

Oct. 1, 1946.

J. Q. MOORHEAD

2,408,673

GAS BURNER SYSTEM

Filed Sept. 29, 1944

2 Sheets-Sheet 1

FIG. 1.

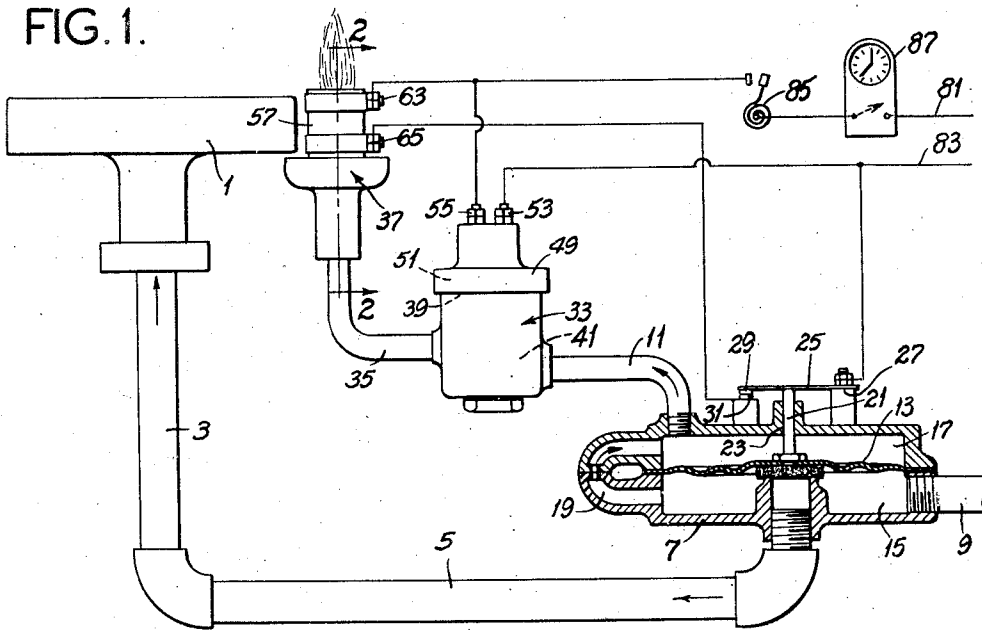


FIG. 2.

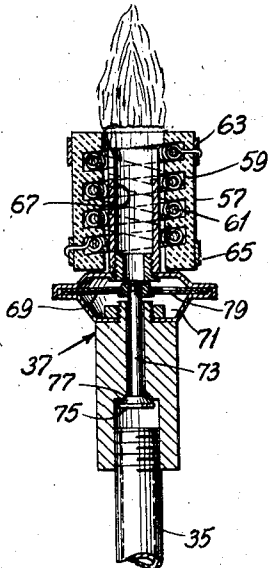
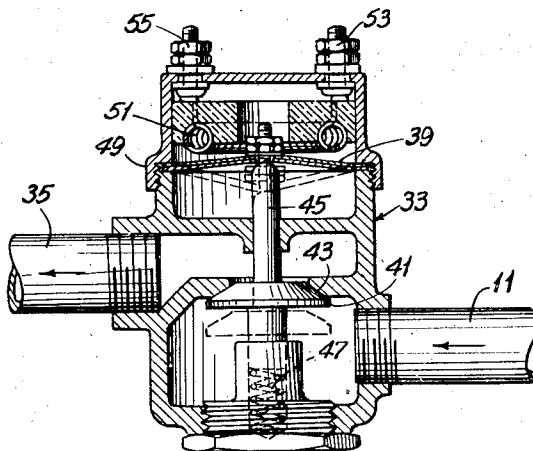


FIG. 3.



John O. Moorhead
Inventor
Haynes and Koenig
Attorneys

Oct. 1, 1946.

J. O. MOORHEAD

2,408,673

GAS BURNER SYSTEM

Filed Sept. 29, 1944

2 Sheets-Sheet 2

FIG. 4.

