Jan. 16, 1951 J. T. WILSON 2,538,222

SAFETY CONTROL GAS BURNER SYSTEM

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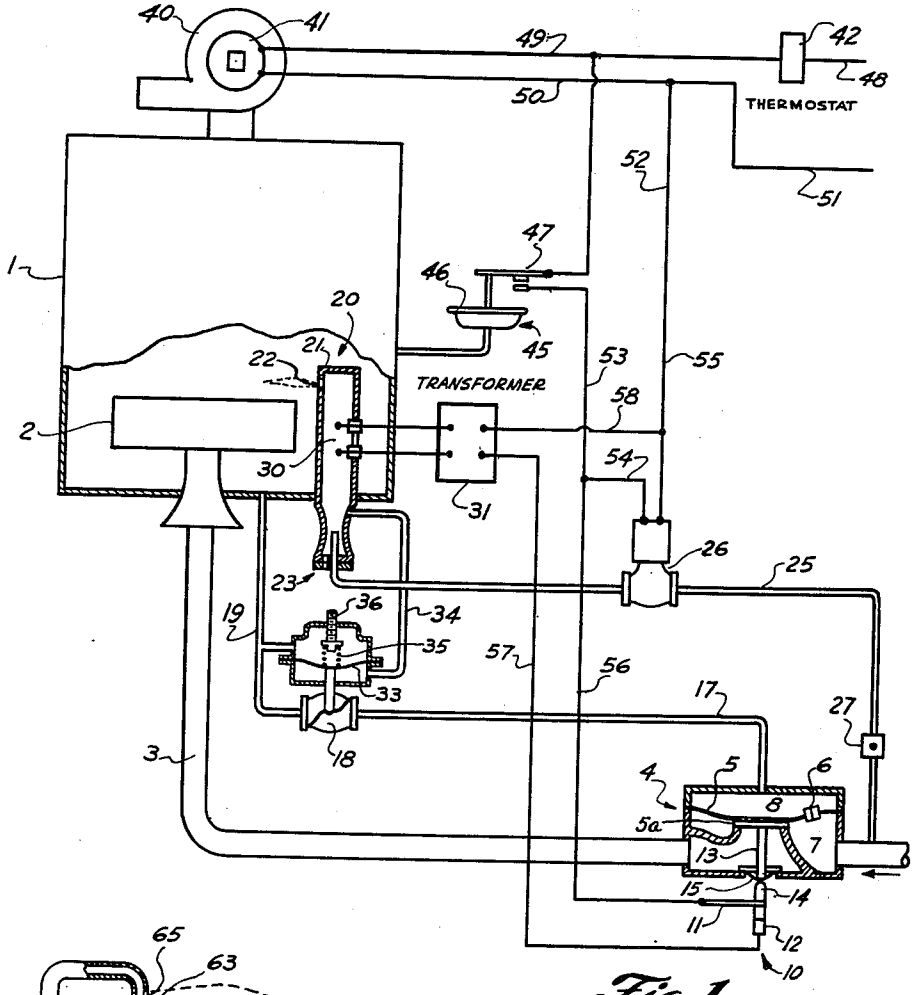

Fig. 1

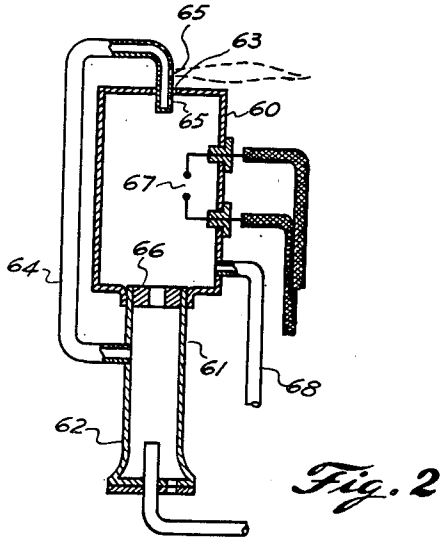

Fig. 2

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SAFETY CONTROL GAS BURNER SYSTEM

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This invention relates to burner control systems, and more particularly to burner control systems of the type in which the burner is ignited by a gas pilot.

In gas fired devices it is desirable to prevent the flow of gas to the main burner when the pilot is not burning. In the past this result has been obtained by the use of a thermal responsive device which is located at the pilot burner so as to be heated by the pilot flame. These devices are inherently slow operating and are difficult and expensive to manufacture.

