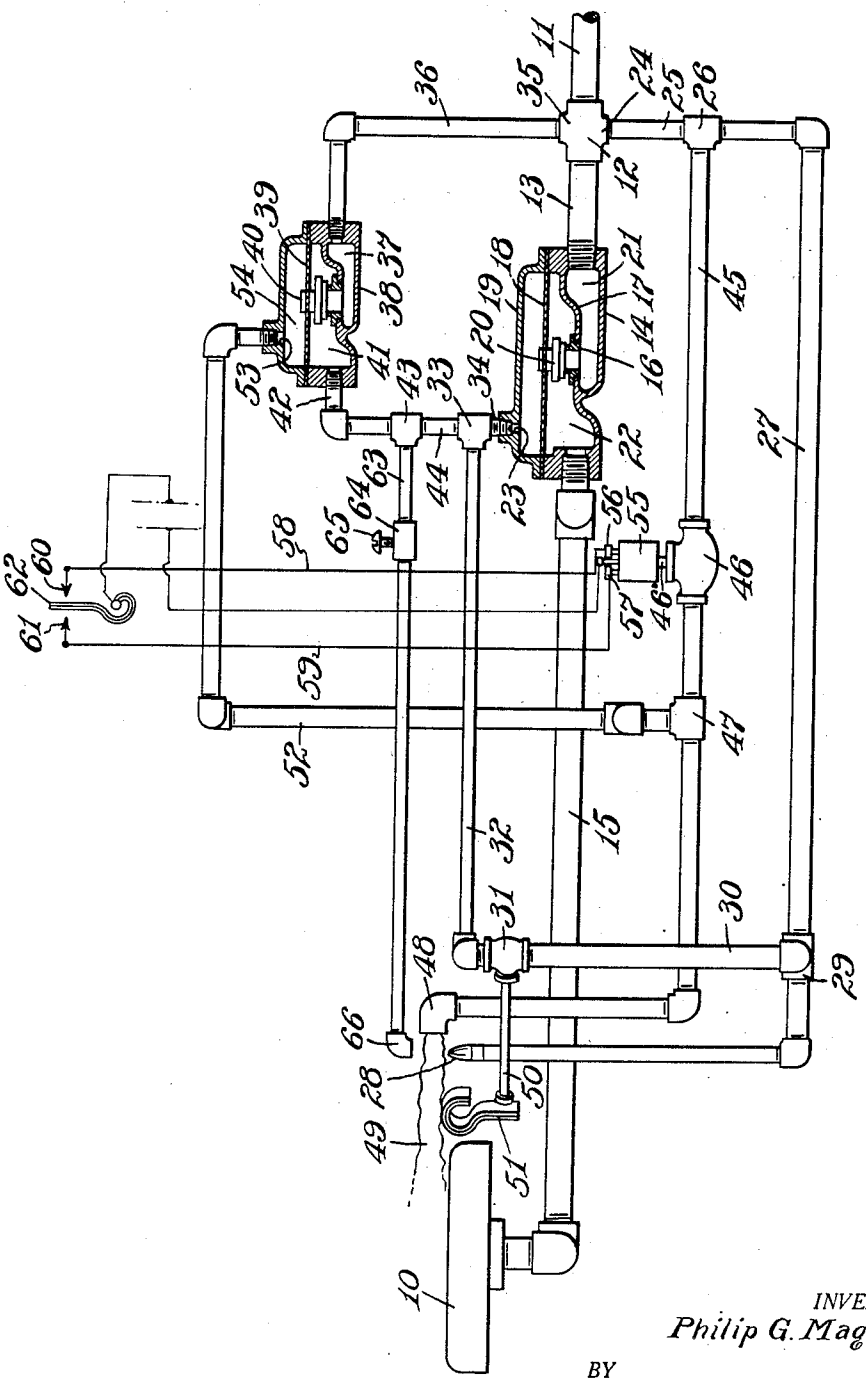
Sept. 6, 1932. P. G. MAGNER 1,875,388

BURNER CONTROL

Filed Oct. 23, 1930



INVENTOR.
Philip G. Magner,

BY

Hood & Hahn.
ATTORNEYS

Patented Sept. 6, 1932

1,875,388

UNITED STATES PATENT OFFICE

PHILIP G. MAGNER, OF WABASH, INDIANA, ASSIGNOR TO MINNEAPOLIS-HONEYWELL REGULATOR COMPANY, OF WABASH, INDIANA, A CORPORATION OF DELAWARE

BURNER CONTROL

Application filed October 23, 1930. Serial No. 490,579.

The present application relates to a burner control, and more particularly to mechanism, under the control of the room thermostat, for controlling the operation of a fluid-fuel heating burner. Among the objects of the invention are to provide mechanism of the class described which shall be absolutely reliable to respond to the demands of the room thermostat, and to prevent a supply of fuel to the main burner in the event of failure of the ignition mechanism, and to cut off the supply of fuel to said main burner in the event of accidental cessation of combustion. Further objects of the invention will appear as the description proceeds.

The single figure is a more or less diagrammatic view of an installation in accordance with the present invention.

In said figure, I have illustrated a main burner 10 adapted to be supplied with a fluid-fuel, such as fuel gas, through a main supply line 11. Said supply line 11 is connected to one branch of a four-way coupling 12, to the opposite branch of which is connected a pipe 13 leading into a valve casing 14. A second pipe 15 leads from said valve casing 14 to said burner 10.

A valve seat member 16 provides a passageway through the partition 17 in said casing 14, and a flexible diaphragm 18 is clamped to said casing through the medium of a cover member 19, said diaphragm carrying a valve member 20 adapted to cooperate with said valve seat member 16 to control flow from the inlet chamber 21 of said casing to the outlet chamber 22 thereof. The cover member 19 is formed with a port 23 leading into the chamber formed by said cover member and said flexible diaphragm 18.

