

March 21, 1933.

C. M. SELBY

1,902,105

THERMOSTATIC CONTROL

Filed Dec. 8, 1930

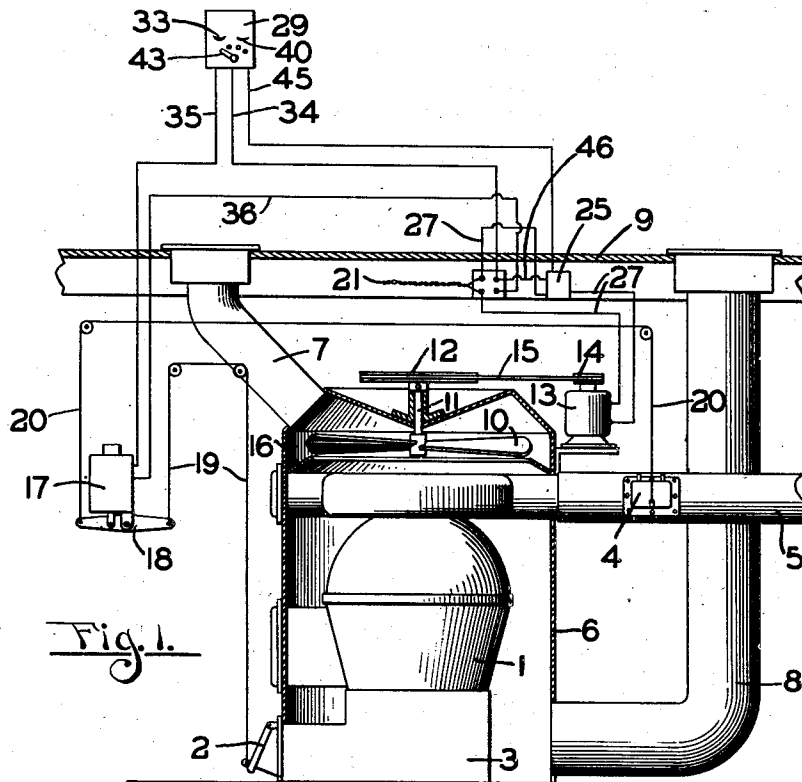


Fig. 1.

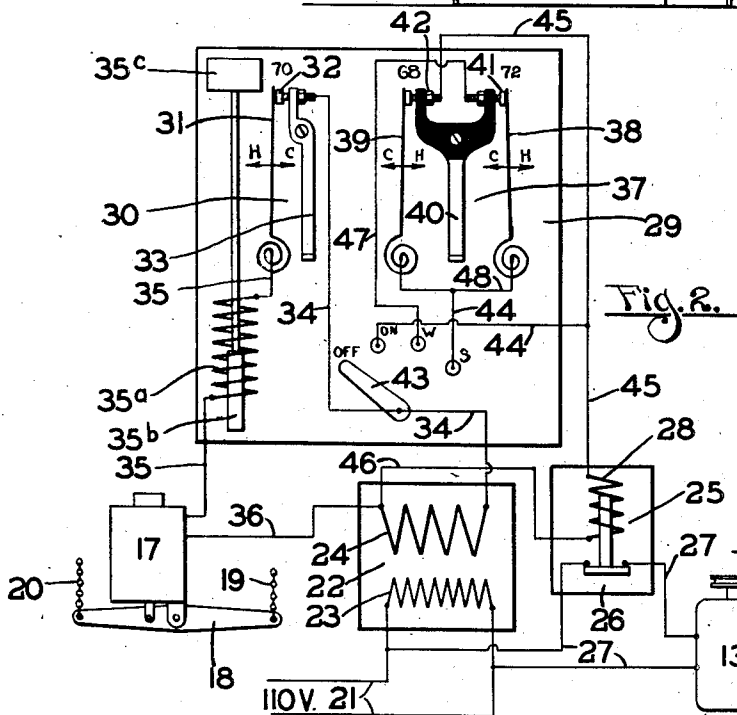


Fig. 2.

Inventor
Charles M. Selby
By
Liverance and
Van Antwerp
Attorneys

UNITED STATES PATENT OFFICE

CHARLES M. SELBY, OF HOLLAND, MICHIGAN, ASSIGNOR TO HOLLAND FURNACE COMPANY, OF HOLLAND, MICHIGAN, A CORPORATION OF MICHIGAN

THERMOSTATIC CONTROL

Application filed December 8, 1930. Serial No. 500,772.