It is a primary object of the present invention to provide a device which responds rapidly to the presence or absence of combustion at the pilot burner and which is also simple and positive in construction.

It is a further object of the invention to provide a device of this character which eliminates the necessity of a thermal responsive device located at the pilot burner.

In accordance with the present invention, a special pilot burner is provided in which a combustible mixture is burned within a confined space. The volume of gases issuing from the burner increases when combustion takes place within the burner due to expansion of the gases by the temperature of combustion. In the present invention a device exterior of the furnace is provided which responds to the increase in pressure in the special pilot burner. This responsive device thus indicates the presence or absence of combustion in the burner. Due to the fact that the device responds to pressure of gases which varies instantly when combustion takes place, the device is very quick acting.

Other objects of the invention will appear from the following description and the appended claims.

For a complete disclosure of the invention, reference is made to the accompanying drawings in which,

Fig. 1 shows one form of gas control system embodying the invention; and

Fig. 2 shows a preferred form of pilot construction.

Referring to Fig. 1, reference character 1 indicates a furnace having a main gas burner 2, which is supplied with gas through a gas line 3, which is controlled by a valve 4. The valve 4 may be of the diaphragm type having a diaphragm 5 which carries a valve member 5a controlling the flow of gas from the inlet to the outlet of the valve. The particular valve illustrated is of the type having a bleeding orifice 6

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which permits gas to bleed from the inlet chamber 7 into the space 8 above the diaphragm, this serving to hold the valve in closed position. The valve 4 is provided with an electric switch 10. This switch is illustrated diagrammatically as including a flexible switch blade 11 which carries a contact adapted to engage and disengage a stationary contact 12. The free end of the flexible blade 11 is actuated in accordance with the position of the valve, for example by a plunger 13 which is attached to the valve member and which operates a switch actuating button 14 through a suitable sealing diaphragm 15. The switch 10 is arranged so that it is closed when the valve 4 is closed and opens when the valve 4 opens.

The diaphragm valve 4 is provided with a feed line 17 which is connected to a control valve 18, which in turn is connected by a tube 19 with the interior of the furnace 1. The control valve 18 is controlled in accordance with the presence or absence of combustion within the pilot burner 20.

Referring to the pilot burner 20, this burner consists of a closed tube 21 which is provided with an orifice 22 arranged so that it projects a flame from the pilot burner to the main burner 2 for lighting the same. The pilot burner is shown as extending from the bottom of the furnace 1 and being provided with a gas-air mixing chamber 23 at its lower end. Gas is supplied to the pilot through a gas line 25 which is controlled by a solenoid valve 26. The gas line 25 is provided with a suitable manual valve 27 for controlling the flame in the pilot burner. The pilot burner 20 is also provided with ignition electrodes 30, these electrodes being located inside the enclosed chamber of the burner and having leads which extend through suitable insulating bushings in the side wall of the pilot burner. These electrodes are attached to the secondary of an ignition transformer 31.

In operation, the gas-air mixture supplied to the pilot burner burns partially within the burner. The supply of gas to the burner is regulated so that all of the mixture does not burn within the pilot, thereby causing a jet of flame to pass through the orifice 22 to the main burner 2 for igniting the main burner. When the pilot burner is ignited, the temperature of combustion causes the volume of gases discharged from the burner to be several times the volume of the gas-air mixture entering the burner. In accordance with the present invention, the increase in pressure caused by combustion is utilized as an indication that the pilot is burning. This change in pres-

sure of gases may be detected in any suitable manner. Preferably the pressure increase is measured by a device which responds to the pressure differential across the restricted outlet from the pilot chamber. This may be done by means of a diaphragm 33, the lower side of which is subjected to the pressure within the pilot burner by means of a tube 34. The upper side of this diaphragm responds to the pressure on the discharge side of the orifice 22 through a suitable line, such as the line 19 which opens into the interior of the furnace 1. The diaphragm 33 serves to operate the control valve 18 and is biased downwardly by a spring 35 having tension adjusting means 36. This adjusting means is adjusted so that when the pressure drop across orifice 22 is below that indicating combustion within the pilot burner, the control valve 18 is held in closed position. However, when combustion takes place within the pilot burner, the pressure increases within the burner and this increase in pressure urges the diaphragm 33 upwardly against the biasing spring 35 for opening the control valve 18. Thus when the volume of gases leaving the pilot increases due to combustion within the pilot, the diaphragm 33 causes the control valve to open.

