Oct. 16, 1934. H. A. MANTZ 1,976,954

CONTROL DEVICE

Filed July 1, 1931

Fig. 1.

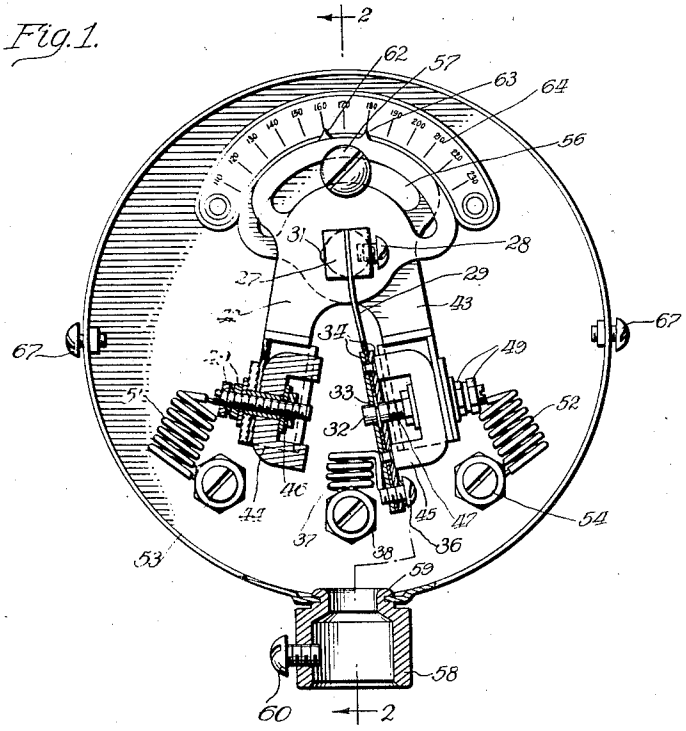
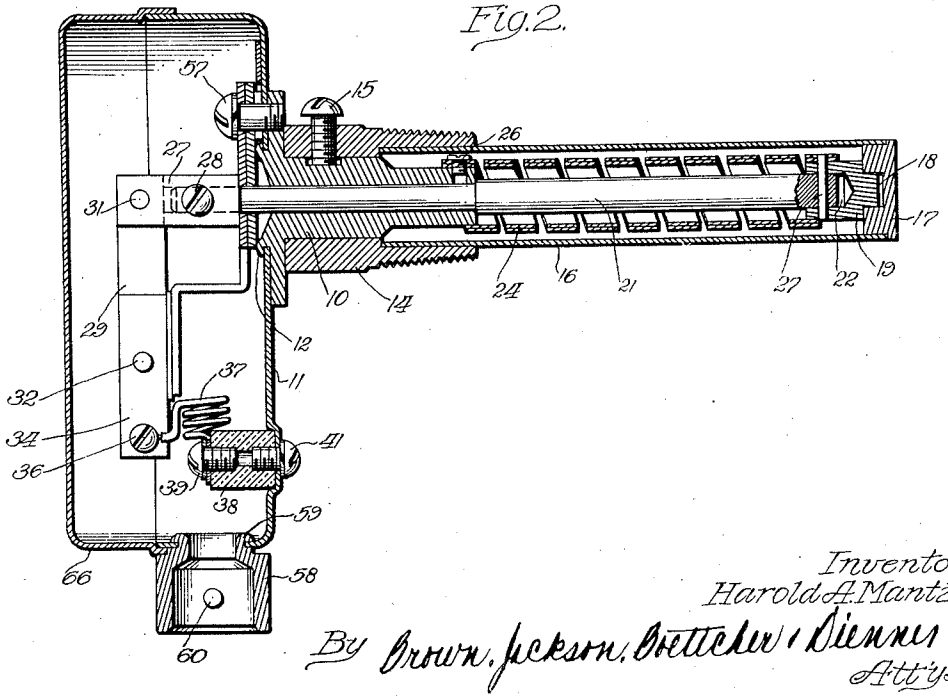


Fig. 2.



