

April 30, 1940.

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2,199,183

HOT AIR FURNACE AND CONTROLS THEREFOR

Filed Nov. 16, 1938

3 Sheets-Sheet 1

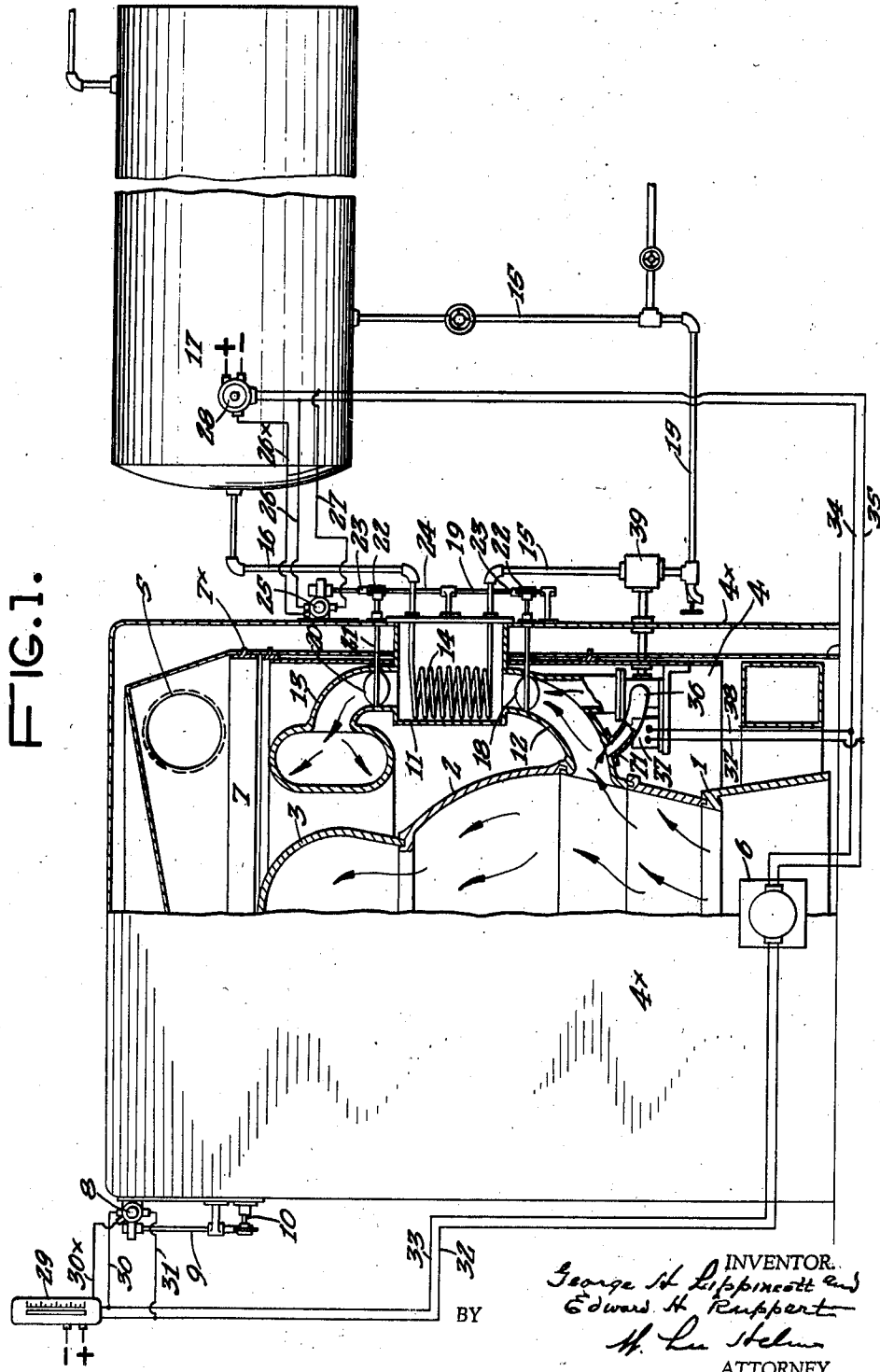


FIG. 1.

