

April 9, 1929.

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1,708,309

THERMAL CONTROLLING SYSTEM

Filed Sept. 10, 1924

FIG. 1.

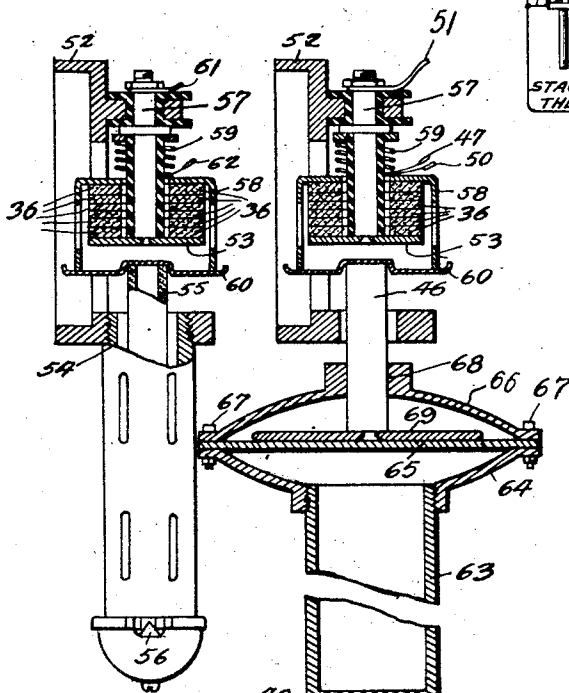
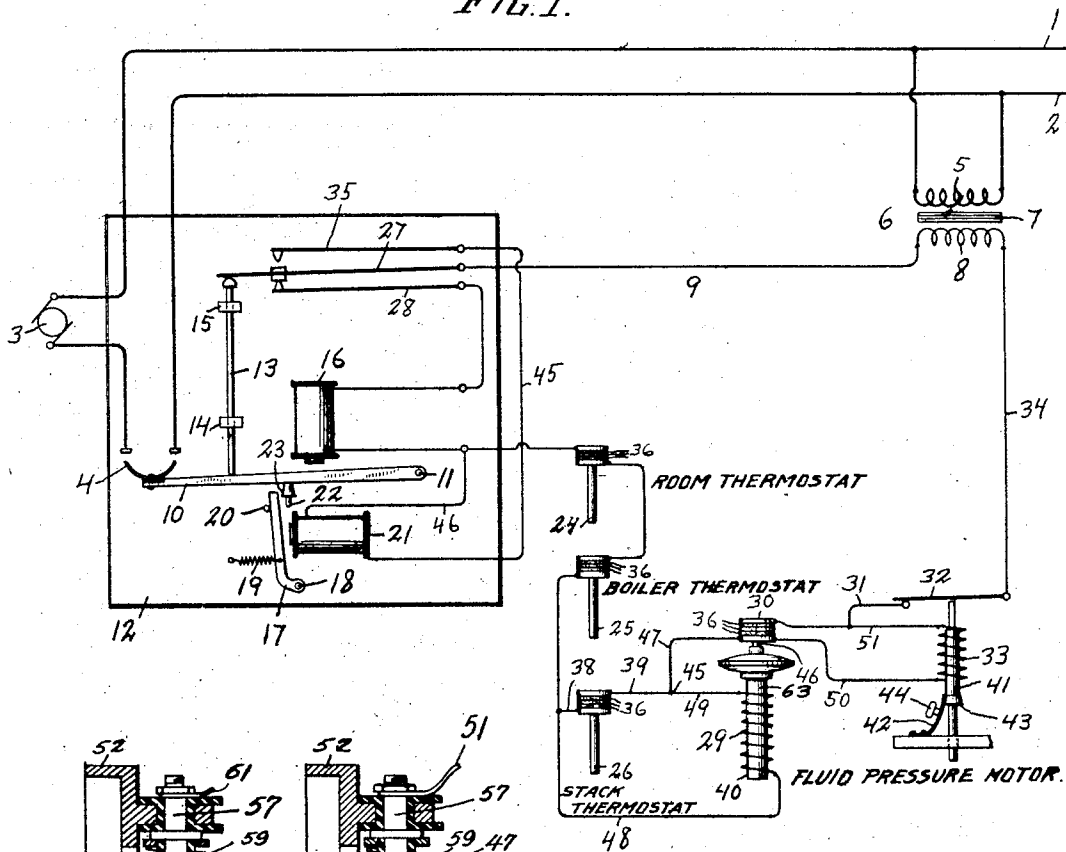


FIG. 2.

