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TEMPERATURE REGULATING SYSTEM

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Fig. 1.

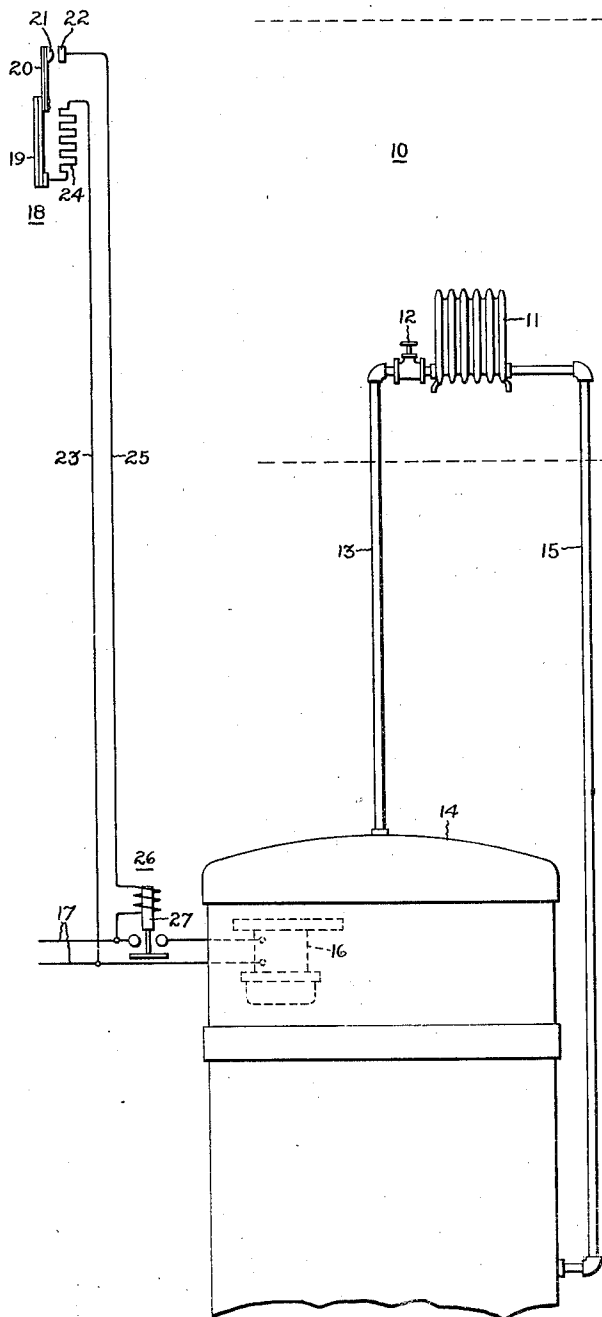
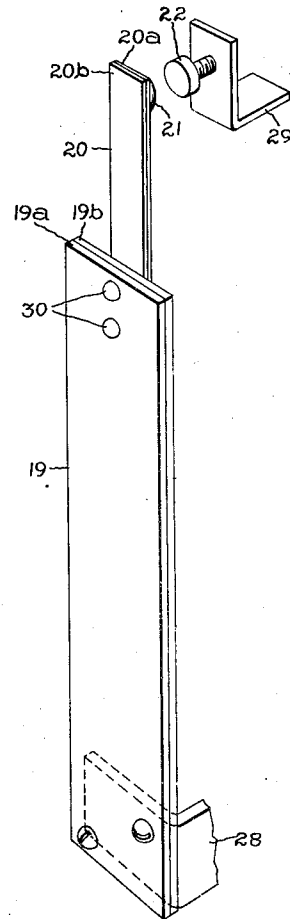


Fig. 2.



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TEMPERATURE REGULATING SYSTEM

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5 Claims. (Cl. 236—68)

My invention relates to a new and improved temperature regulating system for controlling the operation of temperature changing means to maintain predetermined temperatures within a desired region. More particularly my invention relates to improvements in systems in which the thermal responsive means controlling the temperature changing means is influenced by a local source of heat to change the time of control.

Systems of the above type, although widely used, are open to the objection that they are deleteriously affected by voltage fluctuations in the source from which they derive their energy. The voltage fluctuation and the difference from rated voltage in some distribution networks are as much as plus or minus 10 per cent of the rated voltage. Since the heat generated in the thermal element of the system varies as the square of the voltage the fluctuations noticeably disturb normal operation.

It is, therefore, a primary object of my invention to provide means to compensate for the effect of voltage fluctuations upon the temperature regulating system. According to my invention I accomplish this by constructing the thermal responsive means of two bimetallic strips having different electrical resistances fastened at their ends to form a single unitary element. The main element, corresponding to the usual thermostat, is constructed of relatively low resistance material and large cross-sectional area so that it is responsive to changes in temperature of the magnitude normally occurring in the region in which it is placed but, because of its relatively low resistance and large cross-sectional area, will not respond to any great extent to variations in current flow therethrough. The auxiliary element is constructed of a relatively thinner and narrower strip and, preferably of higher resistance material, so that it has a relatively smaller cross sectional area than the main element and is so mounted with respect to the latter that the two move in opposite directions in response to temperature variations. The auxiliary element is also made considerably shorter than the main element so that it will not respond appreciably to variations in an ambient. It will, however, respond readily to variations in current flow. Thus, the smaller strip is not affected by ambient but is affected by current flow and the larger strip is affected by ambient but not by current flow.