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CONTROL DEVICE

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15 Claims. (Cl. 200—138)

This invention relates to thermostatic control devices and has particular relation to a thermostatic control of the snap acting variety.

I have considered the problem of controlling the temperature of an oven or other heating device and have observed that the devices of the prior art are not always satisfactory because of their slowness of action, because fine adjustments cannot be made and because their action is not positive. The devices of the prior art were not satisfactory from the standpoint of sensitivity.

I have conceived of a means for avoiding these difficulties and have provided a device which will satisfactorily maintain the temperature of an oven or the like at certain preselected values without undue wear of or injury to the control means.

A general object of my invention is, therefore, to provide a means of controlling the temperature of a furnace, oven or other heating device.

More particularly it is an object of my invention to provide a device of the above character which is rapid and positive in action, and which is sensitive and capable of close adjustment.

Another object of my invention is to provide a device in which positive contact is made between the fixed and movable contacts.

Another object of my invention is to provide a device of the above character which will accurately determine the temperature of the furnace, oven or other heating device within certain predetermined and preselected limits.

A still further object of my invention is to provide a device which shall be compact, reliable and inexpensive to manufacture and maintain.

A feature of my invention is the provision of magnets for moving the movable portion of the device into positive contact with the fixed contacts and for holding it in this position until a definite change in the temperature of the heat chamber has occurred.

Other and further features and objects of the invention will be more apparent to those skilled in the art upon a consideration of the accompanying drawing and following specification, wherein is disclosed a single exemplary embodiment of the invention with the understanding, however, that such changes may be made therein as fall within the scope of the appended claims without departing from the spirit of the invention.

In said drawing:

Figure 1 is a view in front elevation of a control device in which my invention has been incorporated. The cover of the device has been removed to show the mechanism; and

Figure 2 is a view in vertical section of the device shown in Figure 1 and taken substantially along the line 2—2 thereof.

The present invention deals particularly with thermostatic control devices in which a thermostatic element actuates a switching device to control valves or the like which in turn control the flow of fuel to burners, or for controlling blowers or other devices which control the temperature of a given space such as an oven, a heater, a room, a furnace, a heating chamber or the like. It is apparent that the invention is susceptible to a wide variation of modifications and may be used for a large number of uses.

Referring now to the drawing for a more complete disclosure of this invention there is shown at 10 a base or bearing plate in the form of a flanged bushing to which a cup-shaped case 11 is secured as by means of spinning over a flange 12 of the base to hold the case against the flanged portion of the bushing 10.

A second bushing or sealing plug 14 is engaged over the protruding portion of the bearing bushing plate 10 and held as by means of a setscrew 15. A sleeve 16 is mounted within the bushing 14 to project from it. The open end of the sleeve 16 is closed by means of bearing plug 17 which is grooved to fit within the end of the sleeve and is provided with a recess 18 in its inner wall to afford a bearing for a cup-like shaft collar 19. A shaft 21 projects through the opening in the bushing 10 and into a suitable opening 22 in the cup-like shaft collar 19, and is journaled for rotation with respect to the bushing 10 and the plug 17.

A bi-metallic spiral 24 is secured to the projecting portion of the bushing 10 at one end thereof by means of a screw 26, and at the other end to the collar 19 and shaft 21 by means of a pin 27 which projects through the other end of the spiral, through the cup-shaped bushing 19, and through the outer end of the shaft 21. It may be readily understood that changes in the temperature of the bi-metallic strip operate to partially roll and unroll the spiral to rotate the shaft 21.

The inner end of the shaft 21 projects within the case 11 and an insulating block 27 is secured to the end of the shaft as by means of a screw 28.

A contact or armature lever 29, preferably in the form of a flat spring, is secured to the block 27 as by inserting it in a suitable slot in the block and fastening it in place by means of a rivet 31.

A contact member 32 extends through the lever 29 near the free end thereof and the contact member is preferably held in place by means of armature strips 34 which are riveted to the lever and which engage a centrally located flange 33 on the contact 32.

