

Feb. 4, 1941.

J. S. BAKER

2,230,446

AUTOMATIC CONTROL SYSTEM FOR WARM AIR FURNACES

Filed July 16, 1934

4 Sheets-Sheet 1

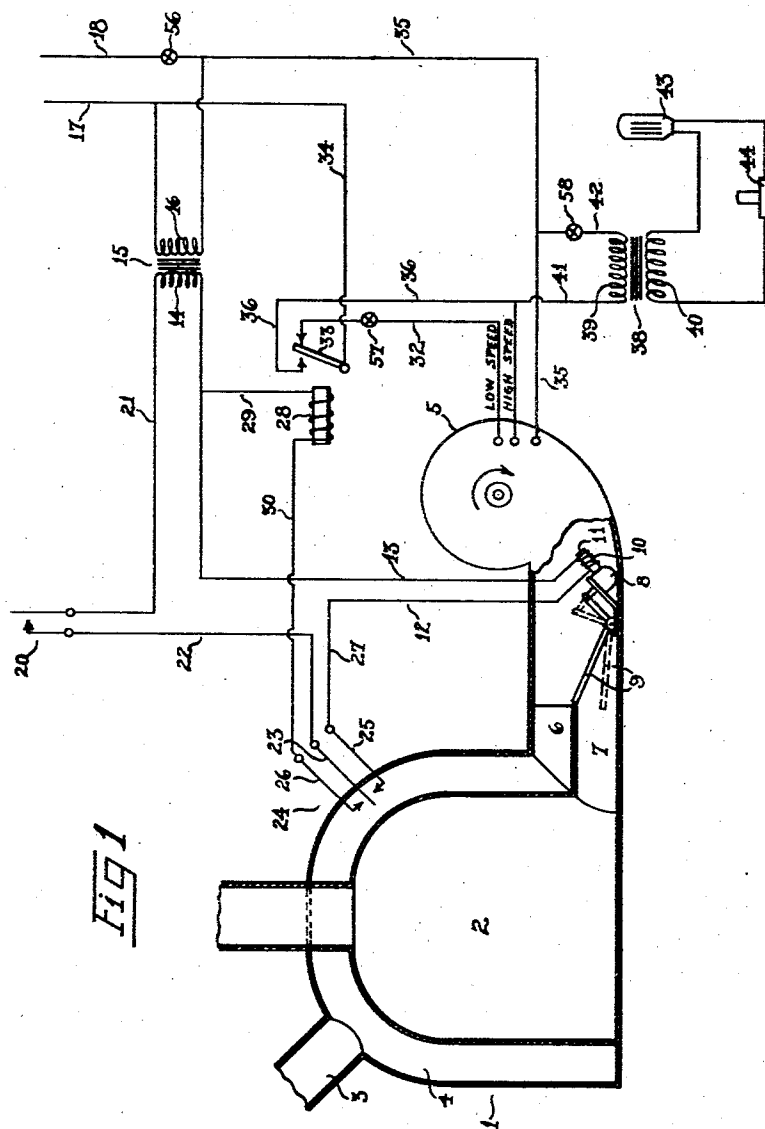


Fig. 1

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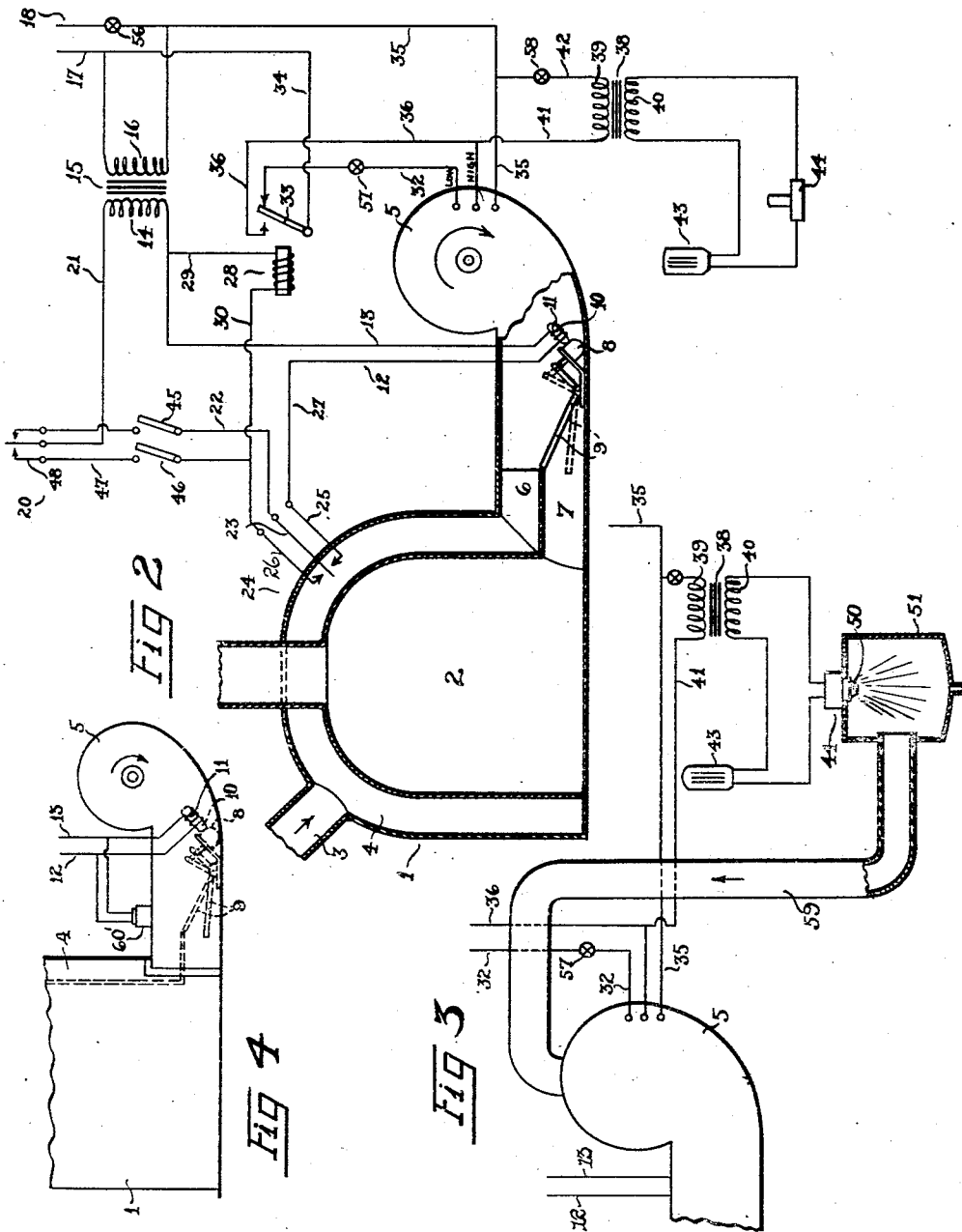
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2,230,446

AUTOMATIC CONTROL SYSTEM FOR WARM AIR FURNACES

Filed July 16, 1934

4 Sheets-Sheet 2



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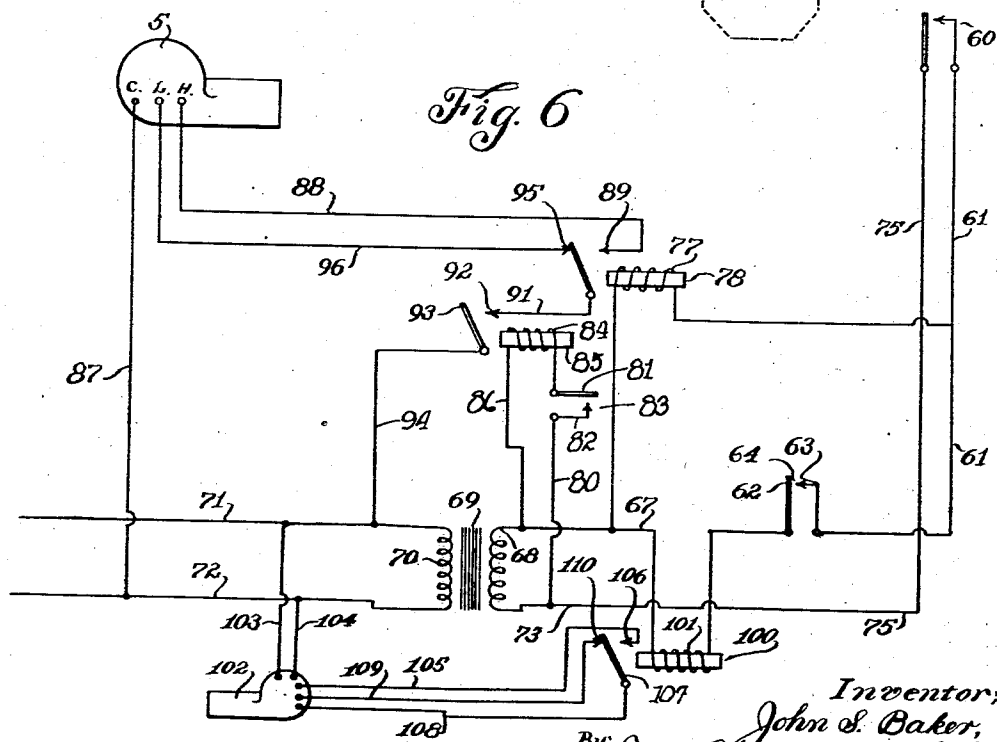
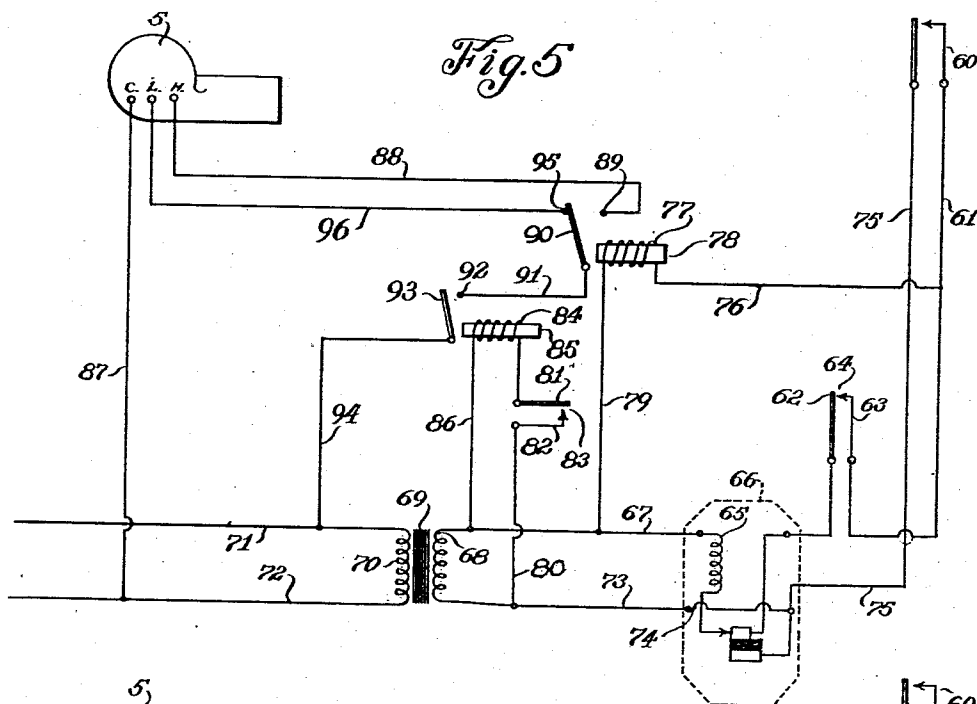
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2,230,446

