controlled between predetermined desirable limits.

Another object of my invention is to provide a device of the above indicated character that shall be simple and compact in construction and positive and reliable in operation.

In practising my invention, I provide two helical bi-metallic members that are secured to a stationary member at one end thereof and adapted to actuate a buckling spring at the other end thereof. The bi-metallic members are so disposed that they tend to turn in opposite directions and actuate the buckling spring, when subjected to temperature changes. The buckling spring actuates a resilient pivotally mounted member to effect engagement between a movable contact member and a plurality of stationary contact members. A magnetic member is provided to maintain positive engagement between the movable and the stationary contact members that are engaged while the heating element of a heat-storage device, that is controlled by the thermostat is energized. The magnetic member also causes disengagement of the contact members to be effected with a snap action. Where a comparatively large current is desired for energizing the heating element of a heat-storage device the thermostat embodying my invention may be used to so actuate a relay that it may close and open the circuit of the heating element.

In the accompanying drawings, Fig. 1 is a plan view, partially in section, of the device embodying my invention; Fig. 2 is a front elevational view of the device shown in Fig. 1; Fig. 3 is a diagrammatic view of a temperature-control circuit embodying the device shown in Fig. 1; Fig. 4 is a diagrammatic view of a modified form of temperature-control circuit embodying the device shown in Fig. 1.

A thermostat 1 for controlling the temperature of a heat-storage device 2 comprises a plurality of helical bi-metallic members 3 and 4 in a casing 5 that is adapted to be inserted in the heat-storage device 2. The bi-metallic members 3 and 4 are secured to the casing 5 at one end thereof and are adapted to actuate a plurality of cam members 6 and 7 by the other ends thereof. A buckling spring 8 is so disposed between the cam members 6 and 7 as to be buckled thereby upon the occurrence of a predetermined temperature in the heat-storage device 2. The bimetallic member 3 is so wound that the element having the greater coefficient of expansion is disposed within the helix and the member 4 is so wound that the corresponding element is disposed on the outer side of the helix. Upon an increase in the ambient temperature, the two members tend, therefore, to turn in opposite directions, because of the differential disposition of the elements composing the same. A compression force is thus applied to the ends of the spring 8, by means of the cam members 6 and 7, that causes the spring to buckle.

A resilient member 9 is pivotally mounted, at one end thereof, on a terminal 10 and has a contact member 11 mounted on the other end thereof. A plurality of terminal blocks 12 and 13 have a plurality of contact members 14 and 15 respectively secured thereto and are so disposed, at the respective sides of the free end of the resilient member 9, that engagement is effected between the stationary contact members 14 and 15 and the movable contact member 11 when the resilient member 9 is actuated by the buckling spring 8. In a simple form of the device in which engagement and disengagement only, between the contact members, are desired, a magnetic member 16 is provided to so attract the resilient member 9 thereto as to maintain positive engagement between the contact members 11 and 14 until the disengagement thereof. The magnetic member 16 further serves to cause the disengagement of the contact members 11 and 14 to be effected with a snap action.

In a simple control circuit, the latter form of controlling device is employed, as illustrated in Fig. 3 of the accompanying drawings. A heating element 17 is adapted to heat the storage device 2 and is connected in series with the circuit 18 and the thermostat device 1. A conductor 18*a*, of the circuit 18, is connected to the terminal block 10 of the thermostat 1, and a conductor 18*b* is connected to one terminal of the heating element 17 the other terminal of which is connected to the terminal block 12.

In the circuit that is illustrated in Fig. 4, a change-over relay 19 is employed. The relay 19 comprises a plurality of contact members 20 and 21 and a plurality of energizing windings 22 and 23, respectively. One terminal of each winding 22 and 23 is connected to the terminal blocks 13 and 12, respectively, and the other terminal of each winding 22 and 23 is connected to the opposite contact members 21 and 20, respectively. The movable contact member 24 is so mounted as to be actuated by the windings 22 and 23 to effect engagement with the stationary contact members 20 and 21. The heating element 17 of the storage device 2 is connected between the contact member 21 of the relay 19 and the terminal block 10 of the thermostat 1. One conductor 18*a* of the circuit 18 is connected to the terminal block 10 and the other conductor 18*b* is connected to the movable contact member 24 of the relay 19.