It is apparent that rotary motion of the shaft 21 caused by rolling and unrolling of the thermostatic spiral 24 will operate to cause oscillatory motion of the contact 32 in a plane parallel to the back wall of the case.

The armature 34 is provided with a threaded opening, near the outer end thereof, to which a screw 36 is threaded in order that a conductor 37 may be secured to afford an electrical connection with the contacts 32. The other end of the conductor 37 is secured to an insulated binding post 38 by means of a screw 39. The binding post is held in place in a suitable recess in the case 11 by means of a screw 41.

A pair of magnet carriers or supports 42 and 43 are pivotally engaged on the shaft 21 between the block 27 and the flange 12 of the plate 10. These supports might be likened to the two parts of a pair of pliers with the handle portions arranged for supporting two oppositely disposed permanent magnets 44 and 45 in which contacts 46 and 47 are fastened, and the jaws overlapping to form a locking means for holding the magnets in any desired position. The magnets are disposed on the magnet carriers 42 and 43 in such a position that they will engage the armature 34 whenever the contact lever 29 is moved to a position adjacent the magnets. The magnets are provided with openings 48 at their central portion in which the contact screws 46 and 47 are located. The contact screws extend through the magnets and are threaded at their outer ends in order that they may be adjusted and fastened, with relation to the magnets, as desired, by means of the nuts 49. The nuts 49 also afford means for securing flexible conductors 51 and 52 to the respective contacts 46 and 47. The other ends of the conductors 51 and 52 are fastened to binding posts 53 and 54 which are similar to the binding post 38 previously described.

The overlapping ends of the magnet carriers 42 and 43 are provided with arcuate slots 56 in order that the magnet carriers may be fastened in any desired position by means of the screw 57 which projects through the coinciding slots 56 and into the plate 10.

A conduit bushing 58 projects through the bottom of the circumferential wall of the case 11 and is secured thereto by spinning a flange 59 of the bushing over the wall of the case. A conduit (not shown) may be fastened within the conduit bushing 58 by means of a screw 60 and the conduit and bushing afford a channel whereby two or three conductors, adapted to make electrical connection with the binding posts 53, 54 and 38, may be introduced into the case 11.

The arcuate overlapping portions of the carriers 42 and 43 are each provided with a suitable pointer 63 and 62, respectively, in order that the carriers, magnets and movable contacts may be accurately set. An arcuate scale 64 is located above the overlapping portions of the magnet carriers and the scale is graduated in degrees of temperature suitable for the oven or other devices, the temperature of which is to be controlled. A cup-shaped cover 66 is secured over the case 11 as by means of screws 67.

In operation the block 27 is adjusted with reference to the shaft 21 by means of the screw 28 until a line projected longitudinally of the lever 29 will intersect the scale 64 at a marking corresponding to the actual temperature of the thermostatic element 24. The magnet carrier 43 is moved until the pointer 62 indicates the minimum desired temperature of the oven or other heater, and the magnet carrier 42 is moved until the pointer 63 indicates the maximum temperature to be attained by the heater.

The operation of the device is as follows: Suppose the oven or other heating device is cold and the heater is started as by manual means. In the present embodiment of the invention, while the oven is cold and during the time it is heating the armature 34 will be in a position adjacent to or against the magnet 45. When the oven temperature reaches a value somewhat above the minimum value indicated on the dial 64 by the pointer 62, the thermostatic element 24 will begin to operate to bias the lever 29 and armature 34 away from the magnet 45. On further increase of the oven temperature the biasing action of the element 24 becomes sufficiently great to overcome the electro magnetic force exerted by the magnet on the armature and the armature will swing over against the magnet 44, thus opening any electrical circuit which may be present through the contacts 32 and 47, and closing any desired electrical circuit through the contacts 32 and 46.

