Feb. 7, 1956 J. L. LUNDGREN ET AL 2,733,760

GAS BURNER IGNITION SYSTEM

Filed Nov. 19, 1951 2 Sheets-Sheet 1

Fig. 1

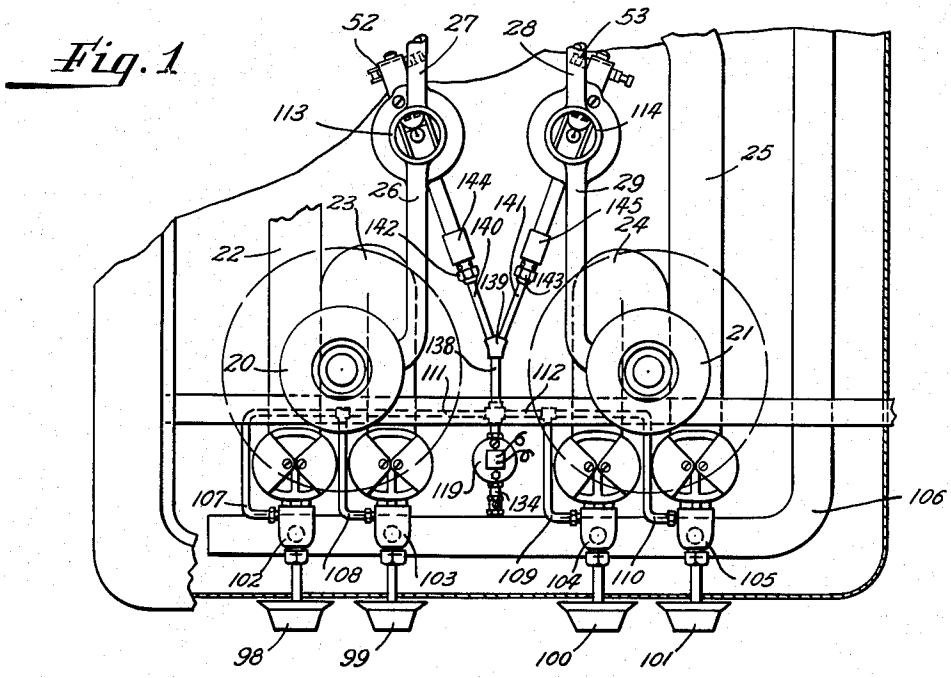

Fig. 2

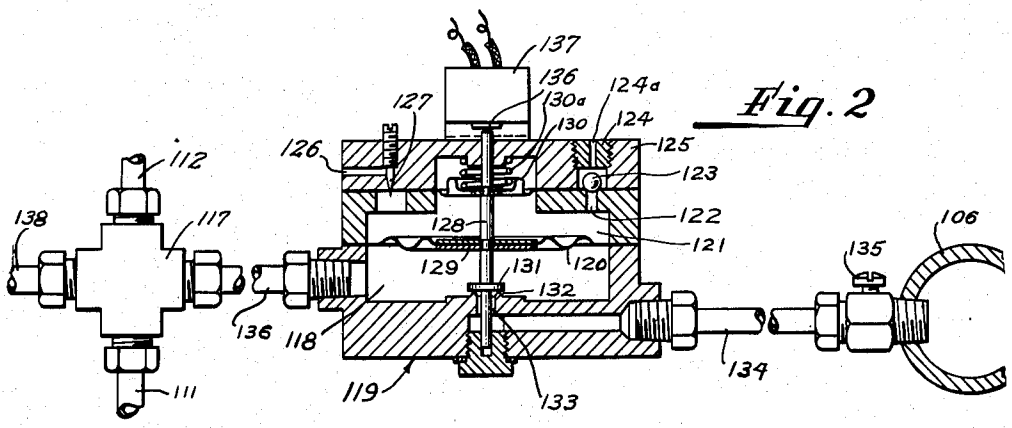

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Fig. 3

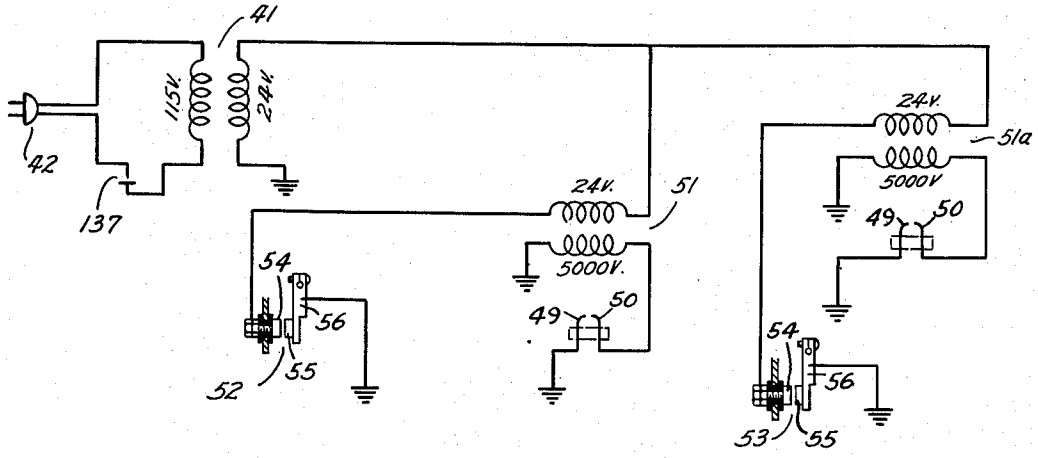

Fig. 4

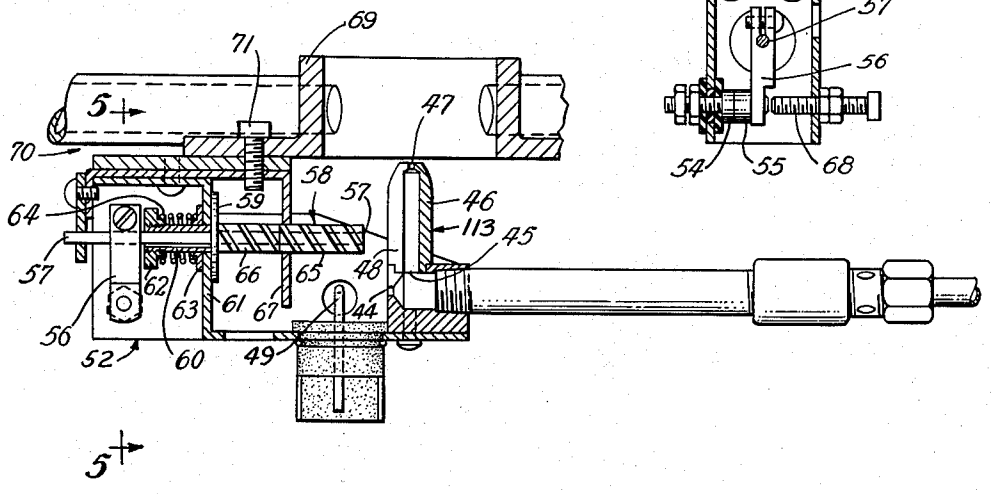

Fig. 5

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GAS BURNER IGNITION SYSTEM

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9 Claims. (Cl. 158—126)

This invention relates to an automatic ignition system for gas burning appliances, and particularly to such a system for igniting the top burners on a gas stove.

It is an object of this invention to provide a novel system for igniting an ignition pilot burner automatically in response to the opening of a shut-off valve for supplying gas to a main burner.

It is also an object of this invention to provide an ignition system for a main gas burner in which the pilot burner is lighted by means of an igniter energized in response to gas pressure resulting from the opening of a shut-off valve for supplying gas to the main burner, and in which there is provided a thermal switch for de-energizing the igniter after the pilot burner is lighted.