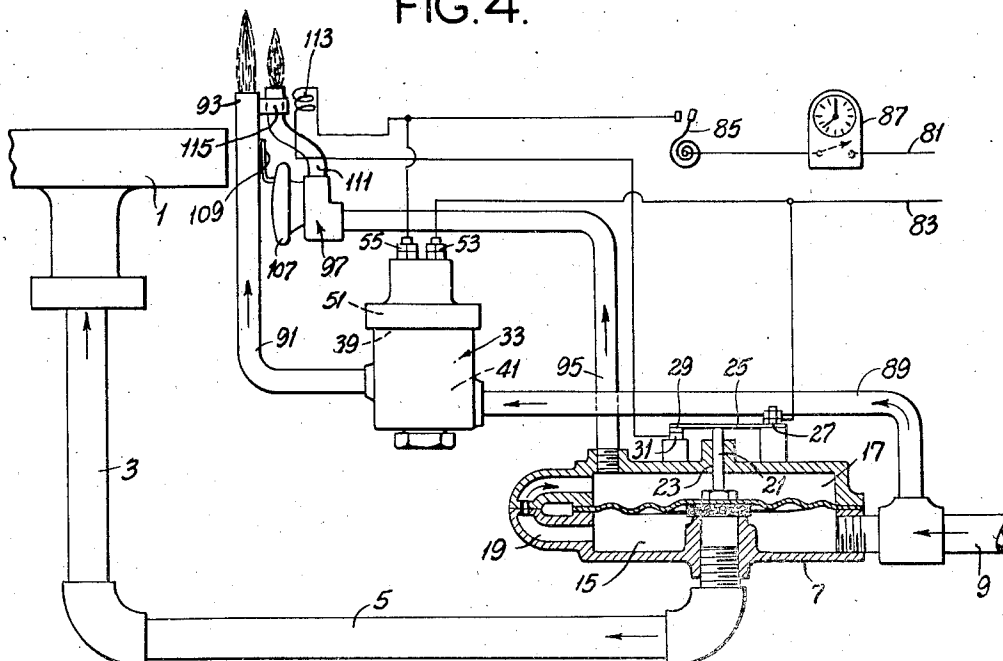
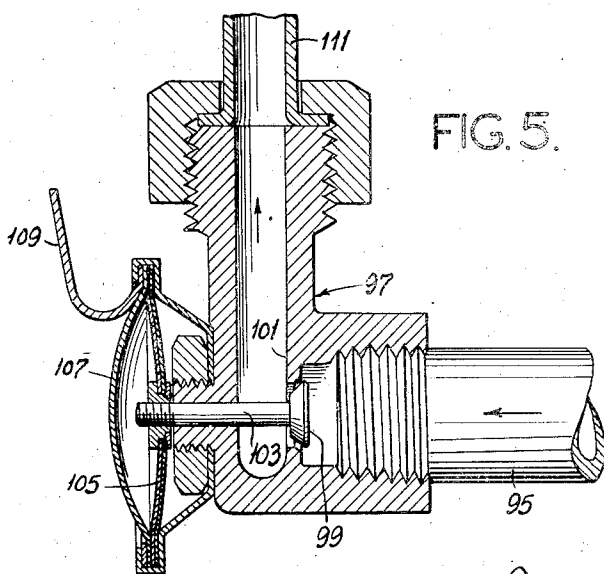


FIG. 5.



John O. Moorhead
Inventor
Haynes and Koenig
Attorneys

UNITED STATES PATENT OFFICE

2,408,673

GAS BURNER SYSTEM

John O. Moorhead, Attleboro, Mass., assignor to
Metals and Controls Corporation, Attleboro,
Mass., a corporation of Massachusetts

Application September 29, 1944, Serial No. 556,348

9 Claims. (Cl. 158—117.1)

1

This invention relates to a gas burner system and more particularly to a pilot ignition system for a gas burner.