AUTOMATIC CONTROL SYSTEM FOR WARM AIR FURNACES

Filed July 16, 1934

4 Sheets-Sheet 3



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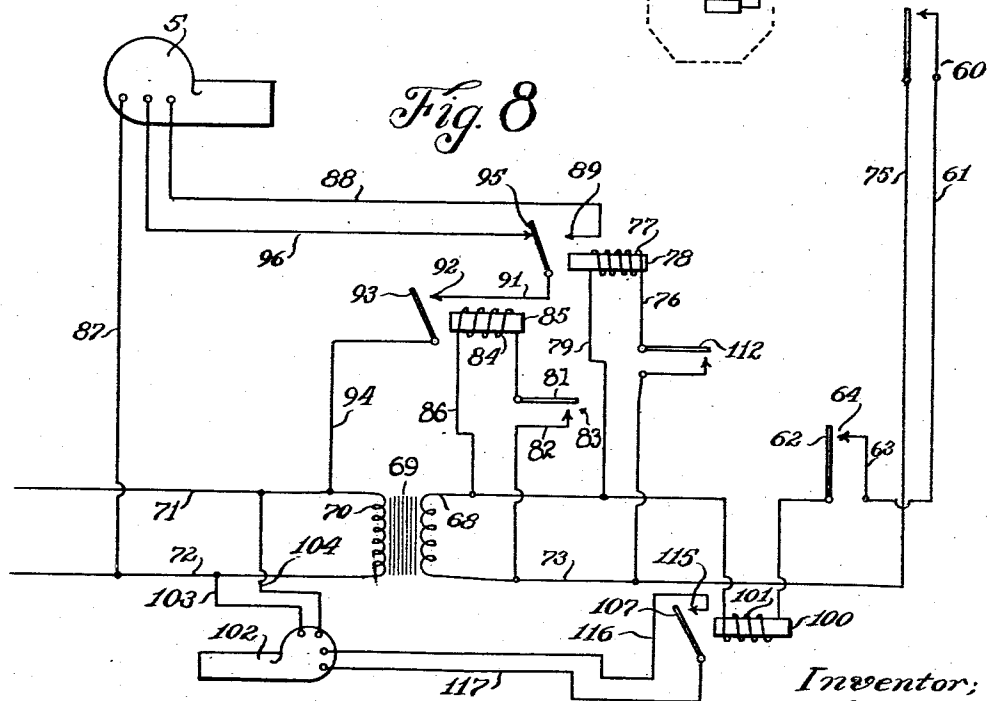
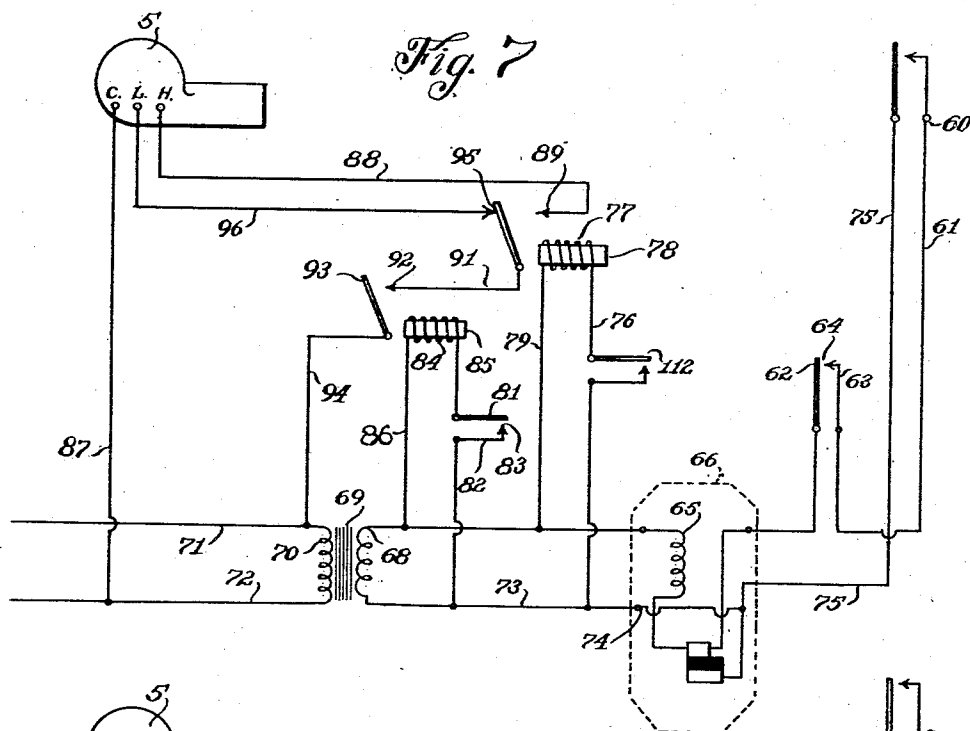
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2,230,446

AUTOMATIC CONTROL SYSTEM FOR WARM AIR FURNACES

Filed July 16, 1934

4 Sheets-Sheet 4



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UNITED STATES PATENT OFFICE

2,230,446

AUTOMATIC CONTROL SYSTEM FOR WARM
AIR FURNACESJohn S. Baker, Chicago, Ill., assignor to Cook
Electric Company, Chicago, Ill., a corporation
of Illinois

Application July 16, 1934, Serial No. 735,457

68 Claims. (Cl. 236—9)

This application is a continuation in part of my abandoned application 645,555 filed Dec. 3, 1932.

5 This invention relates to control apparatus principally for use with a warm air furnace.

More particularly, this invention relates to control apparatus adapted for use with warm air furnaces wherein forced drafts are utilized to support combustion and to bring heated air from the furnace into the room, the apparatus being preferably under the control of a thermostat in the room. It will be understood, however, that the invention is not limited to warm air furnaces utilizing forced drafts to support combustion and to supply heated air to the room, but may be used in ordinary heating systems employing equivalent instrumentalities of control for maintaining a relatively uniform room temperature.

20 In heating systems employing warm air furnaces, as heretofore provided, it has been customary to maintain the control of the furnace under the room thermostat and intermittently increase the rate of combustion as the room temperature drops and the thermostat calls for heat. It has been found, however, that intermittent operation of the heating system results in air stratification, with a temperature of 70° Fahr. (for example) in the region of the thermostat, which will satisfy the thermostat, and a lower temperature of several degrees at or directly above the floor. This condition is known as a "cold 70," is very undesirable and may be overcome chiefly by the use of a forced circulation. On the other hand, in view of poor conditions of chimneys and the uncertainties and variations of them, natural drafts have been found at times to be insufficient to secure proper combustion, particularly when outside conditions might tend to check a natural draft, although the room thermostat might be calling for heat and the outside temperature low enough to require a prompt response by the furnace to increase the combustion in order to prevent serious chilling of the room. Forced drafts for increasing combustion have been employed, however, but difficulty has been experienced in securing a heating system satisfactorily combining a forced circulation for bringing the heated air into the room to prevent stratification of the air and a "cold 70," and maintain a proper warm air circulation during the heating of the room, with a forced draft for increasing the rate of combustion of the furnace sufficiently to prevent

chilling of the room when the thermostat calls for heat.

An object of the invention, therefore, resides in an improved control apparatus adapted particularly for warm air heating systems in which a blower or the like may operate to furnish a forced draft, both to the furnace and warm air duct leading to the room or rooms to be heated, or to the warm air duct alone, either at high or low speeds, depending upon the temperature of the furnace bonnet at the time the room thermostat calls for heat.

A further object of the invention resides in providing improved control apparatus of this type capable of regulating the speed of operation of the blower, or other means furnishing the forced draft, whereby to obtain the proper forced draft and operation of the furnace and to maintain a relatively uniform room temperature at all times.

