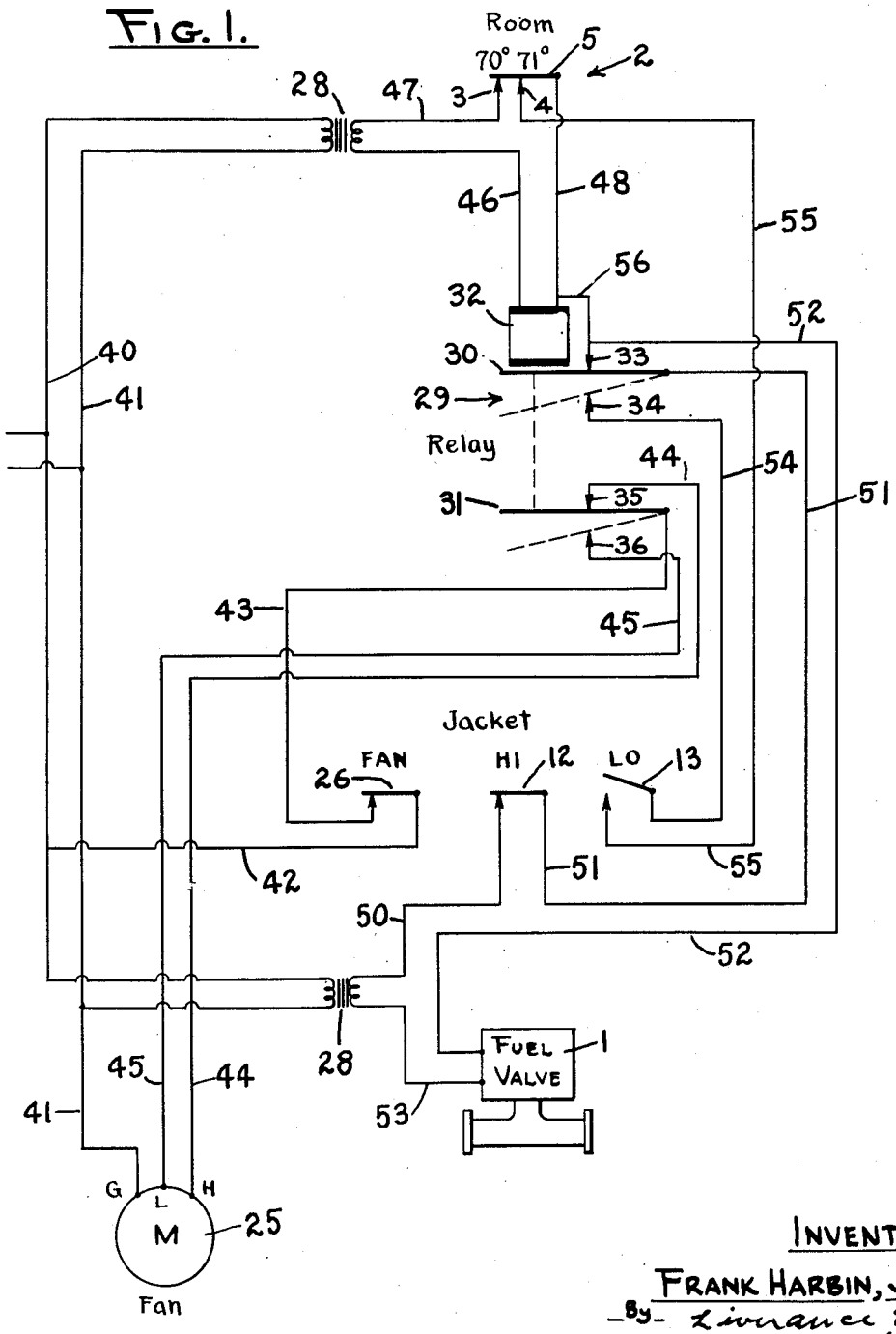
Oct. 28, 1952 F. HARBIN, JR 2,615,634

FURNACE CONTROL DEVICE

Filed Oct. 2, 1950 2 SHEETS—SHEET 1

FIG. 1.