While the invention is not limited to subatmospheric systems, it is intended primarily for such systems. The furnace 1 is shown as being provided with a suction fan 40 driven by an electric motor 41, this fan serving to draw a partial vacuum within the furnace. The remainder of the complete control system illustrated includes a room thermostat 42 which stops and starts the fan and which also controls the ignition transformer 31 and the solenoid valve 26. Preferably a suction responsive device 45 is wired in series with the thermostat so as to prevent the burner from operating unless the fan 40 has created a partial vacuum within the furnace. This device is shown as including a diaphragm 46 which responds to pressure within the furnace 1 and which operates a switch 47.

Operation

With the parts in the positions shown, the thermostat 42 is satisfied and the blower 40 is out of operation. The solenoid valve 26 and ignition transformer 31 are both deenergized. No pressure differential is present across the diaphragm 33 and the pilot valve 18 is closed. This has caused the main gas valve 4 to be in closed position, which in turn results in the switch 10 being in closed position. When the thermostat calls for heat it completes a circuit from line wire 48 through the thermostat, wire 49, blower motor 41, and wire 50 to the line 51. Operation of the blower 40 creates a suction in the furnace which causes the suction responsive device 45 to close the switch 47. This energizes the solenoid valve 26 and simultaneously energizes the ignition transformer 31. The circuit for the solenoid valve extends from wire 49, through wire 52, switch 47, wire 53, wire 54, solenoid valve 26 and wire 55 back to line wire 51. The circuit for the ignition transformer extends from wire 53 through wire 56, switch 10, wire 57, ignition transformer 31 and wires 58 and 55 to line wire 51.

From the foregoing it will be seen that when the room thermostat calls for heat it starts the blower, which creates a suction in the furnace 1. The control 45 responds to this suction and closes a circuit directly to the solenoid valve 26 which supplies gas to the pilot burner 20. Simultaneously the ignition transformer is energized through the switch 10 which is closed at this time, and this causes a spark to occur between the electrodes 30. As a result a gas-air mixture is supplied to the interior of the pilot burner and this mixture is ignited by the electric spark. When the mixture ignites, the temperature of combustion causes the volume of gases to expand, thereby increasing the pressure drop across the discharge 22 from the pilot burner. This increase in differential is detected by the diaphragm 33 which opens the control valve 18. This permits gas to bleed from the chamber 8 in the main diaphragm valve, thereby causing the main valve to open and supply gas to the main burner. This gas is ignited by the jet of flame projecting from the pilot burner.

As the gas valve opens, it permits the switch 10 to open, thereby breaking the circuit to the ignition transformer. Thus when combustion takes place within the pilot burner, the ignition device is cut off and gas is supplied to the main burner. The burner will now operate until the thermostat 48 becomes satisfied. When this occurs, it deenergizes the blower 40 and also deenergizes the solenoid valve 26. The flame within the pilot burner becomes extinguished, thereby causing the pressure within the burner to decrease. The diaphragm 33 responds to this decrease in pressure by closing the control valve 18. This prevents bleeding of gas from the chamber 8 of the main diaphragm valve, thereby causing this valve to close and stop the flow of gas to the main burner.

It will be noted that due to the control of the main gas valve by the pressure in the pilot burner, the main gas valve can never be open without combustion being present within the pilot burner. This insures that the gas supplied to the main burner will always be ignited.

Figure 2

With the pilot burner construction shown in Fig. 1, it is necessary to adjust the supply of the gas-air mixture to the burner so that complete combustion does not take place within the burner. This is necessary so that a sufficient quantity of unburned gases pass through the outlet 22 so as to provide a jet of flame outside the pilot. The pilot burner construction shown in Fig. 2 insures that a satisfactory flame will be present for igniting the main burner almost irrespective of the gas-air mixture supplied to the pilot burner.