A further object of the invention resides in providing an electrical system wherein thermostatic means responsive to furnace temperature may control the operation of the blower or draft producing means, either to increase the rate of combustion or to increase the rate of delivery of heated air into the room.

A further object of the invention resides in providing an improved forced draft control of the type above described adapted for summer or winter use wherein the temperature of the room may be lowered and the air more effectively cooled in the summer months by keeping the air in constant circulation.

A still further object of the invention resides in control apparatus for warm air heating systems which includes humidity control means adapted to operate at such times as to supply proper amounts of moisture to the warm air and maintain the humidity of the room to be heated at a predetermined value, there being means to operate the humidity control means according to humidity conditions and temperature requirements of the room.

A still further object of the invention resides in control apparatus for warm air heating systems in which humidity control means may be employed to accomplish the results above mentioned, yet capable of use with a summer control arranged effectively to cool the room by keeping the air in circulation and to wash the air, if so desired, to maintain a relatively lower temperature, or a relatively uniform cool temperature.

Other objects and advantages of the invention

will be apparent from the following detailed description taken in connection with the accompanying drawings, in which:

Figure 1 is a view partly diagrammatic and partly structural of a two-wire circuit and apparatus embodying the invention;

Fig. 2 is a similar view illustrating a three-wire circuit permitting the use of a winter and summer control;

Fig. 3 is a detailed view of one form of humidity control particularly adapted for summer use;

Fig. 4 is a detailed view illustrating an oil or gas fired furnace connected in a system embodying the present invention;

Fig. 5 is a wiring diagram of a further embodiment of the invention;

Fig. 6 is a wiring diagram illustrating an oil or gas-fired furnace connected in this further embodiment of the invention;

Fig. 7 is a wiring diagram illustrating a still further embodiment of the invention; and

Fig. 8 is a wiring diagram illustrating an oil or gas-fired furnace used in the system shown in Fig. 7.

It may be mentioned at the outset that I contemplate employing a single blower so associated with control apparatus as to maintain a constant circulation of air at low speed through the warm air duct of the furnace and to the rooms until the room thermostat calls for heat. When the room thermostat calls for heat, the control apparatus acts to divert a portion of the blower discharge into the fire box of the furnace to act as a forced draft and to allow the remaining air from the blower to continue circulating through the duct and into the room, which tends, of course, to lower the normal circulation and produce a sensible feeling of a rising temperature. When the forced draft increases the combustion and raises the furnace temperature, the control apparatus acts to increase the speed of the blower to increase the velocity of its discharge as well as to discontinue the forced draft to the furnace. All the air circulated by the blower at high speed will pass through the warm air duct into the room until the room thermostat has been satisfied and its circuit opened. By arranging the control apparatus to keep the blower continuously operating, there will be a constant flow of air through the bonnet of the furnace, which will prevent any overheating and serious damage of the furnace, or which, in summer, will maintain the room at a comfortably cool temperature.

There is preferably included in the control apparatus a relay operating under the control of a furnace thermostat for determining the speed of operation of the blower. The control apparatus may further include a humidostat adapted to operate preferably when the blower is operating at high speed to control the humidity of the air supplied to the blower and to the room through the furnace air duct according to the humidity requirements of the air already in the room. In the event it is desirable to utilize the heating system as a ventilating and cooling system during the summer months, a summer and winter control may be incorporated and the room thermostat employed to control the apparatus according to room temperature. The relay may be operated by the room thermostat when a predetermined high room temperature is reached to run the blower at high and low speed and to place a humidity control in operating condition not only to control the humidity of the air sup-

plied to the room but also to cool the air by washing it if so desired.

Referring to Fig. 1, it will be understood that the furnace may be of any type other than that of the warm air type, and there may be used coal or other solid fuel, or liquid fuel, such as oil or gas, suitable arrangements being made in connection with the control apparatus to allow for such well known variations in the heating art.

Furnace 1 includes a fire box 2, a warm air duct 4, forming a bonnet for the furnace, and one or more warm air ducts 3 leading to the room or rooms to be heated. A blower 5 is illustrated as communicating with warm air duct 4 by a passage 6 and with the fire box 2 by a passage 7.

An electrically operated damper controller 8 is arranged to actuate a damper 9 adapted to swing to open and closed positions at or adjacent to the outlet of blower 5.

Damper 9 may be pivotally mounted to close passage 7 leading to fire box 2 of furnace 1 when swung to closed position and to open passage 7 when swung to its open position, as shown in dotted lines in Fig. 1. It will be understood that the exact location or movement of damper 9 to accomplish the results herein disclosed need not be limited as shown in the drawing, because it will be obvious to those skilled in the art that various other damper constructions may be provided without departing from the essence of the present invention.

Electrically operated controller 8 may include any suitable motor, but as shown, may be a vapor motor having a heating element 10 and a coil 11 arranged in a circuit including wires 12 and 13. It is not believed necessary to describe in detail the construction of the vapor motor because any suitable type of motor may be used. It is only essential to employ a prime mover capable of operating damper 9 to open passage 7 when it is desired to provide a forced draft to the fire box to increase the rate of combustion and to close this passage when the heat of the furnace rises above a predetermined temperature.

The motor circuit, including wires 12 and 13, may include a secondary coil 14 of a transformer 15 having its primary coil 16 connected across the line wires 17 and 18. The circuit of room thermostat 20 includes a wire 21 connecting to secondary coil 14 of transformer 15 and a wire 22 connecting to an intermediate contact 23 of a furnace thermostat 24. Furnace thermostat 24 may be, if so desired, of a type including a cold contact 25 and a hot contact 26. Cold contact may connect to motor circuit wire 12 by a wire 27. Hot contact 26 may include in its connections a control element, such as a relay 28 connected in the line by a wire 29 and to this hot contact 26 by a wire 30. Furnace thermostat may be known as a limit switch adapted to close the motor circuit of the electrically operated damper controller 8 when room thermostat 20 calls for heat and the furnace is at a predetermined low temperature. This limit switch may also act to energize relay 28 while room thermostat 20 is still calling for heat, although the heat of the furnace has been increased to a predetermined temperature.

As previously stated, it is desirable to operate blower 5 at low and high speeds, the low speed effecting a circulation of air which is just sufficient to keep the air in the room in circulation

to prevent air stratification, and, when the thermostat calls for heat and the furnace is cold, to supply a forced draft sufficient to increase the furnace temperature, and also to allow a portion of this circulation to continue to the room, the decreased air flowing to the room as the result of a portion being used as a forced draft, causing a sensible feeling of a rising temperature at a time when the room is cold and awaiting heat from the furnace. The low speed circuit includes a wire 34, armature 33, wire 32, blower 5 and return wire 35. The high speed circuit includes wire 34, armature 33, wire 36, blower 5 and return wire 35.

It is possible to include a humidifying control for controlling the humidity of the air taken in by the blower at its inlet in accordance with the humidity conditions of the air in the room. It is desirable, however, to operate the humidifying control preferably when the blower is operating at high speed and supplying its air discharge to the warm air conduit 4 of the furnace and to the room. This humidifying control may include a transformer 38 connected across the high speed circuit of blower 5. Transformer 38 includes a primary coil 39 and a secondary coil 40, primary coil 39 being connected by the wires 41 and 42 with the wires 36 and 35, respectively, of the high speed blower circuit. Secondary coil 40 may include a humidostat 43 and a humidifying device 44.

The three-wire circuit shown in Fig. 2 includes a summer and winter control also permitting the use of the heating system as an air ventilating and cooling system during the summer months.

It will be noted that a winter switch 45 is inserted in the wire 22 leading from room thermostat 20 to the middle contact 23 of furnace thermostat 24. In the summer months, switch 45 is opened, while a summer switch 46 in a wire 47 leading from a hot contact 48 of room thermostat 20 to wire 30 is closed. It will be observed, therefore, that a heating system embodying my invention may be converted in a simple fashion to a ventilating and cooling system in the summer months by the mere provision of a room thermostat having hot and cold contacts and a summer and winter switch including the connection 47 leading to wire 30 controlling relay 28. A hot room temperature will cause room thermostat 20 to close the circuit at hot contact 48 and energize relay 28 to close the high speed blower circuit. Blower 5 will operate at high speed to supply the required air to maintain a comfortable ventilation in the room.

On the other hand, the humidifying apparatus disclosed in Fig. 1 may be converted into a cooling apparatus as shown in Fig. 3 by providing the humidifying device 44 in the form of a sprayer or air washer 50 arranged in a suitable tank 51 having any suitable air inlet and a duct 52 leading from the intake of blower 5. If it is not desirable to wash the air as shown in Fig. 3, the humidifying device 44 may act to merely provide sufficient humidity to the air supplied to the intake of the blower according to the humidity conditions of the air in the room. It is desirable to include a snap switch 57 in the low speed circuit of the blower so as to permit cutting out of the low speed circuit of the blower during the summer months, however, it will be apparent that failure to open switch 57 during the summer months will permit the blower to operate continuously at low speed, thereby supplying a continuous circu-

lation of the cooling medium to the room during the summer period, except when the temperature of the room rises to close the hot contact of the room thermostat and operate the blower at high speed to effect a more rapid cooling action.

Inasmuch as the control apparatus is entirely automatic and may operate, therefore, as aforesaid, throughout the year without requiring attention other than to operate the winter and summer switches 45 and 46, it may be desirable to provide a snap switch 56 in the line circuit above transformer 15 in order to disable the automatic operation at any time.