Among the objects of this invention are the provision of a gas burner system which operates more efficiently; the provision of a system in which the pilot is efficiently electrically ignited; the provision of a gas burner electrically ignited in which the resistance wire is protected from the pilot flame and main burner flame; and the provision of a gas burner system of the type described in which a pilot is electrically ignited after a time delay. Other objects will be in part apparent and in part pointed out hereinafter.

The invention accordingly comprises the elements and combinations of elements, features of construction, and arrangements of parts which will be exemplified in the structures hereinafter described, and the scope of the application of which will be indicated in the following claims.

In the accompanying drawings, in which are illustrated several of various possible embodiments of the invention:

Fig. 1 is a diagram of the system partially in section;

Fig. 2 is a section on an enlarged scale taken on the line 2—2 in Fig. 1;

Fig. 3 is a section through a gas valve shown in Fig. 1;

Fig. 4 is a diagram of an alternative form of the invention; and

Fig. 5 is a section of the pilot operated control valve in Fig. 4.

Similar reference characters designate corresponding parts throughout the several views of the drawings.

Referring now to Fig. 1, a main burner 1 is connected by pipes 3 and 5 to a diaphragm-controlled regulator valve 7. Diaphragm valve 7 is in turn connected to a gas supply pipe 9 and has a bleed line 11 connected to the opposite side of the diaphragm.

The diaphragm valve 7 is of the usual type and includes a diaphragm 13 which separates compartments 15 and 17. The compartments are connected by a by-pass 19. The flow of gas to pipe 5 is controlled by the bleed 11 in known manner. Thus, when bleed 11 is closed the pressure on both sides of diaphragm 13 is the same since by-pass 19 connects compartments 15 and 17. Opening bleed 11 lowers the pressure in compartment 17 since gas is withdrawn therefrom faster than it can be replaced through by-pass 19. The pressure in compartment 15 now being

2

greater moves diaphragm 13 to admit gas to pipe 5. A shaft 21 is mounted on the diaphragm 13 and projects through an opening 23 in the case. The outer end of shaft 21 abuts contact arm 25. Arm 25 is pivotally mounted at 27 and carries on its opposite end contact 29. Contact 29 cooperates with fixed contact 31 mounted on the exterior of valve 7.

A gas valve 33 is connected to bleed 11 at one side and at the other side to line 35. Line 35 is also connected to a gas pilot 37. Valve 33 is shown in detail in Fig. 3. It is controlled by a snap-acting thermostatic disc 39, such as shown in Spencer Patent 1,448,240 which, when it snaps to its opposite position of concavity shown in dotted lines in Fig. 3, moves valve member 41 from its solid line position to its dotted line position away from seat 43. Shaft 45 which carries valve 41 is abutted at its opposite end by spring 47 which normally keeps the valve seated on 43. Spring 47 is designed so that it is overcome by disc 39 when the latter snaps to its dotted line position. Disc 39 is loosely mounted at its edges in the case 49 of valve 33 leaving the center free to move from one position of concavity to an oppositely concave position.

Disc 39 is designed so that it is normally concave upwardly (in its solid line position) when cool. A heater 51 is located close to disc 39 to transmit heat thereto. Heater 51 is connected to terminals 53 and 55.

Pilot 37 includes a tube 57 made of an electrical insulating material, such as soap-stone, which contains a spiral groove 59. A heater 61 is located in this spiral groove and is connected to terminals 63 and 65. A metal tube 67 is located within the soap-stone tube. Ports are bored in this metal tube to allow the gas to seep around the heater 61. Located below the tube 67 is a thermostatic disc 69 similar to disc 39. Disc 69 is mounted in a chamber 71 which is attached to tube 67. Chamber 71 loosely holds the edges of disc 69 leaving the central portion free to snap from one position of concavity to an oppositely concave position.