It is apparent that the space between the magnets, the electromotive force of the magnets, and the resiliency of the lever 29 may be so chosen that the armature will, by reason of the resiliency of the lever and the thermostatic element, swing from one magnet immediately to the other, or, if desired, the armature may be caused to disengage from the magnets entirely while the temperature of the oven is between the preselected maximum and minimum values.

If the temperature of the heating device becomes lower and approaches the selected minimum value, the armature is drawn away from the magnet 44 to open the circuit through the contacts 32 and 46 and close a circuit through the contacts 32 and 47.

It is apparent that, after an oven temperature has been reached which is between the selected minimum and maximum temperatures indicated by the pointers 62 and 63, the control device will operate to open or close suitable electrical circuits through the contacts 32 and 47 or the contacts 32 and 46, according to whether the temperature in the oven is increasing or decreasing, to energize or deenergize a fan or blower, open or close a valve or other control device to heat or cool the heater, oven or other enclosed space in order to maintain the temperature within the desired limits.

It may readily be understood that, because the strength of a magnetic field increases inversely as the cube of the distance, movement of the armature occurs with a "snap" action which is quite beneficial and which, among other features, avoids burning and pitting of the contact points.

Since the magnets cause positive electrical connection the thermostatic element need not be thick and heavy to hold the contacts closed and consequently a thin, light and more sensitive thermostatic element may be used.

Although I have described a specific embodiment of my invention it is apparent that modifications thereof may be made by those skilled in the art. Such modifications may be made without departing from the spirit and scope of my

invention as set forth in the appended claims.

I claim as my invention:

1. In a temperature control device, a base, a bimetallic element secured at one end thereof to the base, a shaft mounted upon the free end of the bimetallic element, a lever carried by but insulated from said shaft, an armature on the free end of the lever, a magnet adjustably secured to the base and located within the path of movement of the free end of the lever to produce snap movement of the lever from the end portions of its travel, an insulated contact carried by and axially adjustable centrally of said magnet, said magnet being pivoted about said shaft, and means for securing said magnet in position to vary the temperature at which said armature responds.

2. In a temperature control device, a base, a thermostatic element secured at one end thereof to the base, a shaft secured to the other end of the thermostatic element and projecting through the base, a lever secured to the free end of the shaft, a contact upon the end of the lever, an adjustable carrier mounted for rotation about the shaft, a magnet mounted on said carrier, and a fixed contact mounted upon the adjustable carrier, and insulated from said magnet, said last named contact extending through a recess in said magnet and being engaged by said lever contact upon engagement of said lever with said magnet.

3. In a temperature control device, a base plate in the form of a bushing, a second bushing secured over the base plate, a sleeve secured within the second bushing, a plug in the end of the sleeve provided with a recess in the inner wall thereof to constitute a bearing, a spirally wound thermostatic element secured to the base plate and projecting into the tube, a shaft collar secured to the free end of the thermostatic element and journaled within the bearing of the plug, a shaft secured to the collar and projecting through the thermostatic element and the base plate, a casing secured to the base plate, a pair of magnet carriers adjustably secured to the base plate and pivoted for movement about the shaft, an insulating block secured to the projecting end of the shaft, a flexible lever secured to the insulating block, a contact on the flexible lever, contacts secured to the carriers, and permanent magnets mounted one on each of the carriers to control movement of the lever independent of the influence of the thermostatic element near the end portions of its travel.

4. In a device of the class described, a thermostatic element, a shaft secured to said element and rotatable thereby, an armature carried by said shaft, a pair of carrier members pivoted about said shaft, magnets mounted on said carrier members, contacts disposed centrally of and carried by said magnets, and means common to and simultaneously engaging both said carrier members for adjustably securing each of said carrier members in position with respect to said armature independently of the position of the other of said members.

5. In a device of the class described, a thermostatic element, a shaft secured to said element and rotatable thereby, an armature carried by said shaft, a contact on said armature, a pair of pivotally mounted carrier members, magnets mounted on said carrier members, contacts carried by and insulated from said magnets, said contacts extending centrally of said magnets and axially adjustable with respect thereto and being engaged by said armature contact upon actuation of said thermostatic element, and means for adjustably securing each of said carrier members in position with respect to said armature independently of the position of the other of said members.