The operation of the control apparatus above described will now be given: Assume that the winter switch 45 is closed and the summer switch 46 is open and the temperature of the room has dropped sufficiently to close the cold side of room thermostat 20. If the furnace is cold, the motor circuit of the electrically operated damper controller 8 is closed at the furnace thermostat 24. The electrically operated damper controller 8 swings the damper 9 to open position. It will be understood, however, that during this period the blower 5 is operating at low speed, relay 28 has not been energized and armature 33 is in a position bridging the contact of wire 32 of the low speed blower circuit. After damper 9 is swung to open position, a portion of the blower discharge is fed through passage 7 to the fire box to act as a forced draft and to increase the rate of combustion. The remaining portion of the blower discharge passing to duct 4 and the room through duct 3 is less than is normally fed to the room at low speed of the blower, with the effect that there is a sensible feeling of a rising room temperature at a time when the room is cold and about to receive heat from the furnace.

When the heat of the furnace reaches a predetermined temperature, furnace thermostat 24 closes the circuit across its hot contact and operates the control element 28, such as the relay, to swing armature 33 from its contact with wire 32 to the contact of the high speed blower wire 36. Thereupon blower 5 will operate at high speed to increase the blower discharge, and consequently, the circulation of air to the room. When movable contact 23 of furnace thermostat 24 swings from cold contact 25 to hot contact 26, to energize relay 28, the motor circuit of damper controller 8 will open. The cooling effects of the air discharge of blower 5 will tend to accelerate the return movement of the electrically operated damper controller 8 if the prime mover of this controller is a heat motor with its heating unit 10 arranged in the path of the air flow from the blower, as shown in Fig. 1. The forced draft to the furnace is discontinued, therefore, when the blower operates at high speed. By increasing the blower discharge upon a predetermined rise of temperature, rapid and satisfactory heating of the room is assured without the danger of this increased air circulation being sent to the room cold. Also, increasing the air circulation when the furnace is hot prevents any tendency of the furnace to overheat.

If the room thermostat 20 is still calling for heat and the furnace temperature has been lowered by the increased circulation of air from blower 5, furnace thermostat 24 causes its movable contact 23 again to engage cold contact 25 and operate the damper controller 8 so as to swing damper 9 to open position. At the same time the circuit is broken, of course, at the hot contact 26 of the furnace thermostat 24, with the result that

armature 33 drops back to its low speed position connecting wires 32 and 34. Blower 5 immediately operates at low speed and supplies air, a portion of which is again utilized as a forced draft for the fire to increase its rate of combustion. When furnace temperature is again raised, the movable contact 23 will bridge hot contact 26 of furnace thermostat 24. The damper 9 is again closed and the blower is operated at high speed to increase the circulation of air at its discharge outlet. This increased circulation of air again enters the warm air conduit 4 to be heated and fed to the room or rooms through warm air duct or ducts 3. This cycle of operation is repeated until the room thermostat 20 is satisfied.

It will be noted that the humidifying apparatus operates to increase the humidity of the air supplied to the intake of blower 5, preferably when this blower is operating at high speed and supplying its discharge to the room.

If it is desirable to utilize the heating system herein disclosed as a ventilating and cooling system during the summer months, the winter switch 45 is opened and the summer switch 46 is closed. Control element or relay 28 is placed under the direct control of room thermostat 20, instead of furnace thermostat 24, and is actuated when room thermostat closes the circuit at hot contact 48 upon a predetermined rise of room temperature. Blower 5 will then operate at high speed to supply sufficient circulation of air to provide adequate ventilation to the room. If it is desirable to wash the air for the purpose of cooling it, the humidifying device 44 may be a sprayer 50, as shown in Fig. 3, arranged to wash the air entering tank 51 and the pipe 59 leading to the intake of blower 5. Switch 57 may be opened during the summer months to prevent the blower from operating at low speed when the room thermostat is not closed at its hot contact 48, and switch 58 may be opened at any time to cut out the operation of the humidity control circuit.

As before stated, furnace 1 may be of any suitable type and fired by coal, or other solid fuel, or liquid fuel, such as oil or gas. In Fig. 4, I have illustrated diagrammatically an electrically operated control 60', such as an oil valve or gas valve, connected in parallel across the wires 12 and 13 of the motor circuit of the damper controller 8, which will operate to supply fuel, in varying amounts as may be necessary to control the rate of combustion, when thermostat 20 calls for heat and damper controller 8 operates to allow a portion of the air circulation to enter the fire box as a forced draft. Control 60' is merely illustrative of one way in which the present apparatus may be adapted to different furnaces or heating systems.

It is not essential to control the rate of combustion where it is desirable to use the high and low speed blower to control circulation of hot air only from the furnace 1, or the heat-conducting medium, such as hot water, steam or the like, in case of furnaces other than the warm air type. Accordingly, in Fig. 5 there is illustrated the heating system omitting the apparatus and connections providing a forced draft through passage 7 to fire-box 2. The circuit of room thermostat 60 will include wire 61, contacts 62 and 63 of a furnace switch 64, coil 65 of a draft controller 66, wire 67, a secondary coil 68 of a transformer 69, a wire 73, a connection 74 through damper controller 66, and a wire 75.

Two relay circuits are preferably connected across the opposite sides of the circuit of the

room thermostat 60. The first relay circuit includes a wire 76, the coil 77 of a relay 78, and a wire 79. The second relay circuit includes a wire 80, the contacts 81 and 82 of a furnace switch 83, the winding 84 of a relay 85, and a wire 86.

The high speed circuit of blower 5 may include a wire 87, blower 5, a wire 88, a contact 89, an armature 90 of relay 78, a wire 91, a contact 92, an armature 93 of relay 85, and a wire 94.

Draft controller 66 is so arranged that, when its actuating coil 65 is energized, it opens the draft and closes the check, and, when deenergized, it closes the draft and opens the check.

Furnace switch 64 is preferably disposed in the room thermostatic circuit between the damper controller 66 and the room thermostat 60. The movable contact 63 of this furnace switch 64 is adapted to disengage contact 62 and open the room thermostatic circuit when the temperature of the furnace rises above or exceeds a predetermined degree. Accordingly, furnace switch 64 prevents overheating of the furnace by opening the circuit to deenergize actuating coil 65 of the damper controller 66, although room thermostat 60 may continue to call for heat. However, if the temperature of the furnace does not exceed a predetermined degree, the circuit of the room thermostat will remain closed to accelerate combustion at the furnace as long as the room thermostat 60 calls for heat.

The relay circuit, including relay 78, is energized when the current flows through the circuit of the room thermostat. Relay 78 actuates armature 90 to close the high speed circuit of blower 5 at contact 89. However, current will not flow through the high speed circuit of blower 5 if the temperature of the furnace drops below a predetermined degree. This is accomplished by an auxiliary circuit embodying relay 85. The furnace switch 83 is arranged to open this auxiliary circuit in the event the temperature of the furnace falls below a predetermined degree, say, for example, below 100° Fahr. Consequently, it will be impossible for blower 5 to deliver air at a temperature not high enough to raise the temperature in the room. It is found that where the temperature of the furnace is too low, operation of the blower will deliver cold air into the room.

If the furnace is above this predetermined low point, contact 82 of furnace switch 83 will engage contact 81 to energize the relay 85, and cause this relay to attract armature 93 into circuit closing position against contact 92. Current will then flow from one side of the line, wire 94, armature 93, contact 92, wire 91, armature 90 of relay 78, contact 89, wire 88, blower 5, and through wire 87 to the other side of the line.

It will be observed that this arrangement of the apparatus will effect high speed operation of blower 5 whenever room thermostat 60 calls for heat and the furnace is below a predetermined high temperature, say, for example, 165° Fahr., but above a predetermined low temperature, say 100° Fahr. If the room thermostat 60 is satisfied and there is no demand for heat in the room, or if the furnace temperature is above said predetermined high degree of 165° Fahr., such as might cause overheating of the furnace, the actuating coil 65 of damper controller 66 will be deenergized and the combustion checked by the draft opening and the check closing. Moreover, if the room thermostat 60 opens, relay 78 will be

deenergized so that armature 90 will drop back to engage contact 95 of the low speed circuit of blower 5, which low speed circuit includes this contact 95, wire 96, blower 5 and wire 97.

Low speed operation of the blower will then occur if the temperature of the furnace is high enough to prevent the air being delivered by blower 5 from entering the room at a temperature chilling the room, say above the aforesaid low degree of 100° Fahr. Furnace switch 83 will be closed and the relay 85 will be energized. Energization of relay 85 attracts armature 93 into circuit closing position against contact 92. It will be observed, therefore, that the furnace control herein disclosed functions practically at all times to keep the blower 5 in operation, either at high or at low speeds, in order to provide a continuous movement of heated air into the room.

In case the furnace is not fired by coal or other solid fuel but by liquid fuel, such as oil or gas, the damper controller 66 may be omitted and the relay 100 inserted in the circuit of room thermostat 60, such as I have illustrated diagrammatically in Fig. 6. Coil 101 of relay 100 is connected between wire 61 and 67. A combustion supporting device 102 employed in oil or gas fired furnaces, or which may be the oil or gas burner itself, is connected across the line by wires 103 and 104. If so desired, the burner 102 may be of the high and low flame type, having high and low flame circuits controlled by relay 100. The high flame circuit may include wire 105, contact 106, armature 107 of relay 100, wire 108, and device 102. The low flame circuit may include wire 109, contact 110, armature 107 of relay 100, wire 108, and device 102.

In the event the room thermostat 60 calls for heat and the furnace temperature has not exceeded a predetermined degree causing overheating of the furnace, current flowing through the circuit of the room thermostat will energize relay 100 and attract its armature into engagement with contact 106 of the high flame circuit of burner 102. The rate of combustion will be accelerated until the furnace temperature reaches a high point that will effect the opening of furnace switch 84, or, as the result of the increased combustion, permit the blower operating at high speed to deliver sufficient warm air to the room to raise the temperature and open room thermostat 60. When either of these two conditions obtain, the circuit of the room thermostat 60 is opened and armature 107 is allowed to drop into engagement with contact 110 of the low flame circuit of heater 102. The low flame of heater 102 will continue until there is a further demand for heat at the room thermostat 60.