Mounted on the center of disc 69 is a shaft 73 which carries a shut-off valve 75. Valve 75 seats on connecting member 77 attached to chamber 71 and tube 35. Disc 69 is located so that when it is in its Fig. 2 position it seats valve 75 against member 77, but when it snaps to its opposite position of concavity disc 69 moves valve 75 away from its seat. An opening 79 is formed in disc 69 to permit gas flow into the tube 67.

Electrical connections are made from a main

electrical circuit 81, 83 to terminal 27, fixed contact 31, and terminals 53, 55, 63 and 65 as shown in Fig. 1. A suitable room thermostat 85 and a time switch 87, diagrammatically illustrated in Fig. 1, and constituting demand means, are desirably included.

The operation of the device is as follows: Assuming that thermostatic switch 85 and time switch 87 are closed, a circuit is made to terminals 27, contacts 29 and 31, terminals 53 and 55, and terminals 63 and 65. No gas is admitted to pipes 3 and 5 through the diaphragm valve since the bleed 11 is closed. As soon as the current between terminals 53 and 55 has, by means of heater 51, heated disc 39 sufficiently so that the disc snaps to its dotted line position in Fig. 3, valve 41 opens against the bias of spring 47 and gas is admitted from pipe 11 to pipe 35.

At the same time disc 69 has been heated by heater 61 and disc 69 likewise snaps thereby opening valve 75. Gas is thereby admitted by bleed 11 and pipe 35 to pilot 37. Here the gas diffuses around heater 61 through the ports in tube 67 and is thereby ignited. As soon as such ignition takes place the flame is drawn by its own suction out of contact with heater 61 and the pilot is ignited. Admitting gas to bleed 11, tube 35 and pilot 37 opens the diaphragm valve 7 and passes gas to main burner 1 as described above. This is ignited by pilot 37.

When the diaphragm 13 of valve 7 moves in response to gas passing to bleed 11 and pilot 37, the circuit between terminal 27 and terminal 31 is broken by the movement of arm 25 which separates contacts 29 and 31. These contacts remain separated as long as gas passes to pilot 37 and therefore to burner 1. The separation of contacts 29 and 31 breaks the circuit to terminals 63 and 65 so that no more current passes to heater 61. Disc 69, however, is maintained in its hot position by conduction of heat from the pilot flame by means of tube 67. Terminals 53 and 55 remain in the circuit so that heater 51 keeps disc 39 in its dotted line position (Fig. 3). The time delays should be matched to give best performance.

Assume now that either thermostatic switch 85 or time switch 87 opens. This breaks the circuit and no further current passes to terminals 53 and 55. Disc 39 thereupon cools, snaps to its solid line position (Fig. 3) allowing spring 47 to close valve 41. This prevents the passage of gas to pilot 37 and the diaphragm valve thereupon cuts off the flow of gas to burner 1. Thermal disc 69 in pilot 37 cools and closes valve 75. This takes place after diaphragm valve 7 has closed. Closing of the diaphragm valve automatically moves arm 25 to bring contacts 29 and 31 together again and the device is ready to repeat the operation described.

During the operation of burner 1 it will be noted that the pilot 37 is constantly burning to relight the burner 1 if for any cause it goes out. If pilot 37 should go out disc 69 will thereupon cool, snap to the position shown in Fig. 2 and thereby close the bleed circuit to pilot 37. This will cause the diaphragm valve 7 to close cutting off gas to burner 1. If switches 85 and 87 are closed at this time the device will re-cycle, first lighting pilot 37 and thereby lighting burner 1. Until this occurs, however, the escape of gas is prevented since the gas supply to burner 1 is shut off until pilot 37 lights.

It will be noted that heater wire 61 is out of the gas current. This is advantageous since the

gas flow cools the wire and makes it more difficult to ignite the gas. After ignition of pilot 37 the wire is out of the gas flame and is therefore not subjected to the destructive action of the high temperature of the gas flame. Heater 61 can therefore be a Nichrome wire rather than platinum wire previously employed in electrically ignited gas pilots.