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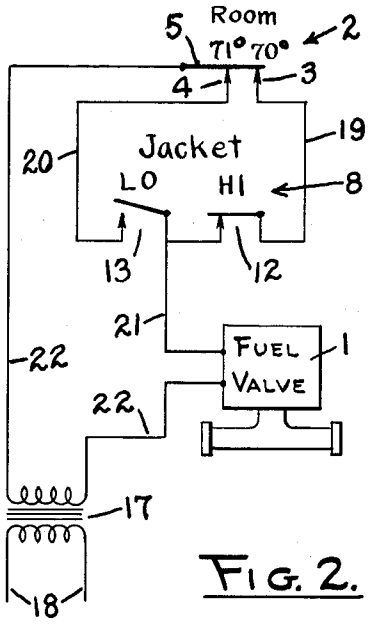


FIG. 2.

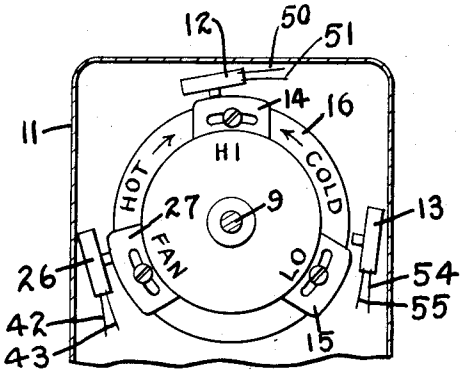


FIG. 3.

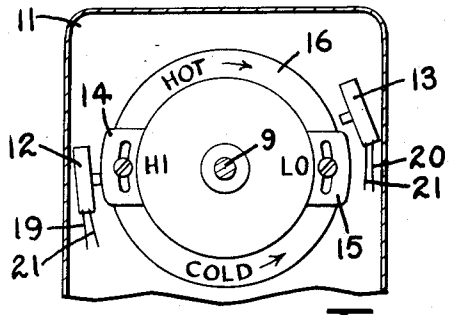


FIG. 4.

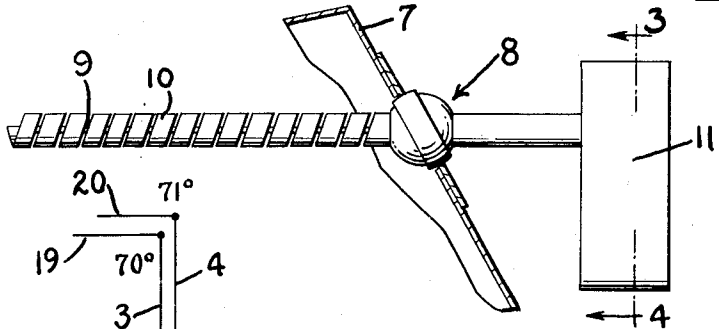


FIG. 5.

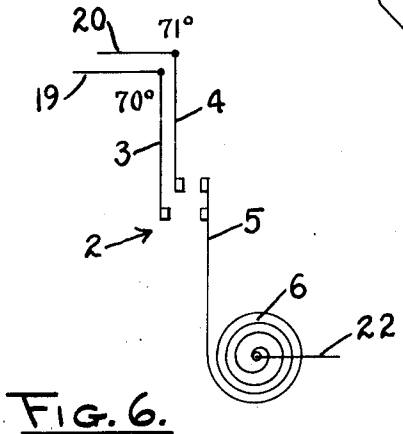


FIG. 6.

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FURNACE CONTROL DEVICE

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Application October 2, 1950, Serial No. 187,863

2 Claims. (Cl. 236—9)

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This invention relates to furnace controls and more particularly to the controls for warm air furnaces used to heat residences. It is adapted to be applied to furnaces having different types of burners such as gas or fuel oil and it may be used with the so-called gravity flow type of furnace in which the flow of air from the furnace to the room is caused by gravity or it may be used with the forced air circulation type of furnace in which a fan is used to induce the circulation.