Fig. 7 illustrates a heating system whether of the warm air type or otherwise, similar to the heating systems shown in Figs. 5 and 6, except that the circuit of relay 78 is connected across the circuit of the room thermostat 60 in advance of the actuating coil 65 of damper controller 66. This arrangement provides for more frequent operations of the high speed of blower 5 without necessitating acceleration of combustion each time the blower is thus operated. A furnace switch 112 adapted to close when the temperature of the furnace exceeds a predetermined degree, say, exceeds 150° Fahr., is inserted in wire 76. Wires 76 and 79 of the circuit of relay 78 are connected across the circuit of room thermostat 60 in advance of the terminals of draft controller 66, so that the high speed circuit of blower

5 will be energized to operate blower 5 at high speed whenever the furnace temperature is above say 150° Fahr. I find that this arrangement affords a very efficient heating action of furnace 1 because more heat may be taken from the furnace with less acceleration of combustion.

The temperatures mentioned of thermostats 64, 83 and 112 are merely illustrative of satisfactorily operating ranges and may be varied without deviating from the principles of operation herein disclosed.

Fig. 8 represents substantially the same heating system shown in Fig. 7 except that a liquid fuel burner is shown in lieu of a solid fuel burner. As in Fig. 6, a relay 100 is substituted in the circuit of room thermostat 60 in lieu of the actuating coil 65 of draft controller 66. However, in this arrangement, device 102 is not provided with a high and low flame circuit. Armature 107 of relay 100 is adapted to move into circuit engaging position against contact 115 when this relay 100 is energized. The circuit is completed across armature 107, contact 115, wire 116, heater 102 and wire 117. It will be understood, of course, that high and low flame circuits of device 102 shown in Fig. 6 may be provided in this instance, if found desirable, or that device 102 may be a combustion supporting device, such as a motor-driven blower or fan.

From the foregoing description, it will be understood that different parts of the system shown may be rearranged to meet existing conditions and demands for any particular installation without departing from the scope of the invention.

I broadly disclose employing a high and low speed motor that may be placed substantially into continuous operation either at high or at low speed so as to provide a continuous circulation of air from the furnace into the room, the amount of air being delivered depending upon the heating requirements of the demand for heat by room thermostat 60. I further broadly disclose controlling the substantially continuous operation of the blower 5 in accordance with the temperature of the furnace 1, this blower being arranged to operate substantially continuously between predetermined high and low furnace temperatures, whereby the blower will operate continuously at low speed when the temperature of the furnace is above said low degree but at high speed when the room thermostat calls for heat and closes its circuit to energize the combustion supporting means 66 or 102.

Without further elaboration, the foregoing will so fully explain the gist of my invention, that others may, by applying current knowledge, readily adopt the same for use under varying conditions of service, without eliminating certain features which may properly be said to constitute the essential items of novelty involved, which items are intended to be defined and secured to me by the following claims.

I claim:

1. In a heating system, a furnace including a warm air duct, means for producing a forced draft for said warm air duct, thermostatic apparatus in the room to be heated, thermostatic apparatus at said furnace, and means controlled by said thermostatic apparatus for directing the forced draft to said warm air duct or diverting a portion of the forced draft to the furnace to increase the rate of combustion.

2. In a heating system, a furnace including a warm air duct, a device for supplying air to said warm air duct and to said furnace to increase

the rate of combustion, electrically operated means for controlling the flow of the air supply to said warm air duct and to said furnace, thermostatic apparatus responsive to the heat produced by said furnace, thermostatic apparatus in the room to be heated and connections between said electrically operated means and said thermostatic apparatus by means of which said electrically operated means may conduct the air supply to said warm air duct or may divert a portion of the air supply to said furnace.

3. In a heating system, a furnace including a warm air duct, a device for supplying air to said warm air duct and to said furnace to increase the rate of combustion, an electrical circuit including a room thermostat and a furnace thermostat, and an electrically operated damper controller in said circuit for controlling the direction of flow of said air supply.

4. In a heating system, a furnace including a warm air duct, a device for supplying air to said warm air duct and to said furnace to increase its rate of combustion, a room thermostat responsive to heat produced by said furnace, a furnace thermostat responsive to the heat of said furnace, an electrically operated controller, and connections between said thermostats and said controller for controlling the direction of flow of the air supply.

5. In a heating system, a furnace including a warm air duct, a motor, a variable speed blower driven by said motor, said blower being connected to said warm air duct and to the fire box of said furnace, electrically operated means for controlling the flow of air circulated by said blower, an electrical circuit in which said means is disposed, and thermostatic apparatus in said electrical circuit by means of which said blower operates at different speeds and said electrically operated means operates to connect said blower either with said warm air duct and with the fire box of said furnace, or with said warm air duct alone.

6. In a heating system, a furnace including a warm air duct, a motor, a variable speed blower driven by said motor producing a forced draft for said warm air duct and the fire box of said furnace, an electrical circuit, thermostatic apparatus controlling said circuit, control means in said circuit operated by said thermostatic apparatus for varying the speed of said blower, and means in said circuit for controlling the feed of the forced draft whereby to direct said forced draft to said warm air duct or to divert at times a portion of said forced draft to said fire box, the feed of the forced draft to said fire box being at a reduced speed of said blower, the feed of the forced draft to said warm air duct being at a higher speed of said blower upon a predetermined rise of furnace temperature.

7. In a heating system, a furnace including a warm air duct, a motor, a high and low speed blower driven by said motor producing a forced draft for said warm air duct and for the fire box of said furnace, an electrical circuit, thermostatic apparatus controlling said circuit, means in said circuit for controlling the speed of said blower, and means in said circuit for closing the draft to said fire box when said blower operates at high speed and for opening the draft to said fire box when said blower operates at low speed.

8. In a heating system, a furnace including a warm air duct, a motor, a high and low speed blower driven by said motor producing a forced draft for said warm air duct and for the fire

box of said furnace, an electrical circuit, thermostatic apparatus responsive to room and furnace temperatures controlling said circuit, control means in said circuit to operate said blower at high speed when the furnace temperature exceeds a predetermined degree, and means in said circuit for closing the draft to said fire box when said blower operates at high speed.

9. In a heating system, a furnace including a warm air duct, a motor, a high and low speed blower driven by said motor producing a draft for said warm air duct and a draft for the fire box of said furnace, an electric circuit in which said blower is connected, a room thermostat in said circuit, a furnace thermostat in said circuit, control means in said circuit to operate said blower at high and low speeds, and means in said circuit for controlling the draft to said warm air duct and to said furnace fire box according to the condition of said thermostat and the speed of said blower.

10. In a heating system, a furnace including a warm air duct, a high and low speed blower producing a draft for said warm air duct and a draft for the fire box of said furnace, an electric circuit in which said blower is connected, control means in said circuit to operate said blower at high and low speeds, electrically operated means for opening and closing the draft to said furnace fire box, a thermostat in said circuit influenced by the furnace temperature, and a second thermostat for closing said circuit upon a predetermined drop of room temperature whereby, if the furnace is at a predetermined low temperature, said control means will operate said blower at low speed and said draft operating means will open the draft to said furnace fire box, and, if the furnace is at a predetermined high temperature, said control means will operate said blower at high speed and said damper operating means will close the draft to said furnace fire box.

11. In a heating system, a furnace including a warm air duct, a blower producing a warm air circulation for said duct and a forced draft for the fire box of said furnace, a control device for varying the speed of said blower, a thermostat responsive to furnace temperature for operating said control device whereby the speed of said blower will be increased by an increased temperature or hot condition of said furnace and will be lowered by a decreased temperature or cold condition of said furnace, means also operating according to the condition of said furnace thermostat for directing the blower discharge either solely to said warm air duct or partly to said furnace fire box and partly to said warm air duct, and a thermostat responsive to room temperature for controlling said furnace thermostat.

12. In a heating system, a furnace including a warm air duct, a blower producing a warm air circulation for said duct and a forced draft for the fire box of said furnace, a control device for varying the speed of said blower, a thermostat responsive to furnace temperature for operating said control device whereby the speed of said blower will be increased by an increased temperature or hot condition of said furnace and will be lowered by a decreased temperature or cold condition of said furnace, means also operating according to the condition of said furnace thermostat for directing the blower discharge either solely to said warm air duct or partly to said furnace fire box and partly to said warm air duct, a thermostat responsive to room temperature for controlling said furnace ther-

mostat, and means controlled by the humidity of the air in the room for controlling the humidity of the air delivered by said blower to said warm air duct according to the temperature conditions of said furnace.

13. In a heating system, a furnace including a warm air duct, a blower producing a warm air circulation for said duct and a forced draft for the fire box of said furnace, a control device for varying the speed of said blower, a thermostat responsive to furnace temperature for operating said control device whereby the speed of said blower will be increased by an increased temperature or hot condition of said furnace and will be lowered by a decreased temperature or cold condition of said furnace, means also operating according to the condition of said furnace thermostat for directing the blower discharge either solely to said warm air duct or partly to said furnace fire box and partly to said warm air duct, a thermostat responsive to room temperature for controlling said furnace thermostat, and means operable upon an increased furnace temperature and the discontinuation of the draft to said furnace fire box for controlling the humidity of the air supplied by said blower to said warm air duct.

14. In a heating system, a furnace including a warm air duct, means for producing a warm air circulation for said duct and a forced draft for the fire box of said furnace, a control device for varying the rate of discharge of said air circulating means, a furnace thermostat influenced by a cold and a warm condition of said furnace, said furnace thermostat operating said control device whereby the rate of discharge of said air circulating means will be increased by a hot furnace condition to be supplied solely to said warm air duct and will be lowered by a cold furnace condition to be supplied as a forced draft to said furnace fire box, and means controlling the direction of flow of the air discharged by said air circulating means according to said hot or cold condition of said furnace.