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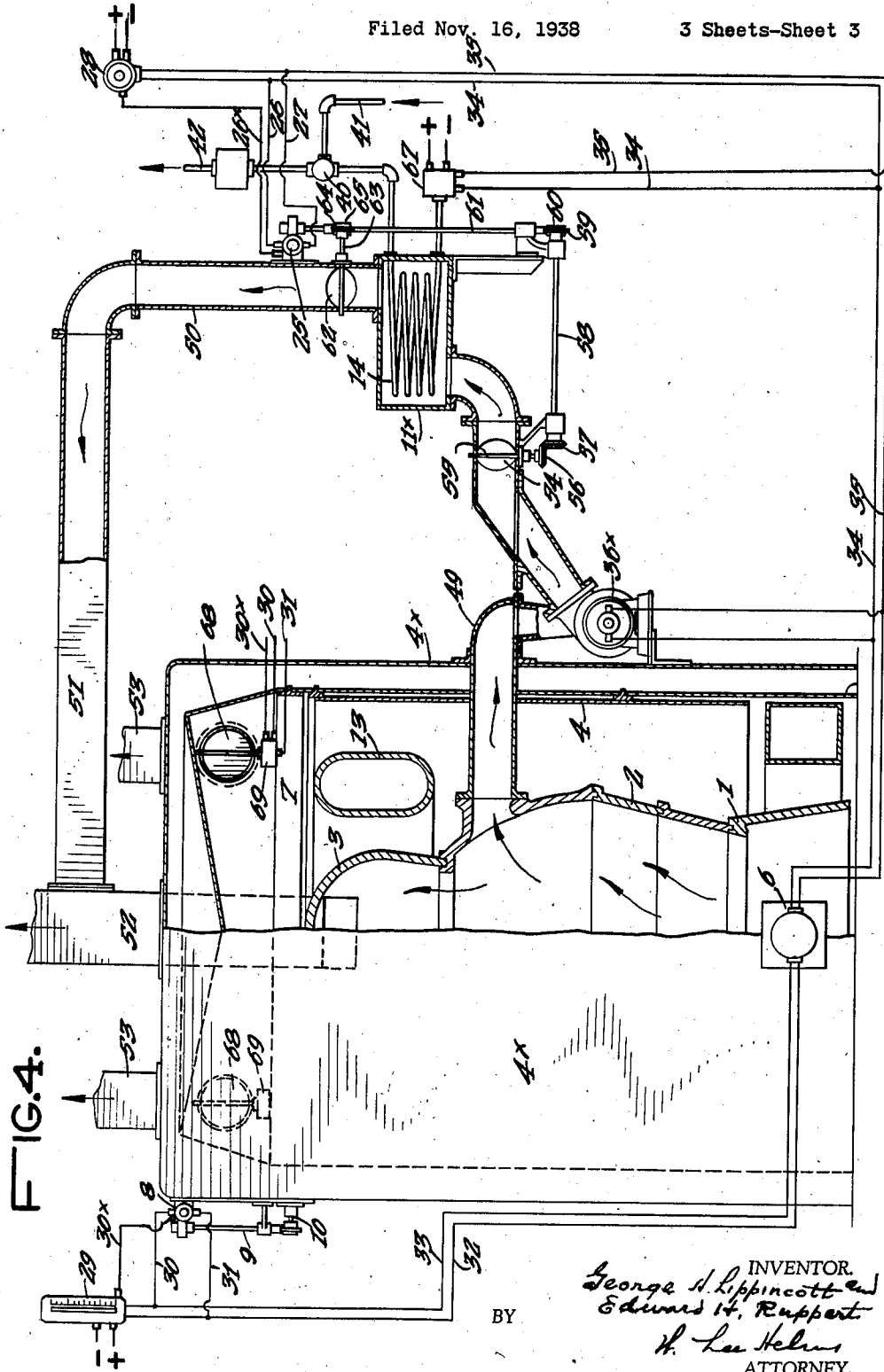


FIG. 4.

