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THERMOSTAT

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My invention relates to an improvement in thermostats and particularly to a thermostat adapted for use with domestic house heating plants. One object of my invention is to provide a thermostat which shall be sensitive to small temperature fluctuations. Another object is the provision of a thermostat in which means are provided for raising the temperature of the thermostat, independently of the room temperature. Another object is the provision of means for causing or enabling a thermostat to operate at a temperature different from that at which it normally operates, without changing the setting of the thermostat. Another object is the provision of means for actuating the thermostatic control in response to temperature changes of less than the normal differentiation. Another object is the provision of a thermostat particularly operable for use with a synchronous motor electric clock. Other objects will appear from time to time in the course of the specification and claims.

I illustrate my invention more or less diagrammatically in the accompanying drawings, wherein—

Figure 1 is a diagrammatic view of one form of my invention; and

Figure 2 is a diagrammatic view of a variant form of my invention.

Like parts are indicated by like symbols throughout the specification and drawings.

Referring to Figure 1 A generally indicates a translating device comprising a motor mounted on any suitable base A¹ adapted to operate any suitable blowing mechanism whereby, along the conduit A² air may be delivered to a furnace diagrammatically illustrated as at A³. The supply of oil or other fuel is not indicated herein but it will be understood that fuel is also delivered along the conduit A² by any suitable device for combustion within the furnace A³. Although the details are not shown it will be understood that in the form of my device herein described and claimed the supply of fuel as well as air may be made responsive to the actuation of the motor A.

B B¹ indicate the wires of the usual house lighting circuit. The motor is put in circuit

with the house lines for example by the conductor B² extending from the line B¹ to the terminal B³, the conductor B⁴ extending from the motor terminal B⁵ to the switch B⁶ and the conductor B⁷ extending from the switch to the line B. The switch is normally withdrawn from the conductor B⁷ as for example by the spring B⁸.

C generally indicates a transformer of which the primary C¹ is in circuit with the lines B and B¹. The secondary C² is in circuit, as by the line C³ C⁴ with the electro-magnet C⁵ which serves to move the switch B⁶, against the spring B⁸ into contact with the conductor B⁷, to close the motor circuit.

Shunted across the line C³ C⁴ is any suitable resistance heating element herein shown as an incandescent light bulb D with the usual filament therein. When the circuit through the line C³ C⁴ is closed the bulb is actuated and serves to heat the thermostatic member generally indicated as D¹ which includes a spiral portion D² and an upwardly extending vertical portion D³.

Pivoted adjacent the free upper end of this vertical portion is a mercury tube D⁴ from which project downwardly beneath its pivot the arms D⁵ which surround the upper end D³ of the thermostatic member. It will be understood that in response to the flexion of the portion D³ to the right or to the left the mercury tube D⁴ will be tilted about its axis. Mounted in the mercury tube are two contact members D⁶ which are interposed in the lines C³. It will be understood that when the tube is tilted in the position in which it is shown in Figure 1 the mercury in the tube provides the conducting connection between the contacts D⁶ and thus closes the circuit through the lines C³ and C⁴. On the contrary, when the member D³ is flexed to the left the tube is so tilted as to withdraw the mercury from the contacts D⁶ and the circuit through the lines C³ and C⁴ is broken.

It will be understood that when the secondary circuit above described is closed the electric light bulb D is illuminated and the electro-magnet C⁵ is actuated. Accordingly the motor rotates and delivers air and fuel to the furnace and at the same time the thermo-

static member D^3 is subjected to the heat of the electric globe.

Referring to Figure 2 the conductor E extends from one motor terminal E^1 to the line B^1 . From the other terminal, E^2 , the conductor E^3 extends directly to the thermostatic member D^1 , to the coil portion D^2 thereof. E^4 indicates a terminal opposed to the upward extension D^3 of the thermostatic leaf, the terminal E^4 being connected by the conductor E^5 with the line B.