To one of the lateral branches 24 of said coupling 12 there is connected a pipe 25 leading through a T-coupling 26 to a pipe 27 which supplies fuel for a pilot flame 28. As will be obvious, flow to the flame 28 is continuous, being uncontrolled by any valve. Said pilot flame 28 is so positioned that it cannot effect ignition of fuel supplied to the burner 10.

A T-coupling 29 coupled in the pipe 27 has connected thereto a pipe 30 leading through a valve 31 to a pipe 32 connected to the shank of a T-coupling 33 to one arm of which is connected a conduit 34 threaded into the port 23 in the cover member 19. The valve 31 is normally open and, as will be obvious, so long as said valve is open, fuel under pressure is supplied to the chamber formed by the cover member 19 and the flexible diaphragm 18, the pressure so built up in said chamber tending to hold the valve member 20 in closed position.

To the opposite branch 35 of the coupling 12 is connected a pipe 36 leading to the inlet chamber 37 of a valve casing 38. A flexible diaphragm 39 carries a valve 40 adapted to control flow from said inlet chamber 37 to the outlet chamber 41 of said casing 38. A pipe 42 connected to said outlet chamber 41 is coupled through a T-coupling 43 to a pipe 44 which, in turn, is coupled to the opposite branch of the T-coupling 33. As will be obvious, when the valve 40 is in open position, flow through the valve casing 38 to the chamber formed by the cover member 19 and the flexible diaphragm 18 is permitted, to tend to hold the valve 20 in closed position.

To the shank of the T-coupling 26 there is connected a conduit 45 leading through a valve 46 and a T-coupling 47 to a check pilot burner 48.

Said burner 48 is so disposed and constructed that, when the valve 46 is open, a stream of fuel emerges from said burner 48 and is ignited by the pilot flame 28 to form a long tongue of flame 49 extending into cooperative relation with the burner 10 to ignite any fuel which may be supplied to the burner 10. The valve 31 is provided with an operating stem 50 extending into operative relation with the movable portion of a thermostat bar 51, and said bar 51 is disposed to be affected by the flame 49 in a manner later to be described.