6. In a control device, a base, a thermostatic element mounted thereon, a shaft secured to said element and rotatable thereby, an armature carried by said shaft, a pair of superposed carrier members, magnets fixedly supported on said members, said members having overlapping slotted portions, and means extending through said slotted portions for adjustably securing each of said members in position with respect to said armature.

7. In a control device, a base, indicia carried by said base, a thermostatic element mounted thereon, a shaft secured to said element and rotatable thereby, an armature carried by said shaft, a pair of superposed pivotally mounted carrier members, magnets fixedly supported on said members, said members having overlapping slotted portions, pointer means carried by said members for determining the desired position of said members with respect to said indicia, and means extending through said slotted portions for adjustably securing each of said members in position.

8. In a control device, a thermostatic element, a shaft secured to said element and rotatable thereby, an armature secured to said shaft, a pair of separately mounted magnets pivoted about said shaft, said magnets having engaging face portions and recessed portions, contacts insulated from said magnets and projecting into said recessed portions, said contacts being axially adjustable with respect to said magnets, and means for securing each of said magnets in desired position with respect to said armature irrespective of the position of said other magnet.

9. In a control device, a thermostatic element, a shaft secured to said element and rotatable thereby, an armature secured to said shaft, a pair of separately mounted magnets pivoted about said shaft, said magnets having engaging face portions and recessed portions, contacts insulated from said magnets and projecting into said recessed portions, said contacts being axially adjustable with respect to said magnets, said armature having a contact engaging said magnet contacts for closing an electric circuit when said armature engages the face portion of said magnets, and means for securing each of said magnets in desired position with respect to said armature irrespective of the position of said other magnet.

10. In combination, a thermally responsive member, a shaft rotatable upon actuation of said member, an armature fixed to said shaft and having a contact adjacent the free end thereof, a pair of pivotally mounted contact carriers, magnets fixed to said carriers adjacent said armature contact on opposite sides thereof, and contact members extending centrally of said magnets and axially adjustable with respect thereto, each of said contact members being engaged by said armature contact simultaneously with the engagement of said armature and the corresponding one of said magnets.

11. In a device of the class described, an armature adapted to be rotated in accordance with temperature changes, magnets disposed upon opposite sides of said armature for limiting the movement thereof, contacts carried by and in-

sulated from said magnets for connecting said armature to predetermined electrical circuits upon engagement of said magnets by said armature, and means comprising a locking screw common to said magnets for securing said magnets in separate fixed predetermined positions with respect to said armature.

12. In a control device, a thermostatic element, a shaft secured to and rotatable by said element, an armature carried by said shaft, a pair of superposed carrier members pivoted about said shaft, contacts carried by said members, and common means spaced radially outwardly of said shaft and engaging both said members for securing said members in fixed position to space said contacts in predetermined positions upon opposite sides of said armature.

13. In a control device having a shaft with an armature rotatable about said shaft in response to temperature changes, a pair of contacts on opposite sides of said armature, separate carrier members for each of said contacts pivoted intermediate their ends about said shaft and having extending indicating portions at the opposite ends thereof, and locking means engaging said carrier members adjacent said indicating portions for securing each of said members in fixed predetermined position with respect to said armature.

14. In combination, an armature responsive to temperature changes, a pair of contacts on opposite sides of said armature adapted to be engaged thereby to establish predetermined electrical circuits, carrier members for said contacts having a common pivot and having overlapping extending end portions, concentric arcuate slots formed in said end portions, and means passing through said slots and adapted to hold said carrier members in fixed position to space said contacts in predetermined positions upon opposite sides of said armature.

15. In combination, a supporting base, an armature mounted thereon and responsive to temperature changes, a pair of carrier members on said base, contacts carried by said members and adapted to be disposed on opposite sides of said armature, and means within the periphery of said carrier members and passing through both said members for frictionally locking said members in fixed predetermined positions with respect to said base.

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