This invention relates to improvements in thermostatic controls and more particularly to thermostatic controls by which electric circuits are opened and closed for the purpose of actuating means for automatically and uniformly heating a house or altering the condition of the air therein.

This invention is particularly devised and adapted to be used in connection with a warm air furnace having means such as a motor driven fan for causing circulation of the air through the furnace and rooms to be heated. It is also adaptable to other heating means having forced circulation of the heating medium and to devices which act to cool the atmosphere.

When used with a warm air heating plant it is not desirable for the circulating fan to operate at all times and under all conditions and neither is it desirable for the fan to operate at all times when the temperature of the house is either above or below the desired point and to stop operation only when the temperature rises nor is it desirable that the fan operate only at high temperatures and cease at low temperatures.

Fan systems used in connection with heating units are advantageous from a standpoint of causing a uniform circulation in all rooms which the heating plant is serving. Positive circulation of air not only provides comfort, but economy in fuel, due to the fact that the circulation is by pressure. For example, it may be assumed that the desired average temperature of the house be 70° F. At room temperature, it is assumed that the combustion in the heating unit is sufficient in connection with the operation of the circulating fan to maintain a given temperature. If the room temperature rises above 70°, then the combustion in the heating unit should be lessened, but decreasing the combustion would not immediately have its effect on the room temperature. Therefore the operation of the fan should cease to substantially decrease the flow of heated air, thereby avoiding excessive increase of room temperature.

If the room temperature should drop below 70° the furnace combustion should be

increased but it might be impossible to increase the combustion promptly and for that reason the furnace temperature would remain low and the room temperature would continue to decrease and when the room temperature had dropped below a certain point it would not be desirable to continue operation of the fan in a comparatively cold furnace and therefore operation of the fan should be stopped until the furnace temperature has increased sufficiently to efficiently heat the air circulated by the fan.

It is also desirable that the circulating fan can be controlled manually under abnormal conditions of comparative furnace and room temperatures, as for example when the house is extremely cold and the furnace combustion fire has been increased and the furnace itself well heated but the house has not had time to become heated it is advantageous to operate the circulating fan even though the room temperature is below the point where the circulating fan would normally become inoperative. Also it may be desirable to operate the circulating fan when the room temperature where the thermostat is located may be at or above the point where the fan may become inoperative for the purpose of warming remote parts of the house which might be colder and harder to heat.

It is also desirable to provide means for operating the circulating fan during the summer when there is no fire in the furnace and it is relatively cold for the purpose of circulating and cooling the air in the house and at this time the fan should operate at all temperatures above a chosen normal temperature and should cease operation at and below said chosen normal temperature.

This invention provides means for accomplishing the above described desirable operations as hereinafter more fully described and pointed out in the claims, reference being had to the accompanying drawing, in which,

Fig. 1 is a diagrammatic elevation of a heating plant with the various means for controlling the heat and thermostatic controls therefor embodying this invention operatively connected, and

Fig. 2 is an enlarged diagram illustrating the electric circuits and essentials of the device.

Like numbers refer to like parts in all the figures of the drawing.

1 represents the body of a furnace having the customary draft door 2 entering the ash pit 3 below the fire and a check draft 4 in the smoke pipe 5. The furnace body is surrounded by the customary jacket 6 spaced from the body and having warm air conduits 7 leading from its upper end and a cold air return conduit 8 entering into its lower end. The furnace is customarily located below the floor 9 of the house and the rooms to be heated are located above said floor and therefore the hot air conduits 7 lead through the floor into the room to be heated while the cold air return conduit 8 is also located in the floor of the said room.

The means for artificially circulating the air through the furnace is herein shown as a fan 10 which is located in the upper part of the furnace jacket, its shaft 11 projecting through the top of said jacket and being provided with a pulley 12. An electric motor 13 is conveniently mounted and its pulley 14 is connected with the pulley 12 by a belt 15 whereby the motor drives the fan. A deflector 16 is located in the furnace jacket to direct the air into the fan blades to improve its efficiency.

A draft actuating device 17 of suitable form is provided, the one herein shown having a pivoted cross arm 18, to the opposite ends of which are connected chains 19 and 20 which extend respectively to the draft door 2 and the check draft 4 whereby movement of the arm 18 on its pivot in one direction will open the draft 2 and close the check draft 4 for the purpose of increasing combustion and movement of the arm in the opposite direction will oppositely actuate the draft doors for the purpose of decreasing combustion. The details of the draft actuating device form no part of this invention excepting inasmuch as it is electrically controlled by means of a thermostat.