I illustrate diagrammatically the use, as a control means, of a synchronous motor clock, the details of which clock do not of themselves form part of the present invention and are therefore not illustrated herein. I may employ any suitable type of clock but I prefer to employ a synchronous motor clock of the type which is provided with a rotor which rotates in synchronism with the controlling rotor, in response to the alternating current cycle. It will be understood that G and G^1 indicate two concentric shafts adapted to rotate the hands G^2 G^3 of the clock, the two shafts being insulated from each other in any suitable way. G^4 diagrammatically indicates the field of the motor, it being in circuit with the lines B, B^1 of the electric lighting circuit. G^5 indicates a secondary winding around the field coil. G^6 indicates a conductive segment connected with the coil G^5 by the conductor G^7 . G^8 is a conductor extending from the coil G^5 to the resistance element G^9 adjacent the thermostatic leaf D^1 . The circuit is completed by the conductor G^{10} extending from the resistance G^9 to the hour hand G^2 .

While the control mechanism herein described might be widely varied without departing from the spirit of my invention I have illustrated a clock wherein the contact of the hour hand G^2 with the conductive segment G^6 actuates the resistance G^9 , by closing the secondary circuit thereto. During the time that the hour hand G^2 overlies the conductive element G^6 the resistance G^9 will be continually actuated and the thermostatic member D^1 will respond to its heat.

It will be realized that whereas I have described and shown a practical and operative device, nevertheless many changes might be made in the size, shape, number and disposition of parts without departing from the spirit of my invention. I therefore wish my description and drawings to be taken as in broad sense illustrative and diagrammatic rather than as limiting me to my specific showing.

The use and operation of my invention are as follows:

A prime object of my invention is to provide a thermostatic control which shall be responsive to relatively small fluctuations of temperature. In the thermostatic leaves commonly used it is difficult to obtain a re-

sponse from the leaves sufficient to make or break an actuating circuit except upon temperature rises or temperature drops of several degrees. I therefore provide supplemental means of supply-heat to a thermostatic element which will raise it close to the critical temperature. Thus a relatively small increase in the temperature of the room, to which the thermostatic member is responsive, when taken in connection with the constant supplemental heating of the bulb D for example or the resistance G^9 , is sufficient to cause a thermostatic leaf to break the actuating circuit and to terminate for the time being the operation of the motor. Supposing that a thermostat is set to operate within four degrees, say to break a circuit at 74 degrees and to close it again at 70, I may employ a small electric light bulb, say six volts, or a small resistance, which may raise the atmosphere about the thermostatic leaf by for example, $3\frac{1}{2}$ degrees. Assuming that the thermostat is operative when the temperature drops to 70 degrees and that the circuit has been closed, upon such operation, and that the motor is delivering air and fuel to the heating plant, and the temperature has begun to rise, with a lag of four degrees in the thermostat, the motor will normally continue to operate until the house temperature reaches 74 degrees. However if, upon the closing of the motor actuating circuit, I automatically close a secondary circuit through the bulb D or the resistance element G^9 , as may be the case, then this supplemental heating means has the same effect on the thermostatic member as if the house temperature had gone up to $73\frac{1}{2}$ degrees.

Therefore a further increase of the house temperature to $70\frac{1}{2}$ degrees, when taken in connection with the supplemental heating effect of the bulb or resistance, is sufficient to cause the thermostatic leaf to break the actuating circuit and to shut off the motor. The thermostat, if then at $70\frac{1}{2}$ degrees, instead of at 74 degrees as would otherwise be the case, will operate to close the actuating circuit again when the room temperature drops $\frac{1}{2}$ a degree. The above figures have been given merely illustratively, and it will be understood that the differential may be made more or less than $\frac{1}{2}$ a degree and that the control may be made as close as desired.

Referring more particularly to Figure 2, I may apply a time control to the supplemental heating arrangement above described in order to cause the thermostat to operate to a different temperature range at night than in day time. As differentiation between the form of Figures 1 and 2 it will be observed that the purpose of the resistance G^9 is different from the purpose of the bulb D, since in the case of Figure 2 the purpose of the supplemental heating arrangement is to operate

the thermostat at a temperature, say ten degrees lower than during normal daytime operation. The form of Figures 1 and 2 can be combined, if desired, by employing one resistance to obtain the close control effect and by employing another with its time control, to supply the greater degree of supplemental heat necessary for stepping the entire thermostatic action down a predetermined number of degrees at night.