The object of the device is to cause a more constant circulation of air from the furnace into the room so that the air in the room will not long remain motionless and stagnant.

To accomplish this result in a gravity flow furnace the furnace is prevented from becoming cold after the room temperature has reached the desired normal degree which is variable but which may be arbitrarily set for the purpose of this description at 70°. After the room temperature has reached the normal 70° the burner of the furnace is controlled to maintain it at moderate warmth so that it will induce the gravity flow of air into the room and this moderate warmth of the furnace, which may be arbitrarily stated as 100°, is maintained until the room temperature has risen slightly above the normal 70° to a temperature which we may state as 71° and at this point the furnace burner stops operation until the room temperature drops below 71° when the furnace burner will again operate to raise the furnace temperature to 100°. And when the room temperature drops below the normal 70° the furnace will go into full operation raising its temperature considerably above 100° to raise the room temperature to normal.

In a forced air circulation system using a fan to circulate the air the same control of the burner is used as above explained for the gravity system but in this forced air circulation a two speed fan may be used and the operation of the fan is controlled so that when the room temperature is below 70° the fan operates at high speed but when the temperature reaches and rises above the normal 70° the fan will be automatically controlled to operate at low speed and this low speed operation of the fan continues at all room temperatures above 70° until the furnace temperature drops to or below substantially room temperature.

For a more complete and detailed understanding of the invention reference is made to the accompanying drawings, in which,

Fig. 1 is a diagram illustrating the electrical connections and various instruments which may be used in a forced circulation system.

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Fig. 2 is a like diagram of the device adapted for a gravity flow system.

Fig. 3 is a sectional view on the line 3—4 of Fig. 5 illustrating the thermostatic switch device controlled by the furnace jacket temperature and adapted for the forced circulation system of Fig. 1.

Fig. 4 is a like section on the line 3—4 of Fig. 5 showing the jacket temperature controlled thermostatic switch adapted for the gravity flow system of Fig. 2.

Fig. 5 is an elevation of the thermostatic device used in the furnace jacket, its mechanism being that of either Fig. 3 or Fig. 4, and

Fig. 6 is a diagrammatic illustration of the room thermostat used in either the forced circulation or gravity flow system.

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

Referring now to Fig. 2 which is a diagram of the gravity circulation system in which the air will not circulate through the heating system and into the room to any extent, unless the furnace temperature is higher than the room temperature. The furnace burner is controlled by an electrically operated fuel valve 1 which preferably is opened when energized and closed when de-energized. The burner is of the single stage type, that is, it has only one stage of operation. It is either full on or off. A room thermostat generally indicated as 2 is located in the room and it is provided with independently adjustable electrical contacts 3 and 4. The circuit is opened or closed through these contacts by a thermostatically operated contact member 5. The contact member 5 is herein illustrated as a single member but it may consist of two separate contact members although it is preferable that whether the contact member be single or double it shall be operated by a single thermostatic element 6 which is herein shown as a coiled bimetal strip, however different thermostatic elements may be substituted for that shown. The device is adjusted so that circuit is broken at the contact 3 when the room temperature reaches normal such as 70° and the circuit is broken at the contact 4 when the room temperature has risen slightly above normal, such as 71°. It is to be understood that these temperatures are given as arbitrary examples and may be altered by adjustment of the thermostat.

The furnace jacket 7 is provided with the jacket thermostat 8 which may be of any conventional construction. That herein shown comprises a shaft 9 projecting into the furnace jacket and having coiled about it a bimetal strip 10

which is connected to the shaft 9 at one end and to the fixed body of the thermostat at the other end. Changes of temperature in the furnace jacket will affect the thermostatic element 10 to cause slight rotation of the shaft 9.