Another object of this invention is to provide a novel ignition system for a main gas burner in which the gas supply to an ignition pilot burner is initially under the control of a shut-off valve for the main burner, and after lighting of the ignition pilot burner there is established a gas supply thereto which is independent of the shut-off valve for the main burner.

Another object of this invention is to provide a novel ignition system operative to maintain a stand-by pilot flame in igniting relation to a main gas burner for a time interval following the shutting off of the main burner.

Another object of this invention is to provide an electric ignition system for the top burners on a gas stove which reduces to a minimum the number of switches required for its successful operation, and which eliminates the necessity for individual switches for each top burner valve knob.

A further object of this invention is to provide a novel electric ignition system for the top burners on a gas stove in which a pilot burner for igniting the top burners is automatically lighted in response to the actuation of any of the top burner valve knobs, and which remains lighted as long as gas is supplied to any of the top burners and for a time interval following the extinguishment of the last top burner.

Other and further objects and advantages of the invention will be apparent from the following description of a preferred embodiment thereof.

In the drawings:

Figure 1 is a fragmentary top view of a gas stove incorporating the present invention;

Figure 2 is a fragmentary view, partly in section, of a portion of the gas supply system for the pilot burners of the present invention;

Figure 3 is a circuit diagram of the electrical portion of the present ignition system;

Figure 4 is a fragmentary view, partly in section, illustrating a pilot burner, thermal switch associated therewith, the igniter for the pilot burner, and the flash tubes leading from the pilot burner to top burners on the stove; and

Figure 5 is a section along the line 5—5 in Figure 4.

Referring to the drawings, the ignition system of the present invention is shown as being associated with a conventional gas stove having a plurality of top burners,

including a pair of front burners 20, 21 and a pair of rear burners (not shown). The respective gas supplies to the top burners are controlled individually by manually operated knobs 98, 99, 100, 101 which control the respective main shut-off valves 102, 103, 104 and 105. These main shut-off valves control the flow of gas from the manifold 106 to the respective mixer conduits 22, 23, 24, 25 leading to the top burners. In addition to these conduits 22–25 leading to the top burners, the main shut-off valves 102–105 have outlets communicating with conduits 107, 108, 109 and 110, which connect with conduits 111, 112 leading to the pilot burners 113, 114.

The pilot burner 113 is located centrally between the front burner 20 and the rear burner located at the left hand side of the stove, and is adapted to ignite the same through the horizontal flash tubes 26, 27. The pilot burner 114 is located centrally between the front burner 21 and the top burner located at the right hand side of the stove, and is adapted to ignite these top burners through the horizontal flash tubes 28, 29.

As best seen in Figure 4, each pilot burner includes a lower horizontal outlet port 44 and a vertical outlet port 45. A tube 46 extends directly above the upper outlet port 45 and is formed with a vertical ignition port 47 at its top. A vertical slot 48 extends from the lower horizontal outlet port 44 to the top ignition port 47 to form a flame path for the ignition of top port 47 from port 44.

Positioned respectively adjacent each of the pilot burners 113, 114 are identical thermal switches 52, 53. Switch 52 is thermally responsive to heat from pilot burner 113, so as to open after ignition of the pilot burner and to close again when the pilot burner goes out. The switch includes a fixed contact 54 (see Figs. 3 and 5) connected to the primary of transformer 51 and a grounded movable contact 55. As best shown in Figs. 4 and 5, the movable contact 55 is carried on a depending arm 56 which is mounted on a shaft 57 to be angularly movable therewith. At its other end shaft 57 is connected to a bimetal helix 58 (see Fig. 4). The other end of the bimetal helix is connected to a transverse collar 59 which is mounted on a tube 60 rotatably mounted on shaft 57. One face of collar 59 abuts against a wall 61 which is part of the bracket assembly supporting the thermal switch. At its other end tube 60 is threaded to hold a nut 62. An annular collar 63 abuts against the other face of bracket wall 61 and rotatably receives tube 60. A coil spring 64 is under compression between nut 62 and collar 63.