15. In a heating system, a furnace including a warm air duct, means for producing a warm air circulation for said duct and a forced draft for the fire box of said furnace, a control device for varying the rate of discharge of said air circulating means, a furnace thermostat influenced by a cold and a warm condition of said furnace, said furnace thermostat operating said control device whereby the rate of discharge of said air circulating means will be increased by a hot furnace condition to be supplied solely to said warm air duct and will be lowered by a cold furnace condition to be supplied as a forced draft to said furnace fire box, means controlling the direction of flow of the air discharged by said air circulating means according to said hot or cold condition of said furnace, and means acting independently of said furnace thermostat for setting said control device in a position causing said air circulating means to operate at said increased rate temporarily and provide a continuous increased air supply to said duct.

16. In a heating system, a furnace including a warm air duct, electrically operated means for producing a warm air circulation for said duct and a forced draft for the fire box of said furnace, a thermostat responsive to room temperature for controlling the circuit of said air circulating means, an electrically operated controller in circuit with said room thermostat for controlling the flow of air produced by said air cir-

culating means whereby to supply the air to said duct and to said furnace fire box, a relay in circuit with said air circulating means, a thermostat responsive to warm and cold conditions of said furnace and controlling said relay to control the rate of discharge of said air circulating means, and means operable at said room thermostat and in the circuit of said relay to effect a temporarily increased rate of discharge of said air circulating means independently of the operation of said furnace thermostat.

17. In a heating system, a furnace including a warm air duct, electrically operated means for producing a warm air circulation for said duct and a forced draft for the fire box of said furnace, a thermostat responsive to room temperature for controlling the circuit of said air circulating means, an electrically operated controller in circuit with said room thermostat for controlling the flow of air produced by said air circulating means whereby to supply the air to said duct and to said furnace fire box, a relay in circuit with said air circulating means, a thermostat responsive to warm and cold conditions of said furnace and controlling said relay to control the rate of discharge of said air circulating means, means operable at said room thermostat and in the circuit of said relay to effect a temporarily increased rate of discharge of said air circulating means independently of the operation of said furnace thermostat, and means in circuit with said relay and operable when said relay is energized to effect an increased rate of discharge of said air circulating means for controlling the humidity of the air delivered by said blower according to the humidity conditions of the air in the room.

18. In a heating system, a furnace including a warm air duct for furnishing heated air to a room to be heated, a thermostat responsive to temperature variations of said room, means for producing an air circulation, means controlled by said thermostat for diverting a portion of said air circulation to the furnace as a forced draft to increase the rate of combustion, means operable upon a predetermined rise of furnace temperature to increase the capacity of said air circulating means to provide increased air circulation to said air duct and to discontinue the operation of said diverting means, and means continuing the operation of said air circulating means at a decreased capacity upon a predetermined rise of room temperature to maintain a constant air circulation to said room while said room thermostat is satisfied to prevent air stratification in said room.

19. In a heating system, a furnace including a warm air duct, means for producing a forced draft to said air duct to provide a constant circulation of air to a room to be heated to prevent stratification of the air therein, a thermostat responsive to temperature variations of said room, means controlled by said thermostat to divert a portion of said forced draft to said furnace upon a predetermined drop of room temperature to increase the rate of combustion in said furnace, and means controlling said air circulating means to provide an increased forced draft upon a predetermined rise of furnace temperature until the heat of said room rises to a predetermined temperature whereby to restore said air circulating means to its original operating capacity of a constant circulation of air to said room to prevent air stratification therein.

20. In a heating system, the combination of

apparatus for controlling the rate of combustion and the rate of supply of a heat conducting medium, thermostatic apparatus responsive to furnace temperature and the temperature of the room to be heated, and means between said control apparatus and said thermostatic apparatus by means of which said control apparatus operates to supply said heat conducting medium between predetermined low and high furnace temperatures and to accelerate the rate of supply of said heat conducting medium and the rate of combustion below a predetermined room temperature.

21. In a heating system, the combination of apparatus for controlling the rate of supply of a heat conducting medium, thermostatic apparatus responsive to furnace temperature and the temperature of the room to be heated, and means between said control apparatus and said thermostatic apparatus by means of which said control apparatus operates to supply said heat conducting medium between predetermined low and high furnace temperatures and to accelerate the rate of said supply below a predetermined room temperature.

22. In a heating system, the combination of apparatus for controlling the rate of supply of a heat conducting medium, thermostatic apparatus responsive to furnace temperature, and means between said control apparatus and said thermostatic apparatus by means of which said control apparatus operates to supply said heat conducting medium between predetermined low and intermediate furnace temperatures and to accelerate the rate of said supply between said intermediate and a predetermined high furnace temperature.

23. In a heating system, the combination of apparatus for controlling the rate of supply of a heat conducting medium, thermostatic apparatus responsive to furnace temperature and the temperature of the room to be heated, and means between said control apparatus and said thermostatic apparatus by means of which said control apparatus operates to supply said heat conducting medium between predetermined low and intermediate furnace temperatures, to accelerate the rate of said supply between said intermediate and a predetermined high furnace temperature, and, irrespective of said intermediate furnace temperature, to accelerate the rate of said supply between said predetermined low and high furnace temperatures when said room temperature drops below a predetermined degree.

24. In a heating system, a heater, an electrically operated device for controlling the rate of combustion at said heater, thermostat responsive to the temperature of the room to be heated, a thermostat responsive to a predetermined high temperature of said heater, a circuit including in series relation said combustion controlling device and said room and furnace thermostats, electrically operated means for controlling the rate of supply of a heat conducting medium, a two speed circuit for said medium controlling means, and connections between said circuits including a second furnace thermostat responsive to predetermined low furnace temperature by means of which said medium controlling means operates at low and high speeds to supply said heat conducting medium to the room to be heated according to furnace and room temperatures.

25. In a heating system, a heater, means for supplying a heat conducting medium at a predetermined rate to the room to be heated, a

thermostat responsive to the temperature of the room, means controlled by said room thermostat to decrease said rate of supply of said heat conducting medium when said room thermostat calls for heat, and means controlled by the temperature of said heater and operable during the period said room thermostat is calling for heat for restoring the rate of supply of said heat conducting medium and for accelerating the same beyond said predetermined rate.

26. In a heating system, a heater, means for supplying a heat conducting medium at a predetermined rate to the room to be heated, a thermostat responsive to the temperature of the room, means controlled by said room thermostat to decrease said predetermined rate of supply of said heat conducting medium when said room thermostat calls for heat, means controlled by the temperature of said heater and operable during the period said room thermostat is calling for heat for restoring said predetermined rate of supply of said heat conducting medium and to accelerate the same beyond said predetermined rate, and means for discontinuing the supply of said heat conducting medium when the temperature of said heater drops below a predetermined low temperature.

27. In a heating system, a heater, means for supplying a forced circulation of a heat conducting medium at a predetermined rate to the room to be heated, a room thermostat responsive to the temperature of the room, and control means responsive to the temperature of said heater for said supply means whereby said heat conducting medium will be supplied at said predetermined rate when said room thermostat is satisfied and will be supplied at an increased rate when said room thermostat calls for heat and said heater is above a predetermined temperature.

28. In a heating system, a heater, means for supplying a heat conducting medium at a predetermined rate to the room to be heated, a room thermostat responsive to the temperature of the room, control means responsive to the temperature of said heater for said supply means whereby said heat conducting medium will be supplied at a predetermined rate when said room thermostat is satisfied and will be supplied at an increased rate when said room thermostat calls for heat, and means operable when said heat conducting medium is supplied at said increased rate for controlling the humidity of the air in the room.

29. In a heating system, a heater, a multi-speed blower for supplying a heat conducting medium from said heater to a room to be heated, a thermostat responsive to the temperature of the room, and means including a thermostat responsive to the temperature of said heater and controlled by said room thermostat for controlling said multi-speed blower whereby to operate said multi-speed blower at a predetermined rate or at an accelerated rate.

30. In a heating system, a heater, a multi-speed blower for supplying a heat conducting medium from said heater to a room to be heated, a thermostat responsive to the temperature of the room, means including a thermostat responsive to the temperature of said heater and controlled by said room thermostat for controlling said multi-speed blower whereby to operate said multi-speed blower at a predetermined rate or at an accelerated rate, and means operable when said heat conducting medium is supplied

plied at said accelerated rate for controlling the humidity of the air in the room.

31. In a temperature controlling system, a heater, multi-speed circulating means for supplying a forced circulation of a heat conducting medium at different rates of flow from said heater to a room to be heated, a thermostat responsive to the temperature of the room, control mechanism associated with said room thermostat and controlling said circulating means at different speeds whereby to supply said heat conducting medium at different rates of flow to maintain the room substantially at a predetermined heated temperature, and means associated with said control mechanism for actuating said circulating means when the temperature of the room exceeds a predetermined temperature whereby to supply said medium at an unheated temperature to the room to maintain the room at a predetermined cool temperature.

32. In a temperature controlling system, a heater, means for supplying a heat conducting medium from said heater to a room to be heated, a thermostat responsive to the temperature of the room in circuit with said supply means, means responsive to the temperature of said heater and in circuit with said supply means and said room thermostat by means of which said heat conducting medium will be supplied at a predetermined rate when the temperature of said heater is at predetermined low temperature but will be supplied at an accelerated rate when the temperature of said heater rises above said predetermined low temperature, and means in circuit with said room thermostat and said heater responsive means for disabling the operation of said supply means at said predetermined rate but continuing the operation of said supply means at said accelerated rate whereby to supply said heat conducting medium as a cooling medium to the room when the temperature of the room exceeds a predetermined high temperature.