To the shank of the T-coupling 47 is connected a conduit 52 leading to the port 53 formed in the cover member of the valve casing 38 and opening into the chamber 54 of which one wall is formed by the flexible diaphragm 39. As will be obvious, when the valve 46 is opened, flow is permitted through the pipe 52 to build up a pressure

in the chamber 54 to hold the valve member 40 in a closed position.

The valve 46 is provided with an actuating stem 46' adapted to be affected by a solenoid 55. To the terminals 56 and 57 of said solenoid are connected leads 58 and 59 terminating in contact posts 60 and 61 adapted to be selectively contacted by the movable bar 62 of a room thermostat, it being understood that a suitable source of electrical energy is connected into the circuit. The arrangement is such that, when the temperature of the room in which the thermostat is mounted falls below a predetermined minimum, the bar 62 contacts the post 60 to open the valve 46, and when the temperature of the room rises above a predetermined maximum, the bar 62 contacts the post 61 to close the valve 46.

To the shank of the T-coupling 43 there is connected a bleed pipe 63 leading through a valve casing 64 provided with a needle valve 65, said conduit terminating in a burner 66. In the illustrated embodiment, the burner 66 is disposed in cooperative relation with the constantly burning pilot flame 28 so that any fuel discharged through said burner 66 will be ignited by said flame 28. Of course it is to be understood that the bleed pipe 63 might be connected into the conduit 27 whereby fuel drained through said bleed pipe would be consumed in the pilot flame 28.

In the operation of the device, it is to be understood that, under normal circumstances, the valve 31 is open, the valve 46 is closed, and the pilot flame 28 is burning. With the valve 46 closed, there is no pressure in the chamber 54 tending to hold the valve 40 closed, and consequently flow is permitted through the conduit 36 and the valve casing 38 to maintain a valve-closing pressure in the diaphragm chamber of the valve casing 14. The pressure so established is supplemented by a flow through the conduits 27, 30, the valve 31 and the conduit 32 to said chamber. A small bleed flow through the conduit 63 will also be established, the fuel thus bled from the system being consumed at the burner 66.

If, now, there is a call for heat, the arm 62 will contact the post 60 to energize the solenoid 55 to open the valve 46. Flow is thus established through the conduit 45 to the burner 48, and, the pilot burner 28 igniting the stream of fuel issuing from said burner, the long flame 49 is established. Since the passage through the valve 46 is materially larger than the opening through the burner 48, a pressure will be built up in the conduit 52 and the chamber 54 to close the valve 40. The valve 20, however, will be maintained in closed position by the pressure built up in the diaphragm chamber of the casing 14 through the valve 31 and the conduit 32. As the flame 49 heats the thermostat member 51, the arm thereof moves toward the right as viewed in the drawing to close the valve 31. It being remembered that there is a bleed flow through the pipe 63, it will be seen that the pressure in the diaphragm chamber of the casing 14 will be reduced immediately upon the closing of the valve 31 to permit opening of the valve 20, whereby fuel flow to the main burner 10 is established. The fuel discharged from the burner 10 is ignited by the flame 49 and, in the case of an accidental momentary extinguishment of the main burner flame, the flame 49 will again ignite the fuel from the main burner.

If there should be, for any reason, an interruption for any considerable period, of the flow of the fuel, the flames 49 and 28 would be extinguished with the extinguishment of the main burner flame. Shortly after the extinguishment of the flame 49, the thermostatic element 51 will become sufficiently cool to reopen the valve 31. If, now, the supply of fuel should be resumed, a valve closing pressure will immediately be built up through the valve 31 and conduit 32 in the diaphragm chamber of the valve casing 14, to prevent a supply of fuel to the main burner 10, and the supply of fuel to said burner cannot be reinitiated, even though the room thermostat is still calling for heat, without first igniting the fuel issuing from the burner 48 and the pilot flame 28.