Current for operation of the motor 13 and the draft operator 17 is preferably taken from the house lighting current which is customarily a 110 volt circuit and is carried through the conductors 21. The motor 13 is preferably actuated by the 110 volt current while the draft operator 17 is preferably actuated by a current of lower voltage, as for example 20 volts, and also the several thermostats are preferably operated in the lower voltage circuits and for that reason a transformer 22 having a primary coil 23 and a secondary coil 24 is provided, the primary coil being connected in the 110 volt circuit while the secondary coil 24 supplies the current of lower voltage.

The switch 25 for making and breaking

the circuit to the motor 13 is of the relay type and comprises the switch proper 26 which is in one of the motor conductor wires 27, the other conductor wire 27 leading directly from the 110 volt circuit to the motor, and the magnet coil 28 which actuates the switch 26 which magnet coil is in the low voltage circuit.

The thermostats which control the various circuits are arranged in a case 29 which is located in the portion of the house to be heated above the floor 9. The thermostat group includes a draft control thermostat 30 which comprises a thermostatically operated element 31 of so-called bi-metal type having one end coiled and fixed to a base and its opposite end free to move when affected by changes in temperature. The thermostatic element 31, as illustrated, will move in the direction indicated by the arrow H when the temperature increases and in the direction indicated by the arrow C when the temperature decreases.

The contact member 32 is arranged near the movable end of the element 31 to be engaged thereby and is adjustably mounted on the adjusting lever 33. The conductor wire 34 extends from one side of the transformer secondary coil 24 and is connected to the contact member 32 and the thermostatic element 31 is connected by the conductor wire 35 to the draft operator 17, the said draft operator being connected with the transformer secondary coil by the conductor 36. By this means the thermostat 30 is in the low voltage circuit which actuates the draft operator 17 and controls the circuit by changes in temperature.

A signaling device coacts with the thermostat 30 and comprises a magnet coil 35a in series with the conductor 35. An armature 35b is acted upon by the magnet coil and carries a signal device 35c at the upper end of its stem. When the draft operator circuit is closed the coil 35a is energized which raises the armature 35b and signal 35c to indicate the operation.

This type of signal device is especially desirable in that the magnet coil can be so designed that it will not appreciably emit heat when energized and it may therefore be closely associated with the thermostatic element without affecting the operation of the thermostatic element.

The relay switch 25, which opens or closes the circuit to the motor 13, is controlled by the double thermostat 37. This thermostat has two bi-metal elements 38 and 39, each coiled and mounted at its lower end and having its upper end free to swing when affected by changes in temperature and each moving in the direction indicated by the arrow H when the temperature increases and in the direction indicated by the arrow C when the

temperature decreases. An adjusting lever 40 is pivoted to the base of the case 29 and has a forked insulated end on which are adjustably mounted the contact members 41 and 42 engageable with the thermostat elements 38 and 39 respectively.

A four point switch having a switch lever 43 is provided on the base, said switch lever being connected by the conductor 34 to one side of the transformer secondary coil 24. The switch has four contact members designated as OFF, ON, W and S. The OFF contact is not in electrical connection and therefore when the switch lever is on this contact the current to the thermostat 37 is broken. It will be here noted that this switch does not affect the current to the draft control thermostat 30.

The ON contact is connected by the conductor 44 and the conductor 45 to the magnet coil 28 of the relay switch 25 which magnet coil is also connected by the conductor 46 to the transformer secondary coil 24 and therefore when the switch lever 43 is on the ON contact the low voltage circuit is closed through the magnet 28 of the relay switch which closes the switch 26 and operates the motor 13. By this means the motor 13 is manually controlled and may be turned off or on by manual operation of the switch lever 43.

The switch contact W, which is for winter automatic control, is connected by the conductor 47 to the thermostat contact 41 and the corresponding thermostat element 38 is connected by the conductor 48 with the thermostatic element 39 and the corresponding contact member 42 is connected by the conductor 45 to the magnet coil 28 of the relay switch 25. This circuit places the two thermostatic elements 38 and 39 in series and it is necessary that both of them be in contact with their respective contact members 41 and 42 to close the low voltage relay switch circuit and therefore when the switch lever 43 is on the W contact for winter operation separation of either of the thermostatic elements 38 or 39 from its respective contact 41 or 42 by increase or decrease in temperature beyond certain limits will cease the operation of the motor 13.