The bimetal helix 58 consists of two different interconnected segments 65 and 66. The segment 65 is exposed to the flame issuing at port 44 and rotates shaft 57 angularly in response to said flame. The segment 66 of the bimetal helix 58 is shielded by bracket wall 67 from the flame at port 44. Segment 66 is of reverse formation from that of segment 65—one having the high expansion metal on the outside and the other having the high expansion metal on the inside. By this arrangement, when variations in ambient temperature occur the respective helical segments 65, 66 tend to rotate in opposite directions, resulting in no angular movement of shaft 57 due to ambient temperature changes. However, the helical segment 65 does respond directly to a flame at port 44 without opposition from the shielded segment 66, so that the shaft 56 is readily moved angularly in response to the condition of the flame at port 44.

With the described thermal switch, when gas issuing from port 44 is ignited, the flame at port 44 heats the exposed segments 65 of the bimetal helix to cause angular movement of shaft 57. This angular movement of shaft 57 moves the movable switch contact 55 away from

fixed contact 54 to break the circuit to the igniter 49, 50. An adjustable stop 68 limits the circuit-breaking movement of contact 55 and thus prevents continued angular movement of shaft 56 in the same direction in response to the continuing flame at port 44. The continuing rotation of the bimetal helix 58 is then imparted to collar 59 which rotates sleeve 60 and nut 62. Thus collar 59 rides frictionally over bracket wall 61 after the movable contact 55 has moved to this extreme of movement.

Then when the flame at port 44 goes out shaft 57 is immediately moved angularly in response to the rotation of bimetal helix segment 65 in the opposite direction. Movable contact 55 is immediately moved the short distance from engagement with stop 68 into engagement with the fixed contact 54. After this engagement takes place further rotation of shaft 57 is prevented and any continuing rotation of helix 58 as it cools is taken up by the described slip friction clutch arrangement. In this manner, the clutch takes up the override of the bimetal helix and insures that only a very small movement of the movable switch contact 55 is required to control the circuit for the igniter in response to the condition of the flame at port 44.

Switch 53 is thermally responsive to heat from the pilot burner 114, and is identical in construction and mode of operation with the described thermal switch 52.

Upstanding annular fittings 69 are disposed above each of the tubes 46 of the pilot burners 113, 114, to receive the inner ends of the respective flash tubes 26 and 27, and 28 and 29. Each of these fittings is disposed immediately above the corresponding pilot burner top port 47, so that a flame at that port is positioned to ignite gas in the adjacent flash tubes issuing from the respective top burners.

For igniting the pilot burners, there are provided adjacent each pilot burner port 44 a pair of spark ignition electrodes 49, 50, which are operative when energized to pass an ignition spark transversely across the gas jet issuing from port 44, which then ignites the top ignition port 47.

A bracket assembly 70 of any convenient form, and including the described depending walls 61 and 67, is attached to each of the annular fittings 69 by means of a screw 71 for supporting each assembly of pilot burner, ignition electrodes and thermal switch.

For controlling the energization of the ignition electrodes there is provided the electrical circuit schematically shown in Fig. 3. This circuit includes a pair of transformers 51, 51*a* whose primaries are in parallel across the 24 volt secondary of a transformer 41. By means of a plug 42 the primary of transformer 41 is energized by ordinary 110–120 volt house current. The primary circuit of the transformer 141 includes a normally open switch 137. The thermal switch 52 is in series with the primary of the transformer 51, while the thermal switch 53 is in series with the primary of the transformer 51*a*. The respective ignition electrodes are connected across the 5000 volt secondaries of the respective transformers 51 and 51*a*. As is readily apparent from the circuit diagram of Fig. 3, the switch 137 must be closed in order to energize the ignition electrodes. When either of the thermal switches 52, 53 opens, the corresponding ignition electrodes are de-energized, even if the switch 137 is closed.