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2,199,183

HOT AIR FURNACE AND CONTROLS THEREFOR

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Application November 16, 1938, Serial No. 240,658

8 Claims. (Cl. 237—19)

The object of the present invention is to provide a novel type of hot air furnace, more particularly designed for household heating, and in which the flow of both the hot gases and the air heated thereby normally pass to the dwelling rooms, are automatically controlled so that in the summer months substantially all of the heat units may, as by forced circulation, and in continuous circulation from and back to the furnace, be absorbed by the coils of a water heater, and in the winter months the gases may be automatically controlled withdraw therefrom, under automatic control, a part sufficient to either continuously maintain a given quantity of water in a storage tank under a predetermined temperature, or to effect "instantaneous" heating of water as it is drawn through a coil in its passage to the point or points of use of the water. In the winter months this is accomplished without disturbing the normal heating and flow of air for the heating of the dwelling rooms, whereas in the summer the stated results are obtained with the passage of heated air shut off between the furnace and the dwelling rooms.

The above objects and further objects of the invention will be hereinafter set forth in detail, with reference to the accompanying drawings, in which

Figure 1 is a view in elevation of an embodiment of the invention, certain parts of the furnace being broken away, as by vertical cross-section;

Figure 2 is a view similar to Figure 1 showing a modified form of the invention;

Figure 3 is a view in sectional elevation, the furnace being fragmentarily shown, of a further modification;

Figure 4 is a view similar to Figure 1, illustrating an embodiment of the invention.

Referring to Figure 1 of the drawings it will be seen that the furnace therein illustrated comprises a base 1, a main body member 2, and a head 3. I have diagrammatically indicated at 6 an oil burner. The burning gases rise upwardly as indicated by the arrows and in their passage transmit heat to the walls of the main body member and head, this heat being absorbed by the air surrounding these members, the thus heated air rising through an insulated chamber formed by the wall 4, 4x, the latter being a sheath which encloses the entire furnace. The hot air will be drawn out from the heating chamber via suitable ducts, as for example, the outlet at 5, which will communicate with the hot air pipe or pipes leading to the rooms to be heated.

Below the outlet duct or ducts 5 and supported by the walls of the hot air chamber surrounding the furnace body, are heavily insulated shutters, one of which is shown at 7, each shutter will be pivoted at its ends, as shown at 7x, and the shutters will be so arranged that they may be rotated vertically, as shown in Figure 1, for the free passage of the heated air to the outlet duct or ducts 5, and may be rotated horizontally so that their side edges will abut and effectively close the air heating chamber to prevent the passage of hot air to the duct or ducts 5.

For the purpose of operating these shutters there is diagrammatically shown at 8 an electric motor operatively connected to a vertical shaft 9, which at its lower end is operatively connected to a horizontal shaft 10, the latter will be operatively connected to the shutter 7, as by lever and link connection, the specific shutter operating means forming no part of the present invention. However, a simple means for operating the shutters may comprise a lever arm fixed to shaft 10, a horizontally moving rod pivotally connected to the lever rod, and links connecting the rod with each shutter.

It will be understood that the furnace head 3 will connect with the usual draft flue leading to a draft stack or chimney.

Preferably within the walls which define the exterior of the air heating chamber, so as to receive heat by convection from the hot air, is a casing 11 which at its base communicates with a flue 12, preferably disposed below the longitudinal center of the furnace body 2. The top of casing 11 communicates with a flue 13, leading to the furnace head 3.

The casing is adapted to enclose a hot water heating coil 14, receiving cold water via pipe 15, and discharging hot water through pipe 16, either directly to the point of use or to a hot water storage tank 17.

The passage of hot gases to chamber 11 is controlled by rotatable closure 18 in flue 12, closure being carried by operating shaft 19, also flue 13 may be closed by a closure disk 20, on a shaft 21, each shaft carries at its end a worm wheel 22 in mesh with a worm 23, on an operating shaft 24, having operative connections with a motor 25.

When a hot water storage tank is employed, motor 25 may be in circuit via wire 26, 27, with an aquastat 28, communicating with the interior of the storage tank. When instantaneous hot water heating is provided for the aquastat may be disposed within a relatively small water cas-

ing communicating at its ends with pipe 16, and an outlet pipe to the place of use of the hot water.