FIG. 3.

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GEORGE A. KNAAK, OF MILWAUKEE, WISCONSIN, ASSIGNOR, BY MESNE ASSIGNMENTS,
TO PENN ELECTRIC SWITCH CO., OF DES MOINES, IOWA, A CORPORATION OF IOWA.

THERMAL CONTROLLING SYSTEM.

Application filed September 10, 1924. Serial No. 736,948.

This invention relates to thermal controlling systems, and the object of the invention is to improve the construction and operation of thermal controlling systems in the manner to be hereinafter described and claimed.

Referring to the drawings, Fig. 1 is an elevation, in diagrammatic form, of circuit controlling mechanism with a diagrammatic illustration of electrical circuits and apparatus; Fig. 2 is an elevation, parts being shown in section, of a thermostat; and Fig. 3 is a vertical section of a fluid pressure motor device and associated mechanism.

Referring to the drawings, the reference numerals 1 and 2 designate conductors for so-called alternating current. These conductors may be considered respectively as the two parts of lines for distributing electric current and an electric motor 3 is thrown across the lines 1 and 2 when the switch 4 is closed. The primary coil 5 of a transformer 6, with iron 7, is connected across the lines 1 and 2 at all times regardless of the position of the switch 4. The reference numeral 8 designates the secondary coil of the transformer 6 and it will be understood that the purpose of the transformer 6 is to supply electric current at all times, at the predetermined low voltage required, for the operation of the controlling electric circuit which is generally designated by the reference numeral 9. The reference numeral 10 designates a metal lever, to which the switch 4 is connected and from which it is insulated. The lever 10 is pivoted by the pivot 11 to a panel 12. A push rod 13 rests against the lever 10 and can be moved freely by the lever 10 through guides 14 and 15 in one direction and, when placed vertically, as shown by the drawings, can be moved in the opposite direction by gravity. An electromagnet 16 is secured to the panel 12 in such a position as to move the lever 10 towards it and thereby close the switch 4 and lift the push rod 13. A latch 17 is pivoted by a pivot 18 to the panel 12 and can be moved in one direction by a spiral spring 19 which is secured to the latch 17 at one end and is secured to the panel 12 at its other end. A stop 20 secured to the panel 12 limits the extent of movement of the latch 17 by the spring 19. An electromagnet 21, which is secured to the panel 12, is arranged to move the latch 17 against the tension of spring 19

until it is stopped by a projection 22 secured to the lever 10. This projection 22 is intended to prevent the latch 17 from actually contacting with the electromagnet 21 while permitting the free end of the latch 17 to be moved into position under a member 23 which extends a sufficient distance from the lever 10 so that the switch 4 will be retained closed when the lever 10 is moved by the electromagnet 16 and the latch 17 is moved under the member 23 by the electromagnet 21.

The reference numerals 24, 25, and 26 designate respectively a room thermostat, a boiler thermostat, and a stack thermostat. These several thermostats may be of any suitable or preferred construction, but I have illustrated them diagrammatically as thermostats of the construction described and claimed in my co-pending application for improvements in controlling devices, Ser. No. 735,529, filed September 2, 1924, and the room thermostat 24 maintains an electric circuit at all times but causes an increase of resistance in the circuit when the temperature has risen to a predetermined degree. The boiler thermostat 25 acts in the same way as the room thermostat 24 and these two thermostats are in series in the circuit. The stack thermostat 26, on the other hand, acts to increase the resistance in the circuit when the temperature falls below a certain predetermined degree. The circuit referred to is a closed circuit, except as hereinafter described, and this is the controlling electric circuit designated by the reference numeral 9.