Referring to Figure 2 in detail the thermostatic member D^1 is interposed in a primary circuit which includes the motor A and the thermostatic leaf and is in direct conductive communication with the lines B and B^1 .

Assuming that the thermostat is set to respond to a temperature of 70 degrees, that is to say, to close the motor circuit and actuate the circuit at 70 degrees, the provision of a resistance G^9 obtains the same effect, upon its actuation, as with an increase say of ten degrees in the room temperature. Thus during the time that the resistance G^9 is heated, the thermostatic leaf D will respond to a house temperature of 60 degrees exactly as, in the day time, it responds to a room temperature of 70 degrees. Whereas I have illustrated this time control of the resistance as in connection with an electric clock, and more particularly, in connection with a synchronous motor clock, it will be understood that a wide range of time indicating mechanisms, whether clock work or electric, could be employed to obtain the same result. The important feature is that a supplemental heating element is actuated in response to the clock, through a certain period of the day or night, in order to effect a change in the response of the thermostatic member to the room temperatures to which it is subjected.

I claim:

1. In a control device the combination with a circuit including a circuit making and breaking element responsive to temperature changes, of supplemental heating means adapted to affect the action of said temperature responsive element, said heating means including a resistance element and an actuating circuit therefor, a clock associated with the control device, and means for making and breaking the circuit for said resistance element in response to the actuation of the clock without affecting the continuity of the circuit including the temperature-responsive element.

2. In a control device, a thermostatic member, a circuit controlled thereby, such thermostatic member being responsive to the general temperature of the room or place in which it is located, and means for causing said thermostatic member to operate at a different temperature from that at which it normally operates, including supplemental

heating means to which said thermostatic member is subjected, and means for actuating said supplemental heating means during a predetermined part of the day without affecting the continuity of the circuit controlled by the thermostatic member.

3. In a control device, a thermostatic member and a circuit controlled thereby, a clock, a supplemental heating means adapted to affect the action of said thermostatic means and means, responsive to the actuation of said clock, for actuating said supplemental heating means without affecting the continuity of the circuit controlled by the thermostatic member.

4. In a control device, a thermostatic member and a circuit controlled thereby, supplemental heating means adapted to affect the action of said thermostatic member and a circuit therefor in connection with a source of electric power, a clock and means for making and breaking the circuit of said supplemental heating means, responsive to actuation of said clock, the continuity of the supplemental heating circuit being unaffected by the operation of the thermostatic member.

5. In a control device, a circuit including a source of power, a translating device and a thermostatically controlled circuit maker and breaker for said circuit, supplemental heating means associated with said circuit maker and breaker and arranged to modify the normal operating characteristics thereof, and time controlled mechanism associated with the supplemental heating means and arranged to render the same active or dormant independently of the continuity of the circuit controlled by the thermostatic circuit maker and breaker.

6. In a control device, an electric circuit including a source of power, a translating device and a temperature responsive circuit maker and breaker, supplemental heating means associated with the temperature responsive circuit maker and breaker and including an electrical resistance element and an energizing circuit therefor, said resistance being arranged to modify the normal operating characteristics of the temperature responsive circuit maker and breaker, and a time controlled switch mechanism for opening and closing the energizing circuit of said resistance at predetermined times without regard to the condition of the circuit controlled by said temperature responsive circuit maker and breaker.

7. In a control device, a circuit including a source of power, a translating device and temperature responsive means for controlling said circuit, heating means including an electrical resistance associated with the control device and arranged to modify the operating characteristic of said temperature responsive means, and means for energizing

and de-energizing the resistance including connections for insuring the continued normal operation of the temperature responsive circuit controller in the event of rupture of the resistance element.

5 Signed at Chicago, county of Cook and State of Illinois, this 18th day of April, 1928.
JAMES L. BREESE, Jr.

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