The jacket thermostat is provided with a head 11 which for this gravity system contains two switches 12 and 13 as illustrated in Fig. 4. These switches are operated to open or close their respective circuits by cams 14 and 15 each adjustably mounted upon a disk 16 attached to the shaft 9 and oscillated thereby in either direction with changes of temperature in the furnace jacket. The cam 14 which actuates the switch 12 is adjusted to break its circuit when the jacket temperature reaches a high limit such as 250°. The cam 14 is of such design that it will not break the circuit at the switch 12 at any low jacket temperature. The cam 15 which actuates the switch 13 is adjusted to break its circuit when the jacket temperature reaches a moderate temperature, such as 100°, which is sufficiently higher than the room temperature to maintain the gravity air flow. This switch 13 is likewise closed at all temperatures below 100°.

Electric current to operate the fuel valve 1 and controlled by the various switches is supplied by a transformer 17 which is supplied by current from a conventional source through the conductors 18. A conductor 19 connects the room thermostat contact 3 with the jacket thermostat switch 12 and the conductor 20 connects the room thermostat contact 4 with the jacket thermostat switch 13. Both of the jacket switches 12 and 13 are connected to the fuel valve by the conductor 21 and the conductor 22 leads from the fuel valve through the transformer 17 to the contact breaker 5 of the room thermostat.

Now when the room temperature is below 70° and the furnace jacket temperature is below 100° all of the switches will be closed and the fuel valve will be energized and opened so that the fire will burn to heat the furnace. As the jacket temperature increases and rises above 100° the switch 13 will be opened but inasmuch as this controls only one of the circuits to the fuel valve it will not by itself stop operation of the burner. When the room temperature reaches 70° the current through the conductor 19 will be broken at the contact 3 which will open the other circuit to the fuel valve de-energizing it and causing it to close and cease burning of the furnace.

Under the foregoing conditions the jacket temperature may be considerably above 100° and although the furnace is not operating it is sufficiently warm to cause circulation of air into the room. As the furnace gradually cools and the jacket temperature drops below 100°, if the room temperature is not above 71°, the switch 13 will be closed and as the circuit is still maintained through the contact 4 and the fuel valve will again open and cause operation of the furnace, thus maintaining the jacket temperature at substantially 100° unless the room temperature rises above 71° at which point the circuit through the conductor 20 will be broken at the contact 4 and even with the switch 13 closed the fuel valve cannot become energized.

By the foregoing means and as long as the room temperature is above 70° the furnace will be kept sufficiently warm to cause air circulation unless the room temperature rises above 71° and then the furnace becomes completely inoperative. When the room temperature drops below 70° both conductors 19 and 20 will be closed at the contacts 3 and 4 and full operations of the furnace will begin.

Referring to Fig. 1 which is a diagram of the forced air circulation system, the furnace is provided with the same type of fuel valve 1 and the same type of room thermostat 2 is used in the room. In addition a fan 25 is provided in the air circulatory system. The same type of furnace jacket thermostat is provided in this system excepting that it is provided with a third switch 26 which controls operation of the fan. A third adjustable cam 27 is mounted on the disk 16 which operates the fan switch 26. This arrangement is illustrated in Fig. 3.

The fan may be driven by a two speed electric motor 25. It is customary to operate the fan motor on high voltage current such as 110-volt and the fuel valve is preferably operated by a lower voltage current such as 25-volt. For that reason the motor is connected directly into the 110-volt system and the lower voltage for the fuel valve system is provided by the like transformers 28 two of which are shown but all of the low voltage current may be supplied by one transformer if desired. This system also includes a relay switch generally indicated as 29 provided with two switch levers 30 and 31 simultaneously actuated by a magnet 32. These switch levers 30 and 31 are moved to the solid line position when the magnet 32 is energized and dropped to the dotted line position when the magnet is de-energized. The relay includes the contacts 33 and 34 which coact with the arm 30 and the contacts 35 and 36 which coact with the arm 31.