Gas valve 33 has been described as a disc and heater gas valve, but in lieu thereof a gas solenoid valve may be substituted. The disc and heater valve is preferred since the time delay thereby obtained avoids danger of gas flashing back if the valve is accidentally stuck. It will be noted that the present control system cuts off current to the heater 61 as soon as the pilot 37 lights. This adds to the life of heater wire 61.

An alternative form of the invention is shown in Figs. 4 and 5. This embodiment is similar to the Figs. 1-3 embodiment but a gas line 89 is taken from the main gas supply pipe 9 ahead of regulator valve 7. Line 89 directly connects gas valve 33 to the gas supply and a pilot line 91 is taken off the opposite side of valve 33 to feed a pilot 93 of the usual type. A bleed 95 is taken from diaphragm valve 7 and is connected to a valve 97.

Valve 97 is a thermostatically operated gas control valve including a shut-off valve member 99 (see Fig. 5) which seats against the tube connection 101. Valve 99 is carried by shaft 103, the other end of which is mounted on the center of a snap-acting thermostatic disc 105. Disc 105 is similar in its operation to discs 39 and 69. Disc 105 is shown in its hot position in Fig. 5; it will be noted that valve 99 has been moved away from its seat. Disc 105 is mounted in a chamber 107. A thermal conducting finger 109 is attached to this chamber and projects outwardly and into heat conducting relationship with the pilot 93, and may contact it (as shown) or finger 109 may extend into the pilot flame. Tube 101 carries a burner port 111 the end of which is located adjacent to pilot 93. A heater wire 113 is close to flash tube 115, attached to the end of pilot 93.

The operation of the Figs. 4-5 device is as follows: Assuming that switches 85 and 87 close, a circuit is made through heater 113, contact 31, contact 29 and terminal 27, and likewise between terminals 53 and 55. Heaters 113 and 51 thereupon begin to heat and shortly disc 39 will snap, opening valve 41. This permits gas to flow to pilot 93. Heater 113 thereupon ignites pilot 93 through the diffusion of gas through flash tube 115. The heat from pilot 93 is transmitted by tube 91 to finger 109 and causes disc 105 to snap to its Fig. 5 position. This permits gas to pass from bleed 95. This gas is ignited by pilot 93.

Opening of bleed 95 operates the diaphragm valve 7 to admit gas to burner 1 which is ignited by pilot 93. Operation of diaphragm valve 7 breaks the circuit to heater 113 by separating contacts 29 and 31. Terminals 53 and 55, however, remain in the circuit and current passes through heater 51 until either switch 85 or 87 opens.

If pilot 93 is accidentally extinguished, it will be reignited by burner 111 or the flow of heat to disc 105 through finger 109 will stop and disc 105 will snap from its Fig. 5 position and close valve 99. This shuts off the bleed from diaphragm valve 7 thereby shutting off the flow of gas to burner 1. The device thereupon recycles, lighting pilot 93 as described above.

5

If switch 85 or switch 87 opens this cuts off the flow of current to heater 51, disc 39 cools and snaps to its opposite position permitting spring 47 to close valve 41. This cuts off pilot 93, disc 105 cools as described above, valve 99 closes, cutting off bleed 95 and this closes diaphragm valve 7 shutting off the gas to burner 1. The device is thereupon ready to recycle when switches 85 and 87 are closed.

It will be noted that in both embodiments of the invention, the breaking of the electrical circuit closes off both the pilot and the main burner, thus preventing the escape of gas. This is a desirable safety feature.

It will be clear that the gas burner system disclosed may be varied in other ways in which the heater wire which ignites the pilot, is physically out of the pilot flame but is adjacent thereto so that gas admitted to the pilot will be ignited by the electrical heater but the flame will flash out of contact with the heater upon ignition.

In addition it will be noted that in the above embodiments the heater which ignites the pilot is turned off after it has accomplished its function. This conserves both electrical current and the heater wire itself. Also the pilot is turned off when the main burner is not operating, thereby saving gas.