At 29 I have diagrammatically shown a room thermostat in circuit with motor 8 via wires 30, 31, and in circuit with the oil burner 6 via wires 32, 33. The aquastat also is in circuit with the oil burner 6 via wires 34, 35.

Within flue 12 may be blown air under pressure from a fan 36, driven by a motor 37 in circuit with wires 34, 35 via branch wires 37, 38. The fan shaft extends through casing wall 4x and is operatively connected with the water pump 39, with which the cold water pipe 15 communicates.

In the operation of the furnace during the summer months, or when no heat is required in the dwelling, thermostat 29 will close the circuit through wires 30, 30x, thereby closing the shutters 7, and the thermostatic contacts via wires 32, 33 will lie in open position, the motor 8 therefore is a reversible motor, having 3 wiring leads, one being a ground. When the aquastat 28 calls for heat, the circuit through wires 33, 34 leading to the oil burner, is closed, and the circuit through the motor 25 also is closed. The oil burner will thus be thrown into operation and the flue closure disks 18 and 20 will be open. Simultaneously with this action, the circuit through motor 37 is closed so that blower 36 and water pump 39 will jointly act, the pump rapidly circulating water through the heating coil 14 and the blower rapidly circulating the hot gases over the surfaces of the heating coil and back into the furnace, part of the gases then being drawn down for recirculation. Carbon products of combustion and smoke may pass out of the stack as customary, but the stack damper may be almost closed. The stack and damper are not shown since they are customary and require no illustration.

When the aquastat opens the circuits at the time the hot water reaches a predetermined hot temperature within tank 17, or within a small mixing tank, and the arrangement is for "instantaneous" hot water and the storage tank is eliminated, the circuit to the oil burner, blower 36, and water pump 39 will be open, and a circuit to the reversible motor 25 established through wires 26, 26x, causing reversal of the motor to close the closure disks 18 and 20.

In the construction of Figure 2, the furnace has substantially the same form as that shown in Figure 1. The heating chamber 11x is located exteriorly of the casing 4x and likewise, the blower 36x. Casing 11x is connected at its base with inlet flue 12x and at its top with the flue 13x. The hot water passes from the heating coil 14 to a mixing chamber 40. This may be so designed that should the temperature of the hot water be in excess it may be tempered by automatic opening of the valve to permit the inflow of cold water through pipe 41. The hot water passes to the point of use via pipe 42. The aquastat controls are the same as shown in Figure 1 and bear the same numerals. The structure shown in Figure 3 is similar to that of Figure 2 but is designed to insure a cycle of the heated gases of combustion from the furnace through the coil chamber, back into the furnace where the gases pick up additional heat and return to the coil chambers. To such end the bottom flue 43 for the coil chamber 14 communicates with an upturned pipe 43x within the furnace, and the return flue 44 leading from the top of the coil chamber may be provided with a

downturned end 44x, within the furnace near the top thereof. The flue controlling closure disks 45, 46 are carried by a vertical shaft 47, operated by the reversible motor 48, from the aquastat 28, through the instrumentality of the wires 34, 35, and 26x.

In each of the constructions forming Figures 2 and 3, when the aquastat calls for heat, circuit will be established through wires 34 and 35 and motor 48 will be operated to rotate closure disk 10 shaft and move the closure disks to open position. At the same time the circuit will be closed through blower 36x and the oil burner, when an oil burner is used. When the aquastat opens the circuit through wires 34 and 35, the circuit 15 will be established through positive wires 26x, and that one of the two wires 34, 35 which serves as a ground, so that the motor 48 will be reversed and the closure disks moved to closed position.