Where an ordinary bimetallic strip is cooperatively associated with a single contact an infinitesimal temperature change will open and close the contacts. In an arrangement consist-

ing of two inversely mounted bimetallic strips a definite temperature change is necessary between the opening and the closing of the contacts. When the contacts close, a current dependent upon the value of the voltage passes through both bimetallic strips. It is obvious, therefore, that variations in current flow due to voltage fluctuations will result in a variation in the temperature differential necessary to effect opening and closing of the contacts. However, the addition of an electrical heating coil to provide the local source of heat compensates for any voltage fluctuations because an increase in current, while it will increase the temperature differential necessary to open the contact, will also increase the heating effect of the local source and thereby decrease the temperature differential necessary to open the contacts. Thus, by properly proportioning the two bimetallic elements and the heating coil the changes resulting from fluctuations in voltage may be made compensatory.

Other objects, purposes, and characteristic features of the invention will in part be pointed out hereafter and will in part be apparent from the description and accompanying drawing. In describing the invention in detail, reference will be made to the accompanying drawing in which:

Fig. 1 shows a diagrammatic representation of one embodiment of the present invention; and Fig. 2 shows a perspective view of the thermal responsive element used in the embodiment of Fig. 1.

Reference numeral 10 represents a space or region such as a building, room or the like that is to be supplied with a heat exchange medium to maintain the temperature conditions therein within predetermined limits. The heat exchange medium, which in the present embodiment is illustrated as being either steam or hot water, is supplied to a radiator 11 under the control of a manually operable valve 12 placed in an inlet conduit 13 leading to the aforementioned radiator from a suitable source of steam or hot water such as a furnace 14. A return conduit 15 for the steam or hot water also leads from the radiator 11 to the furnace. The furnace, illustrated as being an oil furnace of any usual construction, is provided with an electric motor 16 adapted to be energized in order to increase the intensity of the source of heat. The term "intensity of the source of heat" is herein used generically to indicate not only a system in which combustion takes place intermittently but also to include systems in which combustion is continu-

ous but the rate thereof may be varied, as by the operation of dampers.

Energy is supplied to the motor from a suitable source 17 whenever the temperature within the space 10 decreases below a predetermined value. In such event, a thermal responsive means indicated generally by reference numeral 18 and consisting of a main bimetallic element 19 and an auxiliary bimetallic element 20 is adapted to close a circuit across contacts 21 and 22 to energize a relay 26 controlling the operation of the burner motor through a circuit that is as follows: conductor 23, a local source of heat or preheat coil 24, main bimetallic element 19, auxiliary bimetallic element 20, contacts 21 and 22 in engagement, conductor 25, and relay 26. When energized relay 26 actuates its associated switch 27 upwardly to close a circuit from the supply 17 to the motor 16.

Construction of the thermal responsive means 18 is illustrated more clearly in Fig. 2. It will be noted from this figure that the main element 19 is considerably longer, wider and thinner than element 20 and it may be, and preferably is, constructed of material having a lower resistance than the latter element. The element 19 is suitably mounted upon a stationary member 28 and contact 22 is adjustably mounted upon a second stationary member 29. As previously stated, the bimetallic elements are mounted for inverse movement, i. e., the elements move in opposite directions in response to any given temperature variation. Element 19 is preferably constructed of materials having different coefficients of expansion and in the figure section 19a may be made of invar and section 19b of brass. Similarly, element 20 may be constructed of the same materials with the exception that 20a is made of invar and 20b of brass. The two parts may be fastened end to end by rivets 30 or by any other suitable means.

Before considering the description of operation, it may be well to point out that the main bimetallic element 19 is relatively wide and thick and as a result has a considerable cross section area so that it is not greatly responsive to variations in current flow therethrough. However, it is responsive to variations in ambient in the same manner as the usual bimetallic element of any thermal responsive means. On the other hand, the auxiliary bimetallic element or strip 20 is short, narrow, and thin, and, consequently, has a high resistance. It is therefore, responsive to changes in current flow but, on the other hand, is not responsive to changes in ambient because of its short length. The proper ratio of cross section area of the two elements depends upon the electrical resistance of the materials used and may be determined accordingly.

Whenever the temperature within space 10 decreases below a predetermined value, contacts 21 and 22 close the previously described circuit to energize relay 26. The burner motor 16 is energized and space 10 is supplied with heat from the source 14. Whenever the temperature within the space 10 increases above a second predetermined value determined by the differential of operation of the thermostat the relay 26 is deenergized to terminate operation of the furnace 14 and the supply of heat to the space 10.

The preheat coil on the present arrangement performs not only its usual function of changing the time of response of the thermostat but it also acts to compensate for voltage fluctuations by cooperation with the dual element thermostat.