In view of the above, it will be seen that the several objects of the invention are achieved and other advantageous results attained.

As many changes could be made in the above constructions without departing from the scope of the invention, it is intended that all matter contained in the above description or shown in the accompanying drawings shall be interpreted as illustrative and not in a limiting sense.

I claim:

1. A gas burner pilot system comprising a main burner and a pilot burner means, a diaphragm-controlled regulator valve controlling a supply of gas to the main burner, the gas being fed to one side of the diaphragm of said valve, the pilot burner means including a connection to the opposite side of the diaphragm of said valve, a connecting passage between the opposite sides of the diaphragm, a thermostatically controlled gas valve controlling at least part of the gas supply to the pilot burner means, a thermostatically controlled shut-off valve controlling at least some flow of gas supply from the diaphragm valve to the pilot burner means, pilot heater ignition means operatively associated with the pilot burner means, but outside of the pilot flame, an electric heater controlling the thermostatically controlled gas valve, circuit means including demand means arranged to control both of said heaters, and a switch responsive to diaphragm movement of said diaphragm valve adapted to open the circuit only to the pilot heater ignition means independently of the other heater means.

2. A gas burner pilot system comprising a main burner and a pilot burner means, a diaphragm-controlled regulator valve controlling a supply of gas to the main burner, the gas being fed to one side of the diaphragm of said valve, the pilot burner means including a connection to the opposite side of the diaphragm of said valve, a connecting passage between the opposite sides of the diaphragm, a thermostatically controlled gas valve controlling at least part of the gas supply to the pilot burner means, a thermostatically controlled shut-off valve controlling at least some flow of gas supply from the diaphragm valve to the pilot burner means, pilot heater

6

ignition means operatively associated with the pilot burner means, an electric heater controlling the thermostatically controlled gas valve, circuit means including demand means arranged to control both of said heaters, and a switch responsive to diaphragm movement of said diaphragm valve adapted to open the circuit only to the pilot heater ignition means independently of the other heater means.

3. A gas burner pilot system comprising a main burner and a pilot burner means, a diaphragm-controlled regulator valve controlling a supply of gas to the main burner, the gas being fed to one side of the diaphragm of said valve, the pilot burner means including a connection to the opposite side of the diaphragm of said valve, a connecting passage between the opposite sides of the diaphragm, a thermostatically controlled gas valve controlling at least part of the gas supply to the pilot burner means, a thermostatically controlled shut-off valve controlling at least some flow of gas supply from the diaphragm valve to the pilot burner means, pilot heater ignition means operatively associated with the pilot burner means but outside of the pilot flame, an electric heater controlling the thermostatically controlled gas valve, circuit means including demand means arranged to control both of said heaters, means for transmitting heat from the pilot burner means to said shut-off valve, and a switch responsive to diaphragm movement of said diaphragm valve adapted to open the circuit only to the pilot heater ignition means independently of the other heater means.

4. A gas burner pilot system comprising a main burner and a pilot burner means, a diaphragm-controlled regulator valve controlling a supply of gas to the main burner, the gas being fed to one side of the diaphragm of said valve, the pilot burner means including a connection to the opposite side of the diaphragm of said valve, a connecting passage between the opposite sides of the diaphragm, a thermostatically controlled gas valve controlling at least part of the gas supply to the pilot burner means, a thermostatically controlled shut-off valve controlling at least some flow of gas supply from the diaphragm valve to the pilot burner means, pilot heater ignition means operatively associated with the pilot burner means but outside of the pilot flame, an electric heater controlling the thermostatically controlled gas valve, circuit means including demand means arranged to control both of said heaters, and a switch responsive to diaphragm movement of said diaphragm valve adapted to open the circuit only to the pilot heater ignition means independently of the other heater means, one of the thermostatic controls for the pilot burner means being in heat conductive relation to the flame of the pilot burner means to maintain the pilot burner valve open only so long as the pilot burner means carries a flame.