Referring to Fig. 2, the pilot burner includes a circular enclosure 60 which is provided at its lower end with a feed tube 61 extending from a gas-air mixer 62. The enclosure 60 is provided with a restricted opening 63 at its upper end. An ignition tube 64 extends from the supply tube 61 to the top of the burner and then back into the opening 63. This tube is closed at its end and is provided with orifices 65. Preferably a suitable restrictor 66 is located between the gas-air supply tube and the interior of the burner 60 so as to prevent the flame from passing back into tube 61. The enclosure 60 is provided with electrodes 67 for igniting the gas and is also provided with a tube 68 which leads back to the pressure responsive device. With the arrangement shown in Fig. 2, a portion of the gas supply is burned within the enclosed chamber so as to provide an indication of whether or not the pilot burner is ignited. Another portion of the gas-air mixture is carried up to the

outlet **63** from the pilot burner and issues through orifices **65**. The hot gases of combustion issuing from the pilot burner insure that these jets will be ignited. Inasmuch as these jets are supplied with a fresh gas-air mixture which is independent of the burning within the enclosure **60**, it is possible for complete combustion to take place within the enclosure and still have a satisfactory jet of flame issue from the pilot for lighting the main burner.

From the foregoing it will be seen that the present invention provides a gas safety pilot which does not require the use of any thermal element or thermocouple within the furnace. It will also be apparent that the present invention, by responding to increases and decreases in pressure within the pilot burner, will respond quickly to presence or absence of combustion in the burner. The invention thus provides for obtaining fast response with a simple and dependable mechanism. While I have shown and described one embodiment or application of the invention, it will be apparent that many changes may be made without departing from the scope of the invention. It is therefore desired to be limited only by the scope of the appended claims.

What is claimed is:

1. In a control system for a main burner, the combination of, a gas pilot burner for lighting the main burner, said pilot burner being constructed and arranged so that at least partial combustion takes place within the pilot burner and having a restricted outlet for the gases therefrom, whereby a rise in pressure takes place within the pilot burner when it is burning, and means responsive to the pressure within the pilot burner for controlling the main burner.

2. In a control system for a main burner located in an enclosure to be heated, a gas pilot burner located in the enclosure in proximity to the main burner for lighting the same, said pilot burner being constructed and arranged so that at least partial combustion takes place within the pilot burner and having a restricted outlet for the gases therefrom into said enclosure, whereby a differential in pressure exists between the interior of the burner and the interior of the enclosure when the burner is burning, and means responsive to said differential in pressure for controlling the main burner.

3. In a control system for a main burner, the combination of, a pilot burner for lighting the main burner, said pilot burner comprising an apertured chamber for combustion of mixed gases therein and for flame projection through said aperture, and means responsive to the pressure of gases in the pilot burner for controlling the main burner.

4. In a control system for a main burner, in combination, a pilot burner for igniting the main burner, automatic means turning the pilot burner on and lighting the same in response to the demand for heat, and means responsive to an increase in pressure of gasses in the pilot burner for turning on the main burner.

5. A safety pilot for a main burner comprising an enclosed chamber having a restricted outlet, means for supplying a combustible mixture to the chamber and for causing at least a portion of the mixture to burn within the enclosed chamber, a nozzle located adjacent the outlet, means for supplying fuel to said nozzle, said nozzle being adapted to project a jet of fuel therefrom in proximity to said outlet so as to be ignited by hot gases leaving said outlet, said jet serving to light the main burner.

6. A safety pilot for a main burner comprising an enclosed chamber having a restricted outlet, means for supplying a combustible mixture to the chamber and for causing at least a portion of the mixture to burn within the enclosed chamber, and secondary pilot burner means for lighting the main burner, said secondary means being adapted to discharge a jet of unburned fuel adjacent said outlet for obtaining ignition from the hot gases passing from said enclosed chamber.

7. A safety pilot for a main burner comprising an enclosed chamber having a restricted outlet, means for supplying a combustible mixture to the chamber and for causing at least a portion of the mixture to burn within the enclosed chamber, electric ignition means within said chamber for igniting said mixture, and secondary pilot burner means for lighting the main burner, said secondary means being adapted to discharge a jet of unburned fuel adjacent said outlet for obtaining ignition from the hot gases passing from said enclosed chamber.

8. A safety pilot for a main burner comprising an enclosed chamber having a restricted outlet, means for supplying a combustible mixture to the chamber and for causing at least a portion of the mixture to burn within the enclosed chamber thereby causing the volume of gases passing through the outlet to increase when combustion takes place, secondary pilot burner means for lighting the main burner, said secondary means being adapted to discharge a jet of unburned fuel adjacent said outlet for obtaining ignition from the hot gases passing from said enclosed chamber, and a control device responsive to the pressure of the gases within said chamber for controlling the main burner.

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