It is, of course, well-known that the preheat coil creates a false ambient about the thermostat and causes the latter to terminate operation of the heating means sometime prior to the time that the room temperature reaches the value which it is desired to maintain therein. Thus, the furnace is operated intermittently and the "overshooting" of temperature with the space 10 because of time lag in the heating system is avoided and better modulation of temperatures therein is obtained. A detailed description of the operation of the preheat coil with the usual bimetallic thermostat may be obtained from Letters Patent, No. 1,583,496 granted to William L. Shafer on May 4, 1926.

When a single bimetallic element is used, an infinitesimal change of temperature will operate to open the contacts. With an arrangement of the type I have described, a definite fixed temperature differential is required to operate the thermostat because of the flow of current through the auxiliary bimetallic element 20. Upon initial engagement of contacts 21 and 22, a flow of current through both elements 19 and 20 results. The current flow through element 19 has a negligible effect on its temperature because of its larger cross sectional area and lower resistance but the current flowing through element 20 will heat that element and cause it to tend to move to the right and thus maintain a better contact with element 22. On a subsequent increase in temperature the contacts 21 and 22 will not be disengaged immediately, but after a definite temperature rise the contacts are opened and element 20 thereafter moves farther to the left as it cools down to room temperature.

Assuming now that the temperature differential necessary to open the contacts is 1° Fahrenheit and the preheat coil 24 is so constructed that when continuously energized it will raise the temperature therearound 1.2°, the operation of the device will be as follows: When the temperature in space 10 decreases below a predetermined minimum value, contacts 21 and 22 engage to energize relay 26 and the latter in turn energizes motor 16 by closure of switch 27. The furnace is thereby rendered operative and supplies heat to the radiator 11. Simultaneously, the preheat coil 24 is energized and it starts to heat bimetallic element 19 locally. The action of bimetallic element 20 is the same as described above. After the temperature of bimetallic element 19 has been increased 1° as a result of the joint effect of heat from radiator 11 and the preheat coil 24, the contacts 21 and 22 will be disengaged. The operation just described will be continued until the temperature within space 10 rises 1° above the predetermined minimum value at which time bimetallic element 19 will no longer effect closure of contacts 21 and 22.

The operation above described will continue so long as rated voltage is supplied from the source of energy 17. However, it is very seldom that the source of supply in outlying distribution systems remains constant. Usually there is a considerable fluctuation in voltage and it is not unusual to have voltage fluctuations of plus or minus 10 per cent. In such event, the value of preheat would decrease to a value less than the 1° necessary to effect opening of the contacts but at the same time the decreased flow of current through element 20 would likewise result in the requirement of a lesser temperature rise to cause opening of the contacts. Thus, by so proportioning the main and auxiliary elements that these

opposite effects are equal, the objectionable effects of voltage fluctuations are avoided.

What I claim as new and desire to secure by letters Patent of the United States is:

1. In combination, a source of heat exchange medium, means for transferring said medium to desired region, means in said region controlling said source, said means including thermal responsive means consisting of two bimetallic strips of different electrical resistances and an electrical heater influencing one of said strips and controlled by said thermal responsive means.

2. In combination, a source of heat exchange medium, means for transferring said medium to desired region, electrical means for controlling the supply of said medium, a source of electrical energy, thermal responsive means including a pair of bimetallic strips of different cross sectional area fastened end to end for connecting said electrical means to said source of energy, and an electrical heater controlled by said last mentioned means and influencing a predetermined one of said strips for changing the time of control, said electrical heater and bimetallic strips being proportioned to compensate for the effect of voltage fluctuations thereupon.

3. In combination, a source of heat exchange medium, means for transferring said medium to desired region, electrical means for controlling the supply of said medium, a source of electrical energy, a thermal responsive means including a pair of bimetallic strips of different cross sectional area fastened end to end for connecting said electrical means to said source of energy and an electrical heater controlled by and influencing said last mentioned means, one of said strips hav-

ing a relatively large cross sectional area and responsive to variations in ambient temperature and the other a relatively smaller cross sectional area and not responsive to variations in ambient temperature but responsive to variations in temperature caused by current flow therethrough, and said heater being in heat conducting relationship with the strip of larger cross sectional area whereby fluctuations in the voltage of said energy source are compensated for.

4. In combination, a space temperature controlling means having an electrical control circuit, a space temperature responsive switch for controlling said circuit and having an actuating element consisting of two oppositely acting bimetallic strips of different electrical resistance in said circuit, and an electrical heater influencing one of said strips and controlled by said switch.

5. In combination, a circuit control switch having a bimetallic actuating element responsive to ambient temperature conditions and included in the circuit controlled by the switch, an auxiliary bimetallic element reversely mounted on said first element to be included in circuit therewith and formed of high electrical resistance material with relatively small cross sectional area to provide response thereof to the heating action of the current in the circuit substantially independently of ambient temperature, and an electrical heater influencing said actuating element and connected to be energized when the circuit controlled by said switch is closed, said electric heater and said auxiliary bimetallic element being proportioned to compensate for the effect of voltage fluctuation in said circuit.

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