For controlling the switch 137 there is provided a diaphragm communicating with all of the gas supply lines to the pilot burners. The conduits 111, 112 leading to the pilot burners both communicate through a fitting 117 with a chamber 118 formed in the safety valve 119. A diaphragm 120 separates chamber 118 from an upper valve chamber 121. A ball valve 123 is normally seated to block port 122 leading out of the upper valve chamber 121. An annular nut 124 formed with a port 124*a* communicating with the atmosphere is positioned in the top wall 125 of the valve casing above the ball valve. Another orifice 126 communicating with the atmosphere is also formed in wall 125, and an adjustable tapered needle member 127 partially blocks the communication between orifice 126 and the upper valve chamber 121. The position of needle 127 determines the rate at which air may enter into the upper valve chamber 121.

A plunger 128 is connected rigidly to a plate 129 secured to diaphragm 120. Above this connection the plunger is also connected in similar fashion to a mounting diaphragm 130. A coil spring 130*a* acts against diaphragm 130 to bias plunger 128 to its lower position. A valve closure member 131 is carried on plunger 128 and normally bears against seat 132 to close port 133. Port 133 is adapted to effect communication between the lower valve chamber 118 and a conduit 134 connected directly to the gas main 106. An adjustable valve 135 controls the gas pressure in conduit 134.

At its upper end plunger 128 is normally spaced from engagement with the plunger 136 which controls the precision snap-acting switch 137. When plunger 128 is raised it engages the switch plunger to close the switch, as well as opening valve 131 to pass gas through conduit 134, valve chamber 118 and conduit 138 from the gas main 106 directly to the pilot burners 113, 114.

Conduit 138 terminates in a Y fitting 139 which communicates with separate conduits 140, 141 for the pilot burners 113, 114. Flow restricting orifices 142, 143 in the pilot burner conduits 140, 141 restrict the gas flow thereto. These flow restricting orifices cause the gas pressure in lower valve chamber 118 to build up initially when gas is supplied to either of the conduits 111, 112 when one or more of the top burner knobs 98—101 is turned on, so as to raise the diaphragm 120. Mixers 144 and 145 are located at the outlet side of the respective flow restriction orifices 142, 143.

In the operation of this system, when any one of the main shut-off valves is opened, by manual actuation of the corresponding knob, gas is supplied to the conduit 138, and from there to the pilot burners 113, 114, as well as to the proper top burner. The flow restrictions at 142, 143 in the gas supply lines to the pilot burners cause gas pressure to build up in the lower valve chamber 118. Diaphragm 120 is thereby forced upward to lift valve closure member 131 from its seat and furnish an additional supply of gas to the pilot burners directly from gas manifold 106 and independent of the manually-operated main shut-off valves.

Upward movement of the valve plunger 128 in unison with the diaphragm 120 actuates the plunger 136 to close the switch 137 to energize transformer 41. Since the thermal switches 52 and 53 are normally closed, the ignition electrodes 49, 50 at each pilot burner are energized when switch 137 closes. The gas issuing at both pilot burners is ignited by the ignition spark between the ignition electrodes in the manner already described. Thereafter, heat from the lighted pilot burners opens the respective thermal switches 52, 53 to de-energize the ignition apparatus.

Upward movement of diaphragm 120 also results in forcing air from upper valve chamber 121 past ball valve 123 to atmosphere. Air from outside the valve casing is permitted to leak back though aperture 126 into the upper valve chamber 121 at a rate determined by the position of needle 127, when the upward gas pressure on diaphragm 120 has ceased. When all of the main shut-off valves have been closed, the gas pressure from the lines 111, 112 drops so that the diaphragm 120 is permitted to return to its normal position to close valve 131. The rate at which diaphragm 120 returns is determined by the opposing pressure in conduit 134, as well as by the force of spring 130 and the rate of return of air through aperture 126 into the upper valve chamber 121 above the diaphragm. Gas is continued to be supplied through conduit 134 to the pilot burners to maintain stand-by pilot flames thereat until diaphragm 120 has returned to its normal position to seat valve closure member 131.