The controlling electric circuit, as shown by the positions of the parts as they are illustrated by Fig. 1 of the drawings, includes the secondary coil 8 of the transformer 6, the switch member 27, the switch member 28, the electromagnet 16, the room thermostat 24, the boiler thermostat 25, the wire 38, the stack thermostat 26, the wires 39 and 47, the carbon resistance member 30, the connection 31, the switch 32, and the connection 34 which completes the circuit to the secondary coil 8 of the transformer 6. The condition, existing with the switch 4 open, as shown by the drawings, with the other parts in the positions as shown by the drawings, exists when one or the other of the thermostats 24 and 25 have operated to

introduce sufficient resistance into the controlling electric circuit 9 so that the electric current will not energize the electromagnet 16 sufficiently to attract the lever 10 and close the switch 4.

It may be assumed that the electric motor 3 is intended to supply fuel, oil for example, for heating purposes and, with the parts in the positions as shown by the drawings, it may be assumed that the conditions are such that the room thermostat 24 has operated at its predetermined, selected temperature to open the switch 4 and stop the electric motor 3 and the supply of fuel for heating purposes. Assuming now that the temperature in the room falls and the resistance to the passage of the electric current by the room thermostat 24 is diminished, the electric current in the controlling electric circuit 9 will be increased and the electromagnet 16 will be energized sufficiently to attract the lever 10 and close the switch 4 and move the push rod 13. The switch member 27 will be moved towards the switch member 35 but the connection between the switch members 27 and 28 will not be broken until after the switch member 27 has contacted with the switch member 35. This construction of switch members is an old construction and it is only necessary to say here that the switch members 28 and 35 can be made from spring metal and so bent that they will both contact with the switch member 27 unless the switch member 27 is moved to an extreme position in either direction. When the electromagnet 16 is energized sufficiently to attract the lever 10 and close the switch 4, the motor 3 will receive electric current and be set in motion and operate the mechanism, not shown, for supplying fuel, and, as the push rod 13 moves the switch member 27, the electric circuit will be maintained through the electromagnet 16 until after the switch member 27 has also made contact with the switch member 35 and energized the electromagnet 21 to attract the latch 17 and pull it under the member 23 against the projection 22. After the circuit between the switch member 27 and the switch member 28 is broken, the electric current will continue to energize the electromagnet 21 and hold the latch 17 in its latching or locking position under member 23, against the tension of the spring 19, to retain the switch 4 closed.

The system and the apparatus illustrated will work equally as well if the switch member 27 breaks contact with the switch member 28 before making contact with the switch member 35 and vice versa. The diagrammatic illustration of the drawings is intended to illustrate the possibilities of construction and application of apparatus to the system and, with either kind of con-

tact making and breaking described, there will be sufficient movement between the contact parts lengthwise of the switch members to provide for a little rubbing which will keep the contacts clean.

The switch member 4 is illustrated, conventionally, as a type of spring switch member which will yield after closing so that the lever 10 and the push rod 13 can overtravel enough to cause the switch member 27 to contact with the switch member 35.

When the electric motor 3 is in operation the electromagnet 21 is always energized by the electric current so as to act as a no voltage protector, as it will be apparent that if the electric current ceases to flow, or, in ordinary language, if the power fails, the electromagnet 21 will be deenergized and the spring 19 will pull the latch 17 over against the stop 20 thereby permitting the lever 10 to drop and open the switch 4.

The thermostat 26, which has been referred to as a stack thermostat, is a fire or flame control thermostat and may be of any suitable construction for the location where it is placed. It has been referred to as a stack thermostat for the reason that it has been proposed to locate such a device either in the stack or in close proximity thereto, but it may be located in any position where it will function as desired. Its object is to open the controlling electric circuit 9 whenever there is a cessation of heat whether from the main fire or flame itself or from any ignition device and the operation is as follows. Under the effect of a temperature lower than the predetermined temperature, the thermostat 26 increases the resistance of the carbon members 36 and the greater part of the current is shunted through the wire 48, heating coil 29, and wire 49 to the wire 47 thereby heating a fluid in the fluid pressure motor device 40 and causing its plunger 46 to act upon the carbon resistance member 30 to increase the resistance there-through and shunt the current through the solenoid 33 and the wire 51 to the wire 31, switch 32, and wire 34. The current thus shunted sucks up the plunger 41 which strikes the switch 32 and opens it, thus breaking the circuit. A spring latch 42 is provided to engage under a projection 43 on the plunger 41 to hold the plunger in an elevated position with the switch 32 open until the spring latch 42 is released by a person. The drawings illustrate a button or knob 44 which can be conveniently grasped to release the spring latch 42 and permit the plunger 41 to drop and the switch 32 to close. The carbon resistance member 30 in conjunction with the fluid pressure motor device 40, the heating coil 29, the solenoid 33, and the plunger 41 are simply speeding up or quick-action devices to open the switch 32 without the necessity