In the structure of Figure 4 the casing 11x 20 for the heating coil 14 communicates with only a single flue 49 connected with the interior of the furnace. The outward flue for the coil casing, shown at 50, rises to a branch flue 51, leading to the stack 52. In Figure 4 outgoing hot 25 air flues are shown at 53. The closure disk or damper in flue 49 is shown at 54 on a vertical shaft 55 at the lower end of which is a gear 56 in mesh with the gear 57 or horizontal shaft 58. The latter shaft carries a worm gear 59, in 30 mesh with a worm 60, on a vertical shaft 61. The closure disk or damper for flue 50 is shown at 62 on a shaft 63 carrying a worm gear 64 in mesh with a worm 65 on shaft 61. At its upper end 35 shaft 61 is in operative connection with the reversing motor 25, controlled by aquastat 28, in the same manner as described with relation to the structures of Figures 2 and 3.

In all the forms of our furnace the construction is such that the firing unit may be effectively 40 operated for hot water supply automatically during the summer months without circulating hot air into the room ducts and the room. The room thermostat is controlled by the room temperature desired and in turn controls the oil 45 burner motor and the shutters for the furnace, as heat is needed or is not required, in the room. The room thermostat will not function during the summer months or at any time when the room temperature is upwards of 70° through the influence of warm air exterior the rooms. 50

In some cases it may be desirable to employ a damper or dampers 66 for the flues 53 and a motor 69 directly connected to the dampers, or a plurality of motors, as the case may be, these 55 motors being connected to the room thermostat 39 and being reinforcing motors so as to lead to the room thermostat through the wires 30, 30x and 31 as shown in Figure 4.

When the device is used for domestic hot water 60 heating, the opening of a faucet may be utilized to automatically throw on the burner, the motor 6, the blower 36x and also operate the dampers 54 and 62. To this end the pressure valve 67 may be placed at the cold water end of coil 14, 65 as shown in Figure 4, the flow of water into coil 14 causing the pressurestat to close the circuit to the oil burner motor and blower via wires 34, 35. In such case the dampers 54 and 62 need not be operated by the motor 25 which can be eliminated and the dampers can be balanced dampers 70 of a type commonly known which move to closed position in the absence of the air draft impelled by the blower 36x. If positive actuation of the dampers 54, 62, is desired however, the pressure- 75

stat may be a three-contact device, the contacts being connected to the wires 26, 26c and 27 in such manner that when water is drawn into coil 14 the reinforcing motor 25 will rotate to open the dampers and upon shutting off of the water inflow in coil 14 the reinforcing motor will operate to close the said dampers.

In Figure 3 of the drawings, the upturned end for the flue 43 and the downturned end for the flue 44, both ends being located within the furnace body 2, may be connected by a perforated cylinder 70. In the various figures the intake for the blower is shown as a tubular conduit 71. It will be understood that the blower may be disposed directly within one of the flues leading to the coil-receiving casing and that the direction of the hot gases circulated through the casing may be determined as desired. In other words, the gases may lead from the top of the furnace body to the casing, thence downwardly and back into the furnace body at a lower point. As heretofore stated, it is not essential that the flue dampers be positively actuated since they may be balanced so as to be normally closed, and thrown open by the force of movement of the heated gases impelled by the blower.

In the specification reference to oil burner is as an example, any automatic burner being the equivalent of gas burners, automatic solid fuel stokers, etc.

Having described our invention what we claim and desire to secure by Letters Patent, is as follows:

1. In combination with a hot air furnace including a furnace body having a stack outlet for carrying off products of combustion from the furnace body, an air heating chamber exterior to the body and having an outlet duct for passing hot air to the areas to be heated, of shutter means intermediate the air heating chamber and the hot air outlet duct for opening and shutting off communication between them, a casing adapted to receive a hot water coil, intake and discharge flues communicating with the casing and with the furnace body for the passage of hot gases, damper means controlling said flues, a motor driven blower adapted to force the hot gases through said flues and casing, a water heating coil in said casing, a water-receiving element in communication with said coil, an electric circuit, and an electric switch in said circuit in communication with said water-receiving element and adapted to be actuated by a predetermined condition of the water in said water-receiving element, the motor driven blower being in said circuit.