The foregoing described arrangement provides a time delay in shutting off the pilot burners after the last top burner is shut off, thereby establishing a safety feature in the present system to cover the situation where the operator turns on the wrong top burner and discovers his mistake right after ignition of that top burner and opening of the thermal switches. The operator would immediately turn off the mistakenly actuated burner knob and turn on the correct one. However, in this very brief interval, after ignition of the pilot burners in response to turning on the wrong top burner knob, the thermal switches will not have been heated sufficiently by the respective pilot flames at ports 44 to re-close within four seconds after turning off the top burner knob which has been mistakenly actuated. The rapidity with which each thermal switch closes depends upon its temperature—it will close much more rapidly if heated long enough by the pilot flame at 44 to have a high temperature. Therefore, each thermal switch would not be in its normal closed condition, which is necessary to energize the igniter 49, 50, when the correct top burner knob is turned on. If the gas supply to the pilot burners had been shut off immediately upon turning off the mistakenly actuated top burner knob then the igniter would not be energized to re-ignite the pilot burners upon turning on the correct top burner, and thus there would be no provision for igniting that top burner within the standard time limit. With the present system, however, the pilot burners stay on for a time interval after turning off the last top burner which is more than sufficient to insure the ignition of another top burner turned on soon thereafter. When the pilot burners do go out, they will have been lighted long enough to have heated the corresponding thermal switches sufficiently that the latter will close quite rapidly, to condition the igniter for igniting the pilot burner when a top burner is turned on.

Also, if a pilot burner should be blown out by a draft of air through the kitchen while a corresponding top burner is on, the adjacent thermal switch will close promptly, provided the pilot burner has been on an appreciable length of time. The igniter will be energized upon such closing of the thermal switch, as long as one of the top burners is on, to re-ignite the pilot burner.

It is understood that the system of the present invention may embody other electric igniters, such as ignition coils, in place of the described ignition electrodes.

While the foregoing description and the illustrated embodiment of the invention have been directed specifically toward ignition systems for gas stoves, it is to be understood that the principles of the present invention may be used with other gas burning equipment. Furthermore, various variations and modifications which depart from the specific illustrated form of the invention may be adopted without departing from the spirit and scope of the present invention.

We claim:

1. A gas burner ignition system comprising a gas supply line, a main gas burner, conduit means supplying gas from said supply line to said main burner, a pilot burner in igniting relation to said main burner, a first pilot burner conduit means supplying gas to said pilot burner, a shut-off valve in both said conduit means operative to control the flow of gas to said main burner and to said pilot burner, an electrically energized igniter for igniting said pilot burner, a switch controlling the energization of said igniter, diaphragm means controlling the opening and closing of said switch communicating with said conduit means to the pilot burner after said shut-off valve, said diaphragm means being operative in response to gas pressure resulting from the opening of said shut-off valve to close said switch to energize said igniter for igniting the pilot burner, a second pilot burner conduit means for supplying gas to said pilot burner from said supply line, and valve means in said second pilot burner conduit means controlled by said diaphragm means operative to supply gas to said pilot burner independent of said shut-off valve following the ignition of the pilot burner.

2. A top burner ignition system for a gas stove comprising a gas supply line, a plurality of manually operated main shut-off valves each controlling the supply of gas from said supply line to a respective one of a corresponding plurality of top burners, a pilot burner in igniting relation to the top burners, pilot burner conduit means for supplying gas from said supply line to said pilot burner, a pilot burner valve controlling the flow of gas through said conduit means to the pilot burner and including a closure member normally biased to closed position, diaphragm means within said pilot burner valve controlling the position of said closure member, a conduit connected to the outlet of each of said main shut-off valves and communicating with said diaphragm means in said pilot burner valve and operative to supply gas under pressure at one side of said diaphragm means to open said valve closure member upon opening of the first one of said main shut-off valves to be opened, an electrically energized igniter operative to ignite the pilot burner in response to said opening of the first one of said main shut-off valves, a normally closed thermal switch controlling the energization of said igniter positioned adjacent the pilot burner and operative to open when heated thereby to de-energize said igniter after ignition of the pilot burner and to maintain said igniter de-energized while the pilot burner remains lighted, the closure member of said pilot burner valve remaining open by gas pressure exerted against said diaphragm means as long as any one of said main shut-off valves is open, and time delay means within said pilot burner valve operative to delay the closing of said closure member therein for a time interval after closing the last of said main shut-off valves to provide a time delay for the extinguishment of the pilot burner after the last of said top burners is extinguished.