33. In a heating system, a heater, high or low rate combustion producing means for said heater, means for supplying a heat conducting medium from said heater at different rates to a room to be heated, a thermostat responsive to the temperature of the room, a thermostat responsive to the temperature of said heater, and control devices for said combustion producing means and said supply means associated with said thermostats whereby said combustion producing means may operate at a predetermined low or high rate, and said supply means may operate at a predetermined normal or accelerated rate, the rate of operation of said combustion producing means being controlled by predetermined room temperatures and the rate of operation of said supply means being controlled by predetermined furnace temperatures.

34. In a heating system, a furnace, a high and low speed blower to provide a circulation of air to a room to be heated, a thermostat responsive to the temperature variations of said room, a thermostat responsive to the temperature variations of said furnace, and connections between said blower and said furnace thermostat for controlling the operation of said blower at high speed above a predetermined furnace temperature and at low speed below said predetermined furnace temperature.

35. In a furnace control, the combination of apparatus of variable capacity for controlling the rate of supply of a heat conducting medium to a room to be heated, thermostatic apparatus re-

sponsive to furnace temperature and to room temperature, and connections between said control apparatus and said thermostatic apparatus by means of which said control apparatus operates at different capacities to supply the heat conducting medium to said room, said furnace thermostatic apparatus operating said control apparatus to supply the heat conducting medium at one capacity below a predetermined furnace temperature and at another capacity above said predetermined furnace temperature.

36. In a system of the class described, means for supplying a heat transfer medium to a room, a control device for operating said supply means to supply said heat transfer medium at a predetermined rate or at an accelerated rate, a thermostat responsive to the temperature of the room for controlling the operation of said control device, a heater for said heat transfer medium, a thermostat responsive to the temperature of said heater, and mechanism for placing said control device under the operation of said furnace thermostat when said heater is functioning to heat said heat transfer medium or under the operation of said room thermostat when said heater is not functioning and the heat transfer medium is used as a cooling medium for the room.

37. In a system of the class described, means for supplying a heat transfer medium to a room, control means for operating said supply means to supply said heat transfer medium at a predetermined rate and at an accelerated rate, thermostatic apparatus responsive to the temperature of the room for effecting operation of said supply means, a heater for said heat transfer medium, means for controlling the operation of said heater, and thermostatic apparatus responsive to the temperature of said heater for controlling the operation of said control means whereby to supply said heat transfer medium at said predetermined rate and at said accelerated rate according to predetermined heater conditions, said heater thermostatic apparatus having provisions for controlling the operation of said heater control means according to heater conditions independent of the heater conditions controlling the operation of said supply means.

38. A temperature control system of the class described, comprising, in combination, a circulator for circulating a fluid medium to a space the temperature of which it is desired to control, means responsive to the temperature of the fluid medium for operating said circulator at a low speed whenever the temperature of the fluid medium is at a given value, and means responsive to the temperature of the space for operating said circulator at a higher speed when the space temperature diverges from a predetermined value.

39. In a temperature control system, an electrically operated circulator for circulating a fluid medium, a switch responsive to the temperature of the fluid medium, circuit connections controlled by said switch for operating said circulator at one speed when said switch is closed, a thermostatic switch responsive to a temperature condition other than that of the circulating medium, and circuit connections for operating said circulator at another speed when both said switches are closed.

40. The combination with a warm air furnace and an electrically operated circulator for circulating the air heated thereby, of means in control of the supply of heat to said air, a switch

responsive to the temperature of said air and closed when the temperature thereof is above a predetermined minimum value, a circuit for operating said circulator at low speed controlled by said switch, a room thermostat, and connections between said room thermostat, heat supply controlling means and circulator for increasing the supply of heat to said air and for operating said circulator at a higher speed when the room temperature falls below a predetermined value.

41. A temperature control system of the class described, comprising in combination, circulation controlling means in control of the flow of a fluid medium for changing the temperature of a space, means responsive to the temperature of the fluid medium to operate the circulation controlling means to produce a predetermined flow of fluid whenever the temperature of the fluid medium is at a given value, and space temperature responsive means to operate the circulation controlling means to produce a different flow of fluid when the space temperature is at a given value, said fluid medium temperature responsive means preventing operation of the circulation controlling means by the space temperature responsive means if the temperature of the fluid medium is not at said given value.

42. In a system for heating and humidifying a space to be controlled, in combination, means to deliver air to the space, means to heat said air, means to add moisture to the air, means responsive to the humidity of the space in control of said moisture adding means, means responsive to the temperature of the air in control of the air circulating means to increase the circulation of air to the space and to permit control of the moisture adding means by the humidity responsive control only when the temperature of the air is sufficiently high, and means responsive to the temperature of the space in control of the means to heat the air to raise the temperature thereof when the temperature of the space becomes too low.

43. In combination, a heater for heating air delivered to a space, electrical means in control of the heater, a space thermostat in control of said heater controlling means to increase the heating of the air when the space temperature becomes too low, electrical means to circulate the heated air to the space, an air temperature responsive switch in control thereof to increase the circulation of air to the space when the temperature of the air becomes sufficiently high, electrical means to add moisture to the air, a space humidity responsive switch, and circuit connections controlled by the conjoint action of said switches in control of said electrical moisture adding means.

44. In a temperature controlling system, a heater, multi-speed circulating means for supplying a forced circulation of a fluid medium from said heater to a room to be heated, a thermostat responsive to the temperature of the room, control mechanism controlled by said thermostat and operating said circulating means at high speed upon a drop of room temperature to a predetermined point and at low speed upon a rise of room temperature to a predetermined point, and means for reversing the action of the parts for causing said circulating means to operate at high speed upon a rise of room temperature to a predetermined point and at low speed upon a drop of room temperature to a predetermined point.

45. In a temperature control system of the

class described, a heater, a multi-capacity blower device operable at low and high speeds for circulating a fluid medium heated thereby, an electrically operated control device adapted when deenergized for operating said blower device at low speed, a thermostatic switch responsive to the temperature of the fluid medium, a second thermostat switch responsive to room temperature, and circuit connections energizing said control device to operate said blower device at high speed when both said thermostatic switches are closed.

46. In a temperature control system of the class described, a heater, multi-speed circulating means operable at low and high speeds for circulating a fluid medium heated thereby, an electrically operated control device having low and high speed contacts in circuit with said circulating means, a thermostat responsive to room temperature, a thermostat responsive to the temperature of said fluid medium, and circuit connections for energizing said control device to close said high speed contact and to operate said circulating means at high speed when both said thermostats are actuated.

47. In a temperature control system of the class described, a heater, multi-speed circulating means operable at low and high speeds for circulating a fluid medium heated thereby, a control circuit for said circulating means having low and high speed contacts, a control device for closing said low speed contact when deenergized and for closing said high speed contact when energized, a thermostat responsive to the temperature of the fluid medium adapted to close at a predetermined temperature of said fluid medium, and a thermostat responsive to room temperature, the closing of said room thermostat energizing said control device to operate said circulating means at high speed when said fluid responsive thermostat is closed, the opening of said room thermostat deenergizing said control device to operate said circulating means at low speed when said fluid responsive thermostat is closed.

48. In a temperature control system of the class described, a heater, multi-speed circulating means operable at low and high speeds for circulating a fluid medium heated thereby, low and high speed contacts for said circulating means, a relay, a switch arm for closing said low speed contact when said relay is deenergized and for closing said high speed contact when said relay is energized, a thermostat responsive to the temperature of the fluid medium adapted to close at a predetermined temperature of the fluid medium, and a second thermostat responsive to room temperature adapted to close upon a predetermined drop of room temperature to energize said relay and to close said high speed contact.

49. In a heating system, a heater, combustion producing means for said heater, means for circulating a heat conducting medium from said heater to a room to be heated, a thermostat responsive to the temperature of the room for controlling the operation of both said means, a thermostat responsive to a predetermined high temperature of said heater and in circuit with said room thermostat for controlling the operation of said combustion producing means whereby to check or to accelerate the rate of combustion at said heater, and means also controlled by the thermostat of said heater for controlling the operation of said circulating means whereby to circulate said heat conducting medium at a

predetermined rate of flow or at an accelerated rate of flow.

50. A summer-winter control system of the class described, in combination, a heat increasing means for heating a fluid medium to be circulated to a space to be heated, a low and high speed circulator for circulating said fluid medium at different rates of flow, a space thermostat for operating said heat increasing means and for operating said circulator at high speed upon a drop of space temperature in the winter, thermostatic apparatus responsive to the temperature of the fluid medium controlling the operation of said space thermostat, said thermostatic apparatus discontinuing the control of said space thermostat over said circulator upon a drop of temperature of the fluid medium to a predetermined point and preventing the operation of said heat increasing means by said space thermostat to increase the temperature of the fluid medium when the temperature thereof is above a predetermined value, and mechanism for changing the arrangement of the parts in such a manner as to cause operation of said circulator at low speed during normal space temperatures in the summer and to cause operation of said circulator at high speed in the summer when the space temperature becomes too high, said mechanism including means for changing the operative relation of said thermostatic apparatus with respect to said space thermostat so that said heat increasing means cannot be operated by said space thermostat and said circulator may always be operated by said space thermostat irrespective of normal fluctuations in the temperature of the fluid medium.

51. A summer-winter control system of the class described, in combination, a heater for heating a fluid medium to be circulated to a space to be heated, high and low speed circulating means for circulating said fluid medium at different rates of flow, a space thermostat and a thermostat responsive to the temperature of the fluid medium for controlling the operation of said high and low speed circulating means in the winter, and mechanism for changing the arrangement of the parts in such a manner as to cause high speed operation only in the summer when the space temperature becomes too high, said mechanism including means for changing the operative relation of said fluid medium thermostat with respect to the remaining parts so that said circulating means may always be operated by said space thermostat and for disconnecting the low speed operation of said circulating means.