It is to be noted that the thermostat 51 is so disposed as not to be affected by the heat of the pilot flame 28. Thus, the valve 31 can be closed to permit opening of the valve 20 only if the flame 49 is ignited. The flame 49 and the thermostatic member 51 thus comprise a check on the pilot flame 28, whereby flow of fuel to the main burner is prevented in case the pilot flame 28 has, in any manner, been extinguished.

Presuming that the mechanism has functioned properly and that the burner 10 has been ignited, the demand of the room thermostate will, after a period be satisfied. Thereupon, the arm 62 contacts the post 61 to close the valve 46. The flame 49 is thus extinguished, and the thermostatic element 61 will slowly cool down sufficiently to open the valve 31. It is desirable, however, to shut off the main burner flame as quickly as possible after the demand of the room thermostat has been satisfied. The response of the thermostatic element 51 is much too slow, and consequently there is provided means for closing down the valve 20 long prior to the opening of the valve 31. Such means comprises the valve 38. When the valve 46 closes, the supply of fuel through the conduit 52 is cut off and the pressure built up in said conduit and in the chamber 54 is immediately drained through said conduit and the pipe 45 to the burner 48, thus permitting the valve 40 to be opened to build up a pressure in the pipes

42 and 44 and in the diaphragm chamber of the valve casing 14, such pressure closing the valve 20.

As will be obvious, the mechanism illustrated would be utterly inoperative in the absence of the bleed pipe 63. Opening of the valve 20 is dependent upon the draining of pressure from the chamber of which one wall is formed by the diaphragm 18. In the normal operation of the device, when the room thermostat calls for heat, the valve 40 is immediately closed, thus, in the absence of the bleed pipe 63, trapping any fuel remaining between the valve member 40 and the coupling 33. Almost immediately upon the ignition of the flames 49 the valve 31 is closed. With the valves 40 and 31 closed, and supposing the bleed pipe 63 not to be present, a closed chamber is formed comprising the conduit 32, the coupling 33 the pipe 44, the pipe 42, the outlet chamber 41 of the valve casing 38, the pipe 34, and the diaphragm chamber of the valve casing 14. Since there is a valve closing pressure in said diaphragm chamber at the time the valve 31 is closed by the action of the thermostatic member 51, it becomes obvious that the valve 20 could not be opened, except as the result of leakage past the valve 31, or past one or the other of the diaphragms 18 and 39.

I claim as my invention:

1. The combination with a main fluid-fuel burner and a main supply line for supplying fuel thereto, of means for controlling said burner comprising a valve casing connected in said line, a flexible diaphragm in said casing, and movable by differential pressures in said casing to control flow through said casing, a pilot conduit by-passing said valve and terminating adjacent said main burner but operatively disassociated therefrom, an ignition conduit by-passing said main valve and terminating in a burner positioned in operative relation to the terminus of said pilot conduit and to said main burner, a valve in said ignition conduit, means for operating said last-mentioned valve, a branch connected to said main supply line in advance of said main valve and connected to said main valve casing to supply valve-closing pressure fluid to said main valve diaphragm, an auxiliary valve casing in said last-mentioned conduit, a flexible diaphragm in said auxiliary valve casing and movable by differential pressures in said casing to control flow through said casing, a bleed pipe connected to said branch between said auxiliary valve casing and said main valve casing, a pipe by-passing said main valve and connected to supply valve-closing pressure fluid to said auxiliary valve casing, flow through said last-mentioned pipe being controlled by said ignition conduit valve, a pipe connected to said pilot conduit and connected to said branch between said bleed-pipe connection and said main valve casing, a valve in said last-mentioned pipe, and thermo-responsive means positioned to be affected by flame issuing from said ignition burner for controlling said last-mentioned valve.