of waiting for extended movement of thermostatic apparatus, as it is desired to open the switch 4 and stop the motor 3, to prevent pumping oil, or supplying other fuel, after the fire or flame has been extinguished or the ignition device has ceased to function. By using a fluid with a large coefficient of expansion in the fluid pressure motor device 40 an extremely quick opening of the switch 32 can be obtained.

The reference numeral 45 designates a junction point for the wires 39, 47 and 49 and the resistances of the heating coil 29 and the carbon members 36 of the thermostat 26 are so proportioned that normally the small quantity of current which will shunt through the wire 48 will not heat the coil 29 and the fluid pressure motor device 40 sufficiently to cause the plunger 46 to release the pressure upon the carbon members 36 of the carbon resistance member 30 enough to shunt current enough through the solenoid 33 to lift the plunger 41.

The reference numeral 36 is used to designate pieces of carbon or carbon members in the construction of the room thermostat 24, boiler thermostat 25, the stack thermostat 26, and the resistance sentinel 30, to identify the construction and principle of operation of the thermostat illustrated and described in my copending application hereinbefore identified and the thermostats 24, 25, 26 and the resistance sentinel 30, as far as this invention is concerned, may be of any selected construction or type according to location and conditions of use.

Referring to Fig. 2 of the drawings, the reference numeral 52 designates a support to which is secured an unyieldable abutment 53 and a member 54 which forms one part of a thermostatic couple. The member 55 is another member of a thermostatic couple and is supported at its lower end by the member 54. Suitable adjusting means 56 is provided for permitting the raising or lowering of the member 55 with respect to the member 54 to set the thermostat to operate at different predetermined temperatures. The unyieldable abutment 53 is a conductor of electricity and is preferably made of metal and is secured to a bolt 57 which is insulated from the support 1 and which is also surrounded by insulation. A plurality of carbon members 36 are assembled upon the unyieldable abutment 53 and surround the bolt 57 and the insulation around it. A cup member 58 is placed on top of the carbon members 36 and extends below the abutment 53. A spiral spring 59 forces the cup member 58 and the carbon members 36 together against the unyieldable abutment 53. A spider 60 is supported by the member 55 of the thermostatic couple and can contact with the lower open end of the cup member 58 to compress the spiral spring 59 and relieve the pressure ex-

erted by the spring 59 upon the carbon members 36 and thereby increase the resistance offered by the carbon disks to the passage of an electric current. A wire 61 is in electrical connection with the bolt 57 and a wire 62 is in electrical connection with the cup member 58 which is a conductor of electricity. The spider 60 may be made of metal if the member 55 of the thermostatic couple is a nonconductor of electricity or it may be made of nonconducting material if the member 55 is made of conducting material. The electrical circuit between the wires 61 and 62 is completed through the bolt 57, the abutment 53, the carbon members 36, and the cup member 58. It will be readily understood that, if the member 55 of the thermostatic couple has a larger coefficient of expansion than the member 54, an increase in temperature will force the cup member 58 up, compressing the spring 59, reducing the pressure exerted upon the carbon members 36, and thereby increasing the resistance offered to the flow of the electric current, while, if the coefficient of expansion of the member 54 is greater than the coefficient of expansion of the member 55, an increase of temperature will permit the spring 59 to expand and thereby decrease the resistance to the flow of the electric current. In the room thermostat 24 and the boiler thermostat 25, the member 55 has a greater coefficient of expansion than the member 54, while in the stack thermostat 26, the member 54 has a greater coefficient of expansion than the member 55.