3. Apparatus as in claim 2, wherein said thermal switch includes a fixed contact, a stop spaced from said fixed contact, a contact movable between said stop and said fixed contact to open and close the switch, a bimetal helix subject to a flame at the pilot burner and connected to the movable contact to control the position of the latter, and a friction clutch for the bimetal helix taking up the continued expansion or contraction of the helix after the movable contact has been moved to either extreme limit of movement and insuring immediate movement of the movable contact toward its other extreme limit of movement in response to the ignition or extinguishment of said flame at the pilot burner.

4. A top burner ignition system for gas stoves comprising a main top burner, a gas manifold, conduit means extending between said manifold and said main top burner for passing gas from said manifold to said main top burner, a main shut-off valve controlling the flow of gas through said conduit means, a pilot burner conduit connected to receive gas under the control of said shut-off valve, pilot burner means in igniting relation to said main top burner and connected to said pilot burner conduit to receive its gas supply therefrom, a pressure switch including pressure-operated means communicating with said pilot burner conduit and operative to close said switch in response to gas pressure in said pilot burner conduit resulting from the opening of said shut-off valve, an electrically energized igniter in igniting relation to said pilot burner means and controlled by said pressure switch to be energized upon closing of said pressure switch, a switch for de-energizing said igniter following the ignition of said pilot burner means, a bypass conduit having connections to said manifold and said pilot burner means for supplying gas to said pilot burner means independent of said shut-off valve, a normally closed pilot burner valve in said bypass conduit and operable to open position following the opening of said shut-off valve, and time delay means for maintaining said pilot burner valve open

for a time interval following the closing of said shut-off valve to maintain a pilot flame at said pilot burner means in lighting proximity to said main top burner during said time interval.

5. A top burner ignition system for gas stoves comprising a main top burner, a gas manifold, conduit means extending between said manifold and said main top burner for passing gas from said manifold to said main top burner, a main shut-off valve in said conduit means controlling the flow of gas to said main top burner, a pilot burner conduit extending from the outlet side of said shut-off valve to receive a gas supply when said shut-off valve is open, pilot burner means in igniting relation to said main top burner and having a connection to said pilot burner conduit to receive its gas supply therefrom, an electrically energized igniter in igniting relation to said pilot burner means, a normally open pressure switch in the energization circuit for said igniter, said pressure switch including a movable pressure-operated diaphragm communicating with said pilot burner conduit and operable to close said pressure switch in response to gas pressure in said pilot burner conduit resulting from the opening of said shut-off valve, a normally closed thermal switch in the energization circuit for said igniter operable to open in response to heat from said pilot burner means to de-energize said igniter following ignition of said pilot burner means, bypass conduit means extending from said manifold to said pilot burner means to supply gas to said pilot burner means direct from said manifold and independent of said shut-off valve, a normally closed pilot burner valve in said bypass conduit means, means for opening said pilot burner valve following the opening of said shut-off valve, and time delay means for maintaining said pilot burner valve open for a time interval following the closing of said shut-off valve to maintain a pilot flame at said pilot burner means in lighting proximity to said main top burner during said time interval.

6. A gas burner ignition system comprising a gas supply line, a main gas burner, conduit means supplying gas from said supply line to said main burner, a shut-off valve in said conduit means operative to control the flow of gas to said main burner, a pilot burner in igniting relation to said main burner, an electrically-energized igniter for igniting said pilot burner, a switch controlling the energization of said igniter, diaphragm means controlling the condition of said switch, means responsive to the opening of said shut-off valve for supplying gas from the supply line to the pilot burner and for applying gas pressure against said diaphragm means to close said switch to energize said igniter for igniting the pilot burner, a switch thermally responsive to the pilot burner to de-energize said igniter following ignition of the pilot burner, a bypass conduit having a connection to said supply line and to said pilot burner for passing gas thereto independent of said shut-off valve, and a normally closed valve in said bypass conduit controlled by said diaphragm means to open and thereby supply gas through said bypass conduit independent of said shut-off valve following the ignition of said pilot burner.