As the temperature of the heat-storage device 2 attains a predetermined value; the bi-metallic members 3 and 4 so turn the cam members 6 and 7 as to produce a buckling effect in the spring 8 therebetween, that causes it to actuate the pivotally-mounted member 9. In the circuit that is illustrated in Fig. 3, the disengagement of the contact members 11 and 14 opens the circuit of the heating element 17 and precludes a current from traversing the same until the temperature in the heat-storage device 2 has been so reduced that the bi-metallic members 3 and 4 assume their initial positions. In the circuit that is illustrated in Fig. 4, actuation of the resilient member 9 effects disengagement of the contact members 11 and 14, and engagement between the contact members 11 and 15. A circuit is thereby completed from the conductor 18*a*, through the resilient member 9, the contacts 11 and 15, the winding 22 and the contacts 21 and 24 of the relay 19, to the conductor 18*b*, that energizes the winding 22. The winding 22, having become thus energized, so actuates the contact member 24 as to effect disengagement of the contact members 21 and 24 and engagement between the contact members 20 and 24. The disengagement of the contact members 21 and 24 interrupts the flow of current through the heating element 17. After the temperature has been sufficiently reduced in the heat-storage device 2, the bimetallic members 3 and 4 assume their initial positions and permit the buckling spring 8 to assume its initial position. The resilient member 9 is, consequently, permitted to return to its initial position, thereby effecting disengagement of the contact members 11 and 15 and engagement of the contact members 11 and 14. A circuit for energizing the winding 23 is thereby completed from the conductor 18*a*, through the resilient member 9, the contact members 11 and 14, the winding 23 and the contact members 20 and 24, to the conductor 18*b*. The winding 23, being energized so actuates the contact member 24 as to effect disengagement of the contact members 20 and 24 and engagement between the contact members 21 and 24. The circuit connections for energizing the heating element 17 of the heat-storage device 2 is thereby recompleted from the conductor 18*a*, through the heating element 17 and the contact members 21 and 24, to the conductor 18*b*.

Although I have shown a plurality of devices embodying my invention, it is not limited to the particular construction shown since various modifications may be made therein without departing from the spirit and scope of the invention as set forth in the appended claims.

I claim as my invention:

1. In a thermostat, the combination with a resilient member and a plurality of contact members, engagement of which is effected by the resilient member, of a plurality of differentially-wound helical bi-metallic members for actuating the resilient member.

2. In a thermostat, the combination with a plurality of resilient members and a plurality of contact members, engagement of which is effected by the resilient members, of a plurality of helical bi-metallic members mechanically co-operating to actuate the resilient members.

3. In a thermostat, the combination with a plurality of resilient members, a plurality of stationary contact members and a movable contact member actuated by the resilient members, of a plurality of helical bi-metallic members for actuating the resilient member.

4. In a thermostat, the combination with a plurality of cam members, a plurality of resilient members actuated by the cam members and a plurality of contact members, engagement of which is effected by the resilient members, of a plurality of helical bimetallic members for actuating the cam members.

5. In a thermostat, the combination with a plurality of cam members, a buckling member actuated thereby, a plurality of contact members and a resilient member for effecting engagement thereof in accordance with the movement of the buckling member, of a

plurality of helical bi-metallic members for actuating the cam members.

6. In a thermostat, the combination with a plurality of contact members and a movable contact member adapted to effect engagement therewith, of a plurality of helical bi-metallic members, a plurality of cam members actuated thereby, and a buckling member so actuated by the cam members as to effect engagement between the stationary and the movable contact members in accordance with the movement thereof.

7. In a thermostat, the combination with a plurality of contact members and means for causing the disengagement, thereof to be effected with a snap action, of a plurality of helical bi-metallic members a casing therefor, a plurality of cam members actuated thereby, a buckling member actuated by the cam members and a resilient member actuated by the buckling member for effecting engagement of the contact members.