2. The combination with a main fluid-fuel burner and a main supply line for supplying fuel thereto, of means for controlling said burner comprising a valve casing connected in said line, a flexible diaphragm in said casing, and movable by differential pressures in said casing to control flow through said casing, said diaphragm forming one wall of an actuator chamber, a conduit for supplying valve-closing pressure fluid to said diaphragm, a pressure-actuated auxiliary valve in said conduit, a second conduit for supplying valve-closing pressure fluid to said diaphragm, a valve in said second conduit, thermo-responsive means controlling said last-mentioned valve, a constantly-burning pilot burner, a conduit by-passing said main valve for supplying fuel to said pilot burner, an ignition burner, a conduit by-passing said main valve for supplying fuel to said ignition burner, said ignition burner being positioned to direct a stream of fuel across said pilot burner, across said thermo-responsive means, and toward said main burner whereby said stream will be ignited by said pilot burner and will project a flame to ignite said main burner, a valve controlling said last-named conduit, means responsive to temperature conditions at a point remote from said burners for controlling said last-named valve, a conduit controlled by said last-named valve for supplying valve-closing pressure fluid to said auxiliary valve, and a bleed-pipe connected to drain fluid entrapped in said main valve casing actuator chamber and those valves and conduits communicating with said chamber, upon concurrent closure of said auxiliary valve and said first-mentioned temperature-controlled valve.

3. Means for controlling the supply of fluid fuel to a burner comprising a supply line, a main valve in said line, pressure-actuated means for closing said valve, a conduit connected to said line in advance of said valve and supplying valve-closing pressure fluid to said main valve, a normally open valve in said conduit, a second conduit connected to said line in advance of said valve and supplying valve-closing pressure fluid to said main valve, an auxiliary valve in said second conduit, pressure-actuated means for closing said auxiliary valve, a constantly-burning pilot burner connected to said line in advance of said main valve, a check pilot burner, a conduit connecting said check pilot burner to said line in advance of said main valve, a valve connected to control said last-mentioned conduit, a room thermostat controlling said last-mentioned valve, a conduit connected to said last-mentioned conduit beyond

said last-mentioned valve for supplying valve-closing pressure fluid to said auxiliary valve, thermo-sensitive means adapted, when heated, to close said normally open valve, said means being positioned to be influenced by the flame from said check pilot burner, and a bleed pipe for draining fluid entrapped in the system between said auxiliary valve and said normally open valve upon concurrent closure of said valves.

4. Means for controlling the supply of fluid fuel to a burner comprising a supply line, a main valve in said line, pressure-actuated means for closing said valve, a conduit connected to said line in advance of said valve and supplying valve-closing pressure fluid to said main valve, a normally open valve in said conduit, a second conduit connected to said line in advance of said valve and supplying valve-closing pressure fluid to said main valve, an auxiliary valve in said second conduit, pressure-actuated means for closing said auxiliary valve, a constantly-burning pilot burner connected to said line in advance of said main valve, a check pilot burner, a conduit connecting said check pilot burner to said line in advance of said main valve, a valve connected to control flow to said check pilot burner, a room thermostat controlling said last-mentioned valve, a conduit connected to said last-mentioned conduit beyond said last-mentioned valve for supplying valve-closing pressure fluid to said auxiliary valve, thermo-sensitive means adapted, when heated, to close said normally open valve, said means being positioned to be influenced by the flame from said check pilot burner, and a bleed pipe for draining fluid entrapped in the system between said auxiliary valve and said normally open valve upon concurrent closure of said valves, said bleed pipe being positioned and connected to permit combustion of the fluid drained therethrough by the constantly-burning pilot flame.

In witness whereof, I have hereunto set my hand at Wabash, Indiana, this 17th day of October, A. D. one thousand nine hundred and thirty.

PHILIP G. MAGNER.