52. A summer-winter control system of the class described, in combination, a heater for heating a fluid medium to be circulated to a space to be heated, high and low speed circulating means for circulating said fluid medium at different rates of flow, a space thermostat for operating said circulating means at high speed upon a fall of space temperature in the winter and at low speed upon a rise of space temperature in the winter, thermostatic apparatus for controlling the operation of said space thermostat in accordance with temperature fluctuations of the heating medium at said heater, and mechanism for changing the arrangement of the parts in such a manner as to cause high speed operation of said circulating means upon a rise of temperature in the summer and low speed operation of said circulating means upon a drop of temperature in the summer, said mechanism including means for changing said thermostatic apparatus from oper-

ative control of said space thermostat so that said circulating means may always be operated by said space thermostat irrespective of the temperature fluctuations of the fluid medium.

53. In a temperature controlling system, a heater, means for supplying a heat conducting medium from said heater to a room to be heated, a thermostat responsive to the temperature of the room for controlling said supply means, means responsive to the temperature of said heater and associated with said supply means and said room thermostat by means of which said heat conducting medium will be supplied at a predetermined rate when the temperature of said heater is at predetermined low temperature but will be supplied at an accelerated rate when the temperature of said heater rises above said predetermined low temperature, and means associated with said room thermostat and said heater responsive means for disabling the operation of said supply means at said predetermined rate but continuing the operation of said supply means at said accelerated rate whereby to supply said heat conducting medium as a cooling medium to the room when the temperature of the room exceeds a predetermined high temperature.

54. In a heating system, a heater, a thermostat responsive to the temperature of said heater, a thermostat responsive to the temperature of a room, and multi-capacity circulating means for supplying a heating medium from said heater to said room, the capacity of said multi-capacity circulating means being controlled by said heater and room thermostats.

55. In a heating system, a heater, means for supplying a forced circulation of a heat conducting medium at a predetermined rate to the room to be heated, a thermostat responsive to the temperature of the room, means controlled by said room thermostat to increase said rate of supply of said heat conducting medium when said room thermostat calls for heat, and means controlled by the temperature of said heater and operable during the period said thermostat is calling for heat for restoring the said predetermined rate of supply of said heat conducting medium.

56. In a heating system, a heater, means for supplying a forced circulation of a heat conducting medium at a predetermined rate to the room to be heated, a thermostat responsive to the temperature of the room, means controlled by the temperature of said heater to increase said predetermined rate of supply of said heat conducting medium when said room thermostat calls for heat, said means also being operable during the period said room thermostat is calling for heat for restoring said predetermined rate of supply of said heat conducting medium or again to increase the same beyond said predetermined rate, and means for discontinuing the supply of said heat conducting medium when the temperature of said heater drops below a predetermined low temperature.

57. In a temperature controlling system, a heat increasing means, a circulation controlling device for the fluid heated by said heat increasing means, a room thermostat responsive to the temperature of the room, connections between said room thermostat and said heat increasing means for causing heating of the fluid upon a fall in room temperature and for preventing such heating thereof when the room temperature has been restored, and means responsive to the temperature of the circulating fluid for causing circulation of the fluid upon a rise in temperature thereof to a pre-

determined point and continuing such circulation thereof irrespective of the temperature of the room or condition of said room thermostat as long as the temperature of the fluid is above said predetermined point.

58. In a heating system, a heater, heat increasing means for supplying heat to said heater to heat a circulating medium, circulating means for causing a forced circulation of said circulating medium to a space to be heated, a thermostat responsive to the temperature of said space for operating said heat increasing means to increase the temperature of said heater upon a fall of space temperature, thermostatic apparatus responsive to temperature of said heater for preventing the operation of said heat increasing means if the temperature of said heater is above a predetermined maximum, and thermostatic apparatus also responsive to the temperature of said heater for operating said circulating means when the temperature of said heater is above a predetermined value, said circulating means operating to circulate said medium above said maximum heater temperature irrespective of the condition of said space thermostat.

59. In a heating system, a heater, heat increasing means for supplying heat to said heater to heat a circulating medium, circulating means for causing a forced circulation of said circulating medium to a space to be heated, and thermostatic apparatus responsive to heater and space temperatures for operating said circulating means when the temperature of said heater is above a predetermined value and for operating said heat increasing means upon a drop of space temperature below a predetermined value but to prevent such operation of the heat increasing means above a predetermined high heater temperature, said thermostatic apparatus operating said circulating means above said predetermined high heater temperature.

60. In a heating system, a heater, heat increasing means for supplying heat to said heater to heat a circulating medium, circulating means for causing a forced circulation of said circulating medium to a space to be heated, and thermostatic apparatus including connections between said thermostatic apparatus and said circulating means by means of which said circulating means is prevented from operating whenever the temperature of the circulating medium is too low, is operated at low speed whenever the temperature of the fluid medium is at or above a predetermined value and the space to be heated is at or above a predetermined temperature, is operated at high speed when the fluid medium is at or above said predetermined value but the space is below said predetermined temperature, and is operated at high speed whenever the space is at or above said predetermined temperature but the temperature of the fluid medium is excessive.

61. In a heating system, a heater, heat increasing means of different operating capacities for supplying heat to said heater to heat a circulating medium, circulating means for causing a forced circulation of said circulating medium to a space to be heated, connections for causing operation of said heat increasing means at a low capacity to supply minimum heat to said circulating medium above a predetermined temperature of said space to be heated, thermostatic apparatus responsive to the temperature of said circulating medium for causing operation of said circulating means to effect a forced circulation thereof above a predetermined temperature thereof, and ther-

mostatic apparatus responsive to the temperature of said space to be heated for causing operation of said heat increasing means at a higher capacity to supply additional heat to said circulating medium upon a drop of temperature below said predetermined temperature of said space.

62. In a heating system, a heater for heating a circulating medium, conducting means for permitting circulation of said circulating medium for heating a space, circulating means for causing forced circulation of said circulating medium through said conducting means, means for maintaining at all times a predetermined heater temperature whereby slow circulation of the circulating medium through the conducting medium is caused, means responsive to space temperature to increase the heater temperature when the space temperature falls below a predetermined value, and means responsive to heater temperatures to operate said circulating means when the heater temperature reaches a value above a predetermined temperature whereby forced circulation of the circulating medium through said conducting means is provided to heat said space.

63. In a heating system, a heater for heating a circulating medium, conducting means for permitting circulation of said circulating medium for heating a space, circulating means for causing forced circulation of said circulating medium through said conducting means, means for maintaining at all times a predetermined heater temperature whereby slow circulation of the circulating medium through the conducting medium is caused, means responsive to space temperature to increase the heater temperature when the space temperature falls below a predetermined value, means responsive to heater temperature to operate said circulating means when the heater temperature reaches a value above a predetermined temperature whereby forced circulation of the circulating medium through said conducting means is provided to heat said space, and means responsive to a predetermined high heater temperature for rendering said heater temperature increasing means inoperative but permitting operation of said circulating means.

64. In a heating system, a heater for heating a circulating medium, conducting means for permitting circulation of said circulating means for heating a space, circulating means for causing forced circulation of said circulating medium through said conducting means, low and high flame means for controlling the temperature of said heater, means to operate said low and high flame means for maintaining at all times a predetermined heater temperature whereby slow circulation of the circulating medium is caused, means responsive to space temperatures to operate said low and high flame means to increase the heater temperature when the space temperature falls below a predetermined value, and means responsive to heater temperature to operate said circulating means when the heater temperature reaches a predetermined temperature value whereby forced circulation of the circulating medium through said conducting means is provided to heat said space.

65. A heating system including a furnace comprising, in combination, means for increasing the rate of combustion, means for circulating a heat conducting medium heated by said combustion increasing means, thermostatic apparatus responsive to room temperature, thermostatic apparatus responsive to furnace temperature, connections between said combustion increasing

means and said room and furnace thermostatic apparatus for operating said combustion increasing means to supply heat to said medium upon a predetermined drop of room temperature and for preventing such operation when the furnace temperature is at or above a predetermined high limit, and connections between said medium circulating means and said furnace thermostatic apparatus for operating said medium circulating means to circulate said medium during normal operating temperatures of the furnace and continuing without interruption beyond normal high temperature of the furnace whereby said medium is continuously supplied to the room to maintain constant circulation of the heater air therein.

66. In a furnace control, the combination of a variable speed blower for controlling the rate of supply of a heat conducting medium to a room to be heated, furnace and room thermostatic apparatus responsive to furnace and room temperatures, and means controlled by said thermostatic apparatus for operating said blower at different speeds according to predetermined furnace and room temperatures and for continuing operation of said blower at one of said speeds when said room thermostat is ineffective.

67. In a heating system, the combination with a heater, of combustion producing means for said heater, a thermostat responsive to temperature of a room to be heated, a thermostat responsive to the temperature of said heater, connections be-

tween said combustion producing means and both said thermostats for operating said combustion producing means below a predetermined furnace temperature when said room thermostat is actuated by a drop of room temperature below a predetermined degree, means for circulating a heat conducting medium from said heater to the room, connections between said circulating means and said room thermostat for operating said circulating means whereby said heating conducting medium will be supplied to the room at a predetermined volume, and control means associated with said connections and said room thermostat for causing said circulating means to continue operating after said room thermostat is satisfied by a rise of temperature above said predetermined degree whereby said heat conducting medium will be supplied at a reduced volume to the room as long as said room thermostat remains satisfied.

68. A heating circulating system comprising, a heater, a circulating system for conducting a heating medium from said heater to a space to be heated, means for inducing circulation of said heating medium in said circulating system, means for automatically causing operation or cessation of said circulation inducing means when said heater is above or below, respectively, a predetermined temperature, and means for automatically varying the delivery capacity of said circulation inducing means responsive to temperature changes in the space to be heated.

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