5. A gas burner pilot system comprising a main burner and a pilot burner, a diaphragm-controlled regulator valve controlling a supply of gas to the main burner, the gas being fed to one side of the diaphragm of said valve, the pilot burner including a connection to the opposite side of the diaphragm of said valve, a connecting passage between the opposite sides of the diaphragm, a thermostatically controlled gas valve controlling the gas supply to the pilot burner, a thermostatically controlled shut-off valve also controlling flow of gas supply from the diaphragm valve to the pilot burner, pilot heater ignition means

7

operatively associated with the pilot burner but outside of the pilot flame, an electric heater controlling the thermostatically controlled gas valve, circuit means including demand means arranged to control both of said heaters, and a switch responsive to diaphragm movement of said diaphragm valve adapted to open the circuit only to the pilot heater means independently of the other heater means, the thermostatically controlled shut-off valve being in heat conductive relation to the flame of the pilot burner to maintain the shut-off valve open only so long as the pilot burner carries a flame.

6. A gas burner pilot system comprising a main burner and a pilot burner, a diaphragm-controlled regulator valve controlling a supply of gas to the main burner, the gas being fed to one side of the diaphragm of said valve, a thermostatically controlled bleed line controlling said regulator valve, the bleed line being connected to the opposite side of the diaphragm of said valve, a connecting passage between the opposite sides of the diaphragm, a thermostatically controlled gas valve controlling the gas supply to the pilot burner, pilot heater ignition means operatively associated with the pilot burner but outside of the pilot flame, an electric heater controlling the thermostatically controlled gas valve, circuit means including demand means arranged to control both of said heaters, and a switch responsive to diaphragm movement of said diaphragm valve adapted to open the circuit only to the pilot heater ignition means independently of the other heater means, the thermostatically controlled bleed line being in heat conductive relation to the flame of the pilot burner to maintain the bleed line open only so long as the pilot burner carries a flame.

7. A gas burner pilot system comprising a main burner and a pilot burner means, a regulator valve controlling a supply of gas to the main burner, the pilot burner means including control means controlling said regulator valve, a thermostatically controlled gas valve controlling at least part of the gas supply to the pilot burner means, a thermostatically controlled shut-off valve controlling at least some flow of gas supply from said regulator valve to the pilot burner means, pilot heater ignition means operatively

8

associated with the pilot burner means but outside of the pilot flame, a heater controlling the thermostatically controlled gas valve, circuit means including demand means arranged to control both of said heaters, and a switch responsive to movement of said regulator valve adapted to open the circuit only to the pilot heater ignition means independently of the other heater means.

8. A gas burner pilot system comprising a main burner and a pilot burner, a regulator valve controlling a supply of gas to the main burner, the pilot burner including control means controlling said regulator valve, a thermostatically controlled gas valve controlling at least part of the gas supply to the pilot burner, a thermostatically controlled shut-off valve controlling at least some flow of gas supply from said regulator valve to the pilot burner, pilot heater ignition means comprising a heater located within the pilot burner but outside of the pilot flame, a heater controlling the thermostatically controlled gas valve, circuit means including demand means arranged to control both of said heaters, and a switch responsive to movement of said regulator valve adapted to open the circuit only to the pilot heater ignition means independently of the other heater means.

9. A gas burner pilot system comprising a main burner and a pilot burner, a regulator valve controlling a supply of gas to the main burner, the pilot burner including control means controlling said regulator valve, a thermostatically controlled gas valve controlling at least part of the gas supply to the pilot burner, a thermostatically controlled shut-off valve controlling at least some flow of gas supply from said regulator valve to the pilot burner, said pilot burner having a passage-way for gas, the walls of said passageway having at least one port therein, an electric heater for igniting said pilot burner located out of said passage-way but adjacent to said port, a heater controlling the thermostatically controlled gas valve, circuit means including demand means arranged to control both of said heaters, and a switch responsive to movement of said regulator valve adapted to open the circuit only to the pilot ignition heater independently of the other heater.

JOHN O. MOORHEAD.