8. In a temperature-control system, the combination with a heat-storage device, of a casing, a plurality of helically-wound bimetallic members in the casing, a plurality of cam members actuated by the bi-metallic members, a resilient member actuated by the cam members and a plurality of contact members positive engagement and disengagement of which are effected by the resilient member.

9. In a thermostat, the combination with a plurality of differentially-wound helical bi-metallic members, of a resilient member actuated thereby.

10. In a thermostat, the combination with a plurality of differentially-wound helical bi-metallic members, of a resilient member actuated thereby and a contact member controlled by the resilient member.

11. A thermostat comprising a plurality of helically-wound differentially-acting bimetallic members.

12. A thermostat comprising two helically-wound bimetallic members, the convolutions of each being disposed between the convolutions of the other.

13. A thermostat comprising two helically-wound bimetallic members having the same diameter and disposed to present an apparently continuous helix.

14. A thermostat comprising two helically-wound bimetallic members, the convolutions of which are mutually interfitting.

15. A thermostat comprising two helically-wound bimetallic members arranged to form a double interfitting helix, the elements of one bimetallic member being oppositely arranged with respect to the elements of the other.

16. A thermostat comprising a movable contact member normally biased to engage a stationary contact member, means rendered operative with a snap action for effecting the disengagement of the contact members and thermally responsive means for controlling said snap-action means.

17. A thermostat comprising a stationary contact member, a movable contact member normally biased to open position relative thereto, a thermally responsive means, and an operating member controllable by the thermally-responsive means under predetermined temperature conditions and operative only under such conditions to engage and control the actuation of the movable contact member.

18. In a thermostat, the combination with a movable contact member and a thermally responsive device for controlling the actuation of the contact member under predetermined thermal conditions, of means independent of the contact member and operative under the predetermined conditions to actuate the contact member with a quick movement.

19. In a thermostat, the combination with a movable contact member and a thermally responsive device for controlling the actuation of the contact member under predetermined thermal conditions, of energy-storing means controllable by the thermally responsive member and means operative by said means when energized to a predetermined degree for controlling the contact member.

20. In a thermostat, the combination with a movable contact member and a thermally responsive device for controlling the actuation of the contact member under predetermined thermal conditions, of a snap spring controllable by the thermally responsive member and operative when "snapped" to actuate the contact member.

21. A thermostat comprising two spirally wound bimetallic members extending in opposite directions, a supporting member to which one end of each bimetallic member is secured, contactive means so disposed as to be relatively uninfluenced by movements of the bimetallic members within predetermined limits, and means controlled by the bimetallic members for controlling the cooperative relation between the contact members when the movements of the bimetallic members exceed the predetermined limits.

22. A thermostat comprising two spirally wound bimetallic members extending in opposite directions, a supporting member to which one end of each bimetallic member is secured, a plurality of contact members and means controlled by the bimetallic members only when a predetermined degree of energization therein is attained for controlling the cooperation of the contact members.

23. A thermostat comprising two spirally wound bimetallic members extending in opposite directions, a supporting member to which one end of each bimetallic member is secured, a plurality of contact members and

means resiliently supported by the free ends of the bimetallic members for controlling the cooperation of the contact members only when predetermined degrees of energization are attained in the bimetallic members.

24. A thermostat comprising two spirally wound bimetallic members, each supported at one end thereof, a circuit-controlling device, and means resiliently mounted upon and controlled by the free ends of both members for controlling the circuit-controlling device.

25. A thermostat comprising as a unit, a supporting structure, two spirally wound bimetallic members each secured by one end thereof to the supporting structure and extending in opposite directions, and means supported on and controlled by the free ends of the bimetallic members for controlling an external circuit.

26. A thermostat comprising a supporting member, two spirally wound bimetallic members having one end of each secured to the supporting member, an element supported by the free ends of the bimetallic members and controlled by the cumulative action of both bimetallic members, and circuit-controlling means rendered operative by the controlled element when a predetermined torque is established by the two bimetallic members.

In testimony whereof, I have hereunto subscribed my name this 19th day of December, 1919.

HORACE F. BANAN.