The switch contact S, which is used for summer operation, is connected by the conductor 49 to the conductor 48 which is in circuit with the thermostat element 39 which completes the circuit to the relay switch through the contact member 42 and the conductor 45. In this circuit the thermostat element 38 and its contact member 41 are useless.

Operation

Considering first the operation of the device in the winter when the house temperature is to be maintained at a certain average which may be arbitrarily set as 70° F. and assuming

that the house temperature is at 70°, the various parts of the device will be in the positions shown by the drawing excepting that the switch lever 43 will be swung to the switch contact W. In these positions the drafts will be normal and the fire burning sufficiently to heat the furnace body. The position of the thermostat element 31 relative to the contact 32 will here depend upon the character of the draft operator 17 but for the present purpose it may be assumed that the element 31 will be closely located to the contact 32 whereby slight changes in temperature will make or break the contact causing the draft operator 17 to maintain the drafts 2 and 4 in normal or closed position.

The thermostatic elements 38 and 39 will each be in contact with their respective contact members 41 and 42 thereby closing the low voltage circuit to the magnet 28 of the relay switch 25 and holding the switch bar 26 in closed circuit position so that the current from the lighting circuit 21 will flow through the conductors 27 and operate the motor 13 which rotates the fan 10 thus causing air to be artificially circulated through the furnace and into the house to be heated.

When the temperature in the house rises considerably above 70°, as for example 72° or over, the thermostatic element 38 will be moved by the increased temperature out of engagement with its contact member 41 thus breaking the circuit to the relay switch 25 which will open the motor circuit and stop operation of the motor and fan. This will cease the artificial air circulation which will automatically tend to reduce the house temperatures. During this overheated period the thermostatic element 31 will swing entirely clear of its contact member 32 which will cause the draft operator 17 to move to open the check draft 4 which will reduce the combustion and permit the furnace to become cooler. In this manner the controls act to prevent the house from becoming unduly overheated.

If the house temperatures should reduce considerably below 70° the thermostatic element 31 will move to be in constant contact with its contact member 32 which will cause operation of the draft operator to open the draft door 2 for the purpose of increasing the combustion in the furnace and within certain limits the thermostatic elements 38 and 39 will remain in contact which will continue operation of the fan. But assuming that the combustion in the furnace does not increase as desired or as rapidly as is necessary, which may occur for various reasons such as lack of fuel or accumulation of ashes on the grate, and the house temperature continues to decrease below a certain point, for example 68°, then the thermostatic element 39 will be affected by the reduced temperature and will disengage from its contact member 42 break-

ing the circuit to the relay switch and cease operation of the motor and fan.

This is desirable because it is assumed that if the furnace is not sufficiently hot to heat the house to the temperature of 68° then it is not desirable to force an air circulation through the furnace or in other words it is not possible to raise the temperature in the house by forcing a circulation of air around a furnace which is not sufficiently hot to warm it. The parts will remain in this condition until the furnace becomes hot and again raises the temperature of the house to 68° by natural circulation at which time the thermostatic element 39 will engage its contact 42 and close the relay switch circuit and again start operation of the motor and fan.

Under certain conditions it is desirable to control the operation of the fan at will as for example when the house may be too cool to automatically close the fan control circuit but a person may be aware that the furnace is sufficiently hot to warm a forced air current and under these conditions the person may turn the switch lever 43 to the ON contact of the switch which will close the relay switch circuit and start the fan operation. There may also be conditions under which it is not desirable to have the fan operate at all and then the switch lever 43 may be turned to the OFF switch contact which will prevent the fan control circuit being closed under any conditions.

During warm weather of the summer months the furnace may be used as a cooling medium owing to the fact that it is usually located in the basement of a house which is considerably cooler than the upper part thereof and also that it is an iron body of considerable bulk which will retain a cool temperature and therefore operation of the fan will cause air to be circulated from the rooms of the house through the furnace where it is cooled and circulated back into the rooms.

For this purpose the switch lever 43 is turned to the S switch contact completing the low voltage circuit through the conductor 34, switch lever 43, conductors 49 and 48, thermostat element 39, the contact member 42 and the conductor 45 to the magnet 28 of the relay switch 25 and the thermostat element 38 is out of circuit and not operative. The element 39 moves toward the contact 42 as the temperature increases and therefore closes the circuit and operates the fan at all temperatures above a normal temperature to which the device is adjusted and opens the circuit and stops operation of the fan at all temperatures below said normal temperature.