2. In combination with a hot air furnace including a furnace body having a stack outlet for carrying off products of combustion from the furnace body, an air heating chamber exterior to the body and having an outlet duct for passing hot air to the areas to be heated, of shutter means intermediate the air heating chamber and the hot air outlet duct for opening and shutting off communication between them, electrical means adapted to actuate the shutter means including an electric circuit and a room thermostat, a casing adapted to receive a hot water coil, a flue leading from the interior of the furnace substantially below said stack outlet and communicating with said casing, a discharge flue for carrying gases out of said casing, closure means for the first named flue, a water heating coil in said casing, a hot water-receiving element in communication with the coil, electrical means

adapted to actuate the flue closure means, including a circuit, and an aquastat switch in said last-named circuit and applied to said hot water-receiving element.

3. In combination with a hot air furnace including a furnace body having a stack outlet for carrying off products of combustion from the furnace body, an air heating chamber exterior to the body and having an outlet duct for passing hot air to the areas to be heated, of shutter means intermediate the air heating chamber and the hot air outlet duct for opening and shutting off communication between them, a casing adapted to receive a hot water coil, a flue leading from the interior of the furnace body and communicating with the lower end of said casing, a flue leading from the interior of the furnace substantially below said stack outlet and communicating with the top of the casing, and means for impelling a circuitous passage of hot gases from the furnace body through the casing and back into the furnace body for reheating and comprising a blower having communication with one of said casing-connected flues, a water-receiving element in communication with the coil, a switch associated with said water-receiving element and adapted to be actuated when said water reaches a predetermined condition, an electric circuit including said switch and a motor connected to said blower and in said electric circuit.

4. A hot air furnace constructed in accordance with claim 3, in combination with an automatic burner for the furnace, electrical control means for said burner in the electrical circuit, a second electrical circuit and a room thermostat in said circuit, said second circuit being connected to said burner electrical control means, the said second circuit also being connected to the shutter means intermediate the air heating chamber and the hot air outlet duct, said shutter means including a motor-driven actuator.

5. A hot air furnace constructed in accordance with claim 3, in combination with an automatic burner for the furnace, and electrical control means for said burner in the electrical circuit for the blower.

6. In combination with a hot air furnace including a furnace body having a stack outlet for carrying off products of combustion from the furnace body, an air heating chamber exterior to the body and having an outlet duct for passing hot air to the areas to be heated, of shutter means intermediate the air heating chamber and the hot air outlet duct for opening and shutting off communication between them, a casing adapted to receive a hot water coil, intake and discharge flues communicating with the casing and with the furnace body for the passage of hot gases, a hot water-receiving tank communicating with said coil, and means for recirculating hot gases through said casing, including an electric circuit, an aquastat in said tank, a blower in connection with one of said flues, a motor for driving said blower, and an electric circuit connected to the motor and to the aquastat.

7. In combination with a hot air furnace including a furnace body having a stack outlet for carrying off products of combustion from the furnace body, an air heating chamber exterior to the body and having an outlet duct for passing hot air to the areas to be heated, of shutter means intermediate the air heating chamber and the hot air outlet duct for opening and shutting off communication between them, a casing adapted to receive a hot water coil, intake and dis-

charge flues communicating with the casing and with the furnace body for the circulation of hot gases, a hot water tank communicating with said coil, and means for simultaneously recirculating 5 hot gases through said casing and water through the coil and said tank, comprising a cool water conduit leading from the tank to the inlet end of the coil, a hot water conduit leading from the outlet end of the coil to the tank, a motor-driven 10 blower connected to one of said flues, an aquastat in the tank, a motor-driven pump in one of said water conduits, and an electric circuit for the driving of the blower and water pump, said circuit being connected to and controlled by the 15 aquastat.

8. In combination with a hot air furnace including a furnace body having a stack outlet for carrying off products of combustion from the

furnace body, an air heating chamber exterior to the body and having an outlet duct for passing hot air to the areas to be heated, a casing adapted to receive a hot water coil, intake and discharge 5 flues communicating with the casing and with the furnace body for the passage of hot gases, a motor driven blower adapted to force the hot gases through said flues and casing, a water heating coil in said casing, a water-receiving element in communication with said coil, an electric circuit, and an electric switch in said circuit in communication with said water-receiving element 10 and adapted to be actuated by a predetermined condition of the water in said water-receiving element, the motor driven blower being controlled 15 by the actuation of said switch.

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