7. A gas burner ignition system comprising a gas supply line, a main gas burner, conduit means supplying gas from said supply line to said main burner, a shut-off valve in said conduit means operative to control the flow of gas to said main burner, a pilot burner in igniting relation to said main burner, an electrically-energized igniter for igniting said pilot burner, a switch controlling the energization of said igniter, diaphragm means controlling the condition of said switch, means responsive to the opening of said shut-off valve for supplying gas from said supply line to the pilot burner and for applying gas pressure against said diaphragm means to close said switch to energize said igniter for igniting the pilot burner, a switch thermally responsive to said pilot burner to de-energize said igniter following ignition of the pilot burner, pilot burner conduit means for supplying gas from the supply line to the pilot burner, valve means in said pilot burner conduit means controlled by said diaphragm means and operative to supply gas to said pilot burner independent of said shut-off valve following the ignition of the pilot burner, and time delay means controlling said diaphragm means and operative to maintain said valve means open for a time interval following the closing of said shut-off valve to maintain a pilot flame at said pilot burner during said time interval.

8. A top burner ignition system for a gas stove comprising a gas supply line, a plurality of top burners, a plurality of conduits for supplying gas from said supply line to said top burners, a manually operable main shut-off valve in each of said conduits controlling the flow of gas to the respective top burner, a pilot burner in igniting relation to said top burners, a plurality of pilot burner conduits connected respectively to said top burner conduits after said shut-off valves for supplying gas to the pilot burner under the control of said shut-off valves, an electrically-energized igniter for igniting said pilot burner, a switch controlling the energization of said igniter, diaphragm means controlling the opening and closing of said switch and communicating with each of said conduits after the shut-off valve thereat and operative in response to gas pressure resulting from the opening of any of said main shut-off valves to close said switch to energize said igniter for igniting the pilot burner, pilot burner conduit means for supplying gas from the supply line to the pilot burner, a valve in said pilot burner conduit means controlled by said diaphragm means and operative to supply gas to said pilot burner independent of said shut-off valves following the ignition of the pilot burner, and time delay means controlling said diaphragm means and operative to maintain said diaphragm-controlled valve open for a time interval following the closing of the last one of said shut-off valves to be closed, whereby to maintain a pilot flame at said pilot burner during said time interval.

9. A top burner ignition system for a gas stove comprising a gas supply line, a plurality of top burners, a plurality of conduits for supplying gas from said supply line to said top burners, a manually operated main shut-off valve in each of said conduits controlling the flow of gas to the respective top burner, a pilot burner in igniting relation to said top burners, a plurality of pilot burner conduits connected respectively to said top burner conduits after said shut-off valves for supplying gas to the pilot burner under the control of said shut-off valves, an electrically-energized igniter for igniting said pilot burner, a switch controlling the energization of said igniter, diaphragm means controlling the opening and closing of said switch and communicating with each of said conduits after the main shut-off valve thereat and operative in response to gas pressure resulting from the opening of any of said shut-off valves to close said switch to energize said igniter for igniting the pilot burner, a bypass conduit having a connection to said supply line to said pilot burner for supplying gas thereto independent of any of said shut-off valves, a pilot burner valve in said bypass conduit controlled by said diaphragm means and operative to supply gas from said bypass conduit to said pilot burner independent of said shut-off valve following the ignition of the pilot burner, and time delay means controlling said pilot burner valve to maintain said pilot burner valve open for a time interval following the closing of the last one of said shut-off valves to be closed, whereby to maintain a pilot flame at said pilot burner during said time interval.

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