While certain specific temperatures have been mentioned it is to be understood that the device is adjustable to operate at any desired temperature. In the draft controlling thermostat 30 the lever 33 is pivotal and in the fan controlling thermostat 37 the lever 40 is

pivotal and the respective contact members 32, 41 and 42 are adjustably mounted upon their respective levers, preferably by screw threads, and by this means the relative positions of the respective elements and contact members may be governed and adjusted either by means of the screw threaded contact members in the levers or by moving the levers themselves on their pivots. It is preferable that the adjustment by the operator be by means of moving the levers which have ends projecting through slots in the casing 29.

The invention has here been described and shown in the drawing as applied to a house having a warm air furnace but it is conceived that the invention is readily applicable to other devices which treat or condition the air. The device may be readily applied to a hot water heating system having means for producing an artificial forced circulation of the water in the system. The invention may also be applied to a means for humidifying the air regardless of whether the air is heated or cooled. In fact, it is conceived that the invention may be used with any device which conditions the air which is circulated and the claims are to be considered as of scope to include such modifications of the specific structure herein shown.

I claim:

1. In combination, an air conditioning device, means for producing a forced circulation of air therethrough, and temperature responsive means for controlling the actuation of said circulation producing means, said temperature responsive means including mechanism acting to cause actuation of said circulation producing means at temperature within a normal range and to cause inaction thereof at temperatures both above and below the said normal temperature range.

2. In combination, an air conditioning device, means for producing a forced circulation of air therethrough, temperature responsive means for controlling the actuation of said circulation producing means, said temperature responsive means including mechanism acting to cause actuation of said circulation producing means at temperature within a normal range and to cause inaction thereof at temperatures both above and below the said normal temperature range, said temperature responsive means also having means capable of adjustment whereby it will cause actuation of the circulation producing means at all temperatures above a normal degree and cause inaction thereof at all temperatures below said normal degree.

3. In combination, an air conditioning device, means for producing a forced circulation of air therethrough, temperature responsive means for controlling the actuation of said circulation producing means, said temperature responsive means including mechanism acting to cause actuation of said

circulation producing means at temperature within a normal range and to cause inaction thereof at temperatures both above and below the said normal temperature range, and means for adjusting the mechanism of said temperature responsive means whereby the said normal range of temperature at which said circulating means is caused to operate may be governed both as to extent between minimum and maximum and as to minimum and maximum degree.

4. In combination, an air conditioning device, means for producing a forced circulation of air therethrough, temperature responsive means for controlling the actuation of said circulation producing means, said temperature responsive means including mechanism acting to cause actuation of said circulation producing means at temperatures within a normal range and to cause inaction thereof at temperatures both above and below the said normal temperature range, combined with manual means for controlling the actuation of said circulation producing means manually at will regardless of temperatures.

5. In combination, an air conditioning device, means for producing a forced circulation of air therethrough, a thermostat acting to close an electric circuit at temperatures below a certain degree and vice versa, a second thermostat acting to close an electric circuit at temperatures above a certain degree and vice versa, said electric circuits being in series and when completed acting to operate said circulation producing means and vice versa for the purpose of causing said circulation producing means to actuate within a normal range of temperatures and to cease actuation both above and below said normal range.

6. In combination, an air conditioning device, means for producing a forced circulation of air therethrough, a thermostat acting to close an electric circuit at temperatures below a certain degree and vice versa, a second thermostat acting to close an electric circuit at temperatures above a certain degree and vice versa, said electric circuits of each thermostat being in series and when completed acting to operate said circulation producing means and vice versa for the purpose of causing said circulation producing means to actuate within a normal range of temperatures and to cease actuation both above and below said normal range, combined with means for shifting said electric circuit whereby the circuit for effecting actuation of said circulation producing means is completed through said second mentioned thermostat only for the purpose of causing actuation of said circulation producing means at all temperatures above a certain degree and for causing inaction thereof at all temperatures below said certain degree.

7. In combination, an air conditioning device, means for producing a forced circulation of air therethrough, a thermostat acting to close an electric circuit at temperatures below a certain degree and vice versa, a second thermostat acting to close an electric circuit at temperatures above a certain degree and vice versa, said electric circuits of each thermostat being in series and when completed acting to operate said circulation producing means and vice versa for the purpose of causing said circulation producing means to actuate within a normal range of temperatures and to cease actuation both above and below said normal range, combined with means for manually opening or closing said electric circuit at will irrespective of temperatures.

In testimony whereof I affix my signature.
CHARLES M. SELBY.

85

90

95

100

105

110

115

120

125

130