The high voltage current is carried by the conductors 40 and 41, conductor 41 being connected directly to the ground post of the two speed fan motor 25. The conductor 40 is joined with the fan switch 26 by the conductor 42 and the conductor 43 leads from the switch 26 to the relay switch lever 31. The conductor 44 leads from the relay contact 35 to the high speed post of the motor 25 and the relay contact 36 is connected by the conductor 45 with the low speed post of the motor 25. By this means the fan motor is operated at high speed when the magnet 32 is energized and the arm 31 lifted and the fan motor is operated at low speed when the magnet is de-energized and the lever 31 is lowered as long as fan switch 26 is in contact.

The conductors 46, 47 and 48 form a circuit for the magnet 32 through the transformer 28 and the room thermostat contact 3 and the thermostat member 5 thereof when the room temperature is below 70°. When the magnet 32 is energized the relay lever 30 is raised into engagement with the contact 33 and circuit to the fuel valve is completed through the conduit 50, the jacket thermostat switch 12, and the conduits 51, 52 and 53 through the transformer 28. When the room temperature rises above 70°, but is below 71°, the relay magnet 32 is de-energized and the lever 30 drops against the contact 34 and if the furnace jacket temperature is below 100° the fuel valve is energized through the conductor 50, the jacket thermostat switch 13, the conduit 55, through the room thermostat, the conduit 48, the jumper 56, and the conduits 52 and 53.

Therefore in this forced air circulation when the room temperature is below 70° the fuel valve is open so that the furnace is in full operation and the fan motor is operated at high speed. But when the room temperature reaches the normal 70° the circuit is broken at the contact 3 in the room thermostat and the relay magnet is

de-energized. The relay levers then drop and close the circuits to operate the fan motor at low speed and if the furnace jacket temperature is above 100° the circuit to the fuel valve is broken by the jacket thermostat switch 13. If the jacket temperature drops below 100° while the room temperature is below 71° the jacket switch 13 will close and open the fuel valve to raise the furnace temperature. However when the room temperature rises above 71° the circuit is broken at the contact 4 and the fuel valve will not open no matter how low the furnace temperature drops and if the furnace temperature falls below substantially room temperature the jacket thermostat switch 26 will open to stop operation of the fan motor.

Therefore it will be seen that this system, applied to either the gravity flow circulation or the forced air circulation system, will operate to raise the room temperature to a normal 70° and will also maintain an air circulation through the system at a lower temperature and reduced flow when the room temperature is above 70° but below 71°. When the room temperature rises above 71° the heating system ceases operation completely so that the room temperature will not be raised to an undesirable point and at this temperature the lack of air circulation in the room is not noticeable.

The invention is defined in the appended claims and is to be considered comprehensive of all forms of structure coming within their scope.

I claim:

1. The combination with a room heating system having a furnace with an electrically controlled single stage burner therefor, and a two-speed electric air circulating fan, of a control device comprising a room thermostat having two electric contact breakers operated by a thermostatic element to open and close at different temperatures, a furnace temperature controlled thermostat having two electric contact breakers operated by a thermostatic element to open and close at different temperatures to control the operation of the burner, said furnace thermostat also having a third contact breaker operated by the said thermostatic element to control operation of the fan, a single relay switch having two synchronously moving switch members, each making and breaking two circuits, one of said switch members being in the burner control circuit and the other in the fan control circuit, the lower temperature room thermostat contact breaker controlling energization of said relay switch which, when energized, closes the circuit through the higher temperature furnace thermostat circuit breaker to operate the furnace burner and also closes the high speed fan circuit through the furnace thermostat fan contact breaker, said relay switch, when deenergized, closes the circuit through the lower temperature furnace thermostat circuit breaker to operate the furnace burner, and also closes the low speed fan circuit through the furnace thermostat fan circuit breaker, the higher temperature room thermostat circuit breaker being in series circuit with the lower temperature furnace thermostat circuit breaker.

2. The elements of claim 1 in which deenergization of the relay switch throws the higher temperature room thermostat circuit breaker and the lower temperature furnace thermostat circuit breaker in series circuit with the higher temperature furnace thermostat circuit breaker.

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