Referring now to Fig. 3 of the drawings, the tube 63 is closed at its lower end and has a cap 64 secured to its upper end. A diaphragm 65 is secured between the cap 64 and the cover 66, the cover, cap and diaphragm being secured together in any suitable manner as, for example, by bolts 67. The plunger 46 is guided in a bore 68 in the cover 66 and is provided with the customary head 69 above the diaphragm 65. It will be apparent that, when pressure is generated in the tube 63, below the diaphragm 65, by heating a fluid, the diaphragm will force the plunger 46 upwardly. The resistance member 30 is composed of a support 52, an unyieldable abutment 53, a bolt 57, carbon members 36, a cup member 58, a spiral spring 59, and a spider 60, these parts corresponding with the same parts as already described in connection with the thermostat shown by Fig. 2 of the drawings, and the bolt 57 being insulated from the support 52, the cup member 58, and the carbon members 36 in the same manner as hereinbefore described. The plunger 46, when forced outwardly by expansion of fluid in the tube 63, presses the spider 60 and the cup member 58 up, relieving the pressure exerted by the spring 59 on the carbon members 36, and thereby in-

creases the resistance to the flow of the electric current through the carbon members 36, while a diminution of the pressure of a fluid in the tube 63 permits the spring 59 to expand and force the cup member 58 and the carbon members 36 against the abutment 53, thereby reducing the resistance to the flow of the electric current.

What I claim is:

1. The combination in a thermal controlling system, of an electric motor for supplying a heating medium, a switch for controlling the operation of said motor, electromagnetic means for closing said switch, electromagnetic means for holding said switch closed, a thermal responsive device, switch members for controlling the position of said switch, one of said switch members being adapted to make contacts separately with others of said switch members to establish electrical circuits through said thermal responsive device and either said electromagnetic means for closing said switch or said electromagnetic means for holding said switch closed.

2. In a thermal controlling system, the combination with a main electric circuit, of an electric motor included in said main circuit for supplying a heating medium, a switch for closing said main circuit, a controlling circuit, electromagnetic means for actuating said switch included in said controlling circuit, electromagnetic means for retaining said switch closed included in said controlling circuit, a thermal responsive device and switch mechanism included in said controlling circuit for causing one or the other of said electromagnetic means to be energized, and an electrically actuated mechanism included in said controlling circuit for opening said controlling circuit.

3. In a thermal controlling system, the combination with a main electric circuit, of an electric motor included in said main circuit for supplying a heating medium, a switch for closing or opening said main circuit, a controlling circuit, electromagnetic means for actuating the said switch included in said controlling circuit, electromagnetic means for retaining said switch closed included in said controlling circuit, a thermal responsive device and switch mechanism included in said controlling circuit for causing one or the other of said electromagnetic devices to be energized, a heating coil in-

cluded in said controlling circuit, a heat responsive device adapted to be affected by said heating coil, a switch in the controlling circuit adapted to be opened by the action of the heat responsive device, and a thermal responsive device in the controlling circuit adapted to shunt electric current through said heating coil.

4. In a thermal controlling system, the combination with a main electric circuit, of an electric motor for supplying a heating medium included in said main electric circuit, a switch for closing said main electric circuit, a controlling circuit, electromagnetic means for controlling said switch included in said controlling circuit, electromagnetic means for retaining said switch closed included in said controlling circuit, a thermal responsive device and switch mechanism included in said controlling circuit for causing one or the other of said electromagnetic means to be energized, a heat actuated motor, a resistance member in the controlling circuit, the resistance of which is adapted to be increased by the effect of heat on said heat actuated motor, a heating coil for generating heat for said heat actuated motor, a thermal responsive device for controlling the generation of heat in said heating coil, a second switch in said controlling circuit, a solenoid coil in said controlling circuit, and a plunger to open said second switch.

5. In a thermal controlling system, the combination with a main circuit, of an electric motor, for supplying a heating medium, a switch for closing said main circuit, electromagnetic means for closing said switch, electromagnetic means for retaining said switch closed, a thermal responsive device and switch mechanism for causing one or the other of said electromagnetic means to be energized, a controlling circuit, electrical heating means with a heat responsive device in the controlling circuit, a switch in the controlling circuit adapted to be opened by a rise of temperature of the heat responsive device, a thermal responsive device for controlling the operation of said heat responsive device to open said switch, a solenoid coil and plunger to open said switch, and means for latching said last mentioned switch opened.

In witness whereof I hereto affix my signature.

GEORGE A. KNAAK.