

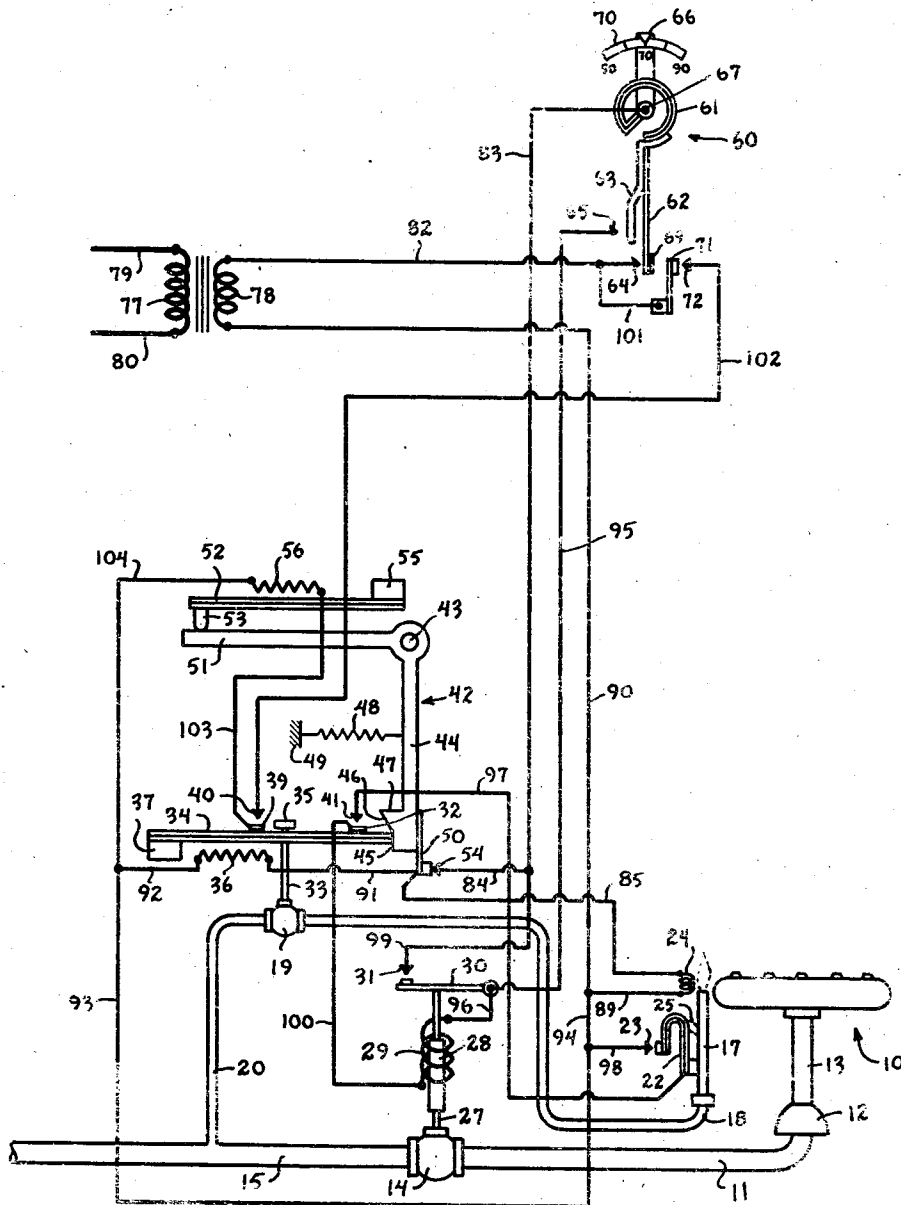
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BURNER CONTROL SYSTEM

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BURNER CONTROL SYSTEM

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The present invention relates to a burner control system and more particularly to one having a normally constantly burning pilot burner with means for conveniently placing the same in and out of operation.

In the conventional gas burning system, the gas burner is ignited by a constantly burning pilot burner. This system has the disadvantage that in order to prevent the unnecessary consumption of fuel by the pilot burner during the summer months, the pilot burner must be turned off. Inasmuch as this may be a hazardous operation and since the relighting of the pilot burner is particularly hazardous, it is the usual custom of the gas company to insist upon shutting off and relighting the pilot burners. Inasmuch as a demand for relighting of the pilot burner in the fall usually occurs upon the existence of the first cold day, the greater majority of the customers desire their pilot burner lighted at approximately the same time. Since this is obviously impossible, considerable inconvenience is encountered by the customer. As a result of these difficulties, a system has been employed in many cases in which the pilot burner is reignited each time that there is a call for heat. The difficulty with such a system is that the igniting apparatus when so used has inherently a relatively short life and the apparatus, in order to be safe under all possible conditions, must be relatively complicated.

It has been proposed to overcome these difficulties by employing a system wherein the pilot burner is normally constantly burning but may be conveniently shut down whenever desired and reignited in a convenient manner. The present invention is concerned with an improved form of such a system.

An object of the present invention is to provide a system having a main burner and controlled by a condition responsive device and a normally constantly burning pilot burner with means associated with the condition responsive device for shutting down a pilot burner when desired.

A further object of the present invention is to provide such a system wherein when the flow of gas to the pilot is thus interrupted and upon the condition responsive device calling for burner operation, the pilot valve is automatically reopened and the pilot burner is reignited.

A further object of the present invention is to provide such a system in which upon the pilot valve being opened, the igniting means is rendered operative for a predetermined period of

time sufficient to insure ignition of the pilot burner.

A further object of the present invention is to provide such a system wherein the pilot burner valve is normally held open by a catch and in which an electrothermal motor means is provided for releasing the catch.

Other objects of the invention will be apparent from a consideration of the accompanying specification, claims and drawing in which the invention is shown in schematic form.

Referring to the drawing a conventional gas burner is represented by the reference numeral 10. The burner 10 is supplied with gas through a pipe 11 which leads into a mixing chamber 12. The mixing chamber is for the purpose of mixing the gas with air and is connected to the burner 10 by a pipe 13. The pipe 11 is connected to the outlet side of a gas valve 14, the inlet side of which is connected to a pipe 15 leading to a suitable source of gas (not shown).

Associated with the main burner 10 is a pilot burner 17, this pilot burner is connected through a pipe 18, a valve 19 and a pipe 20 with the pipe 15 connected to the inlet side of valve 14. Mounted on the pilot burner 17 is a bimetallic element 22 which upon being heated is adapted to move into engagement with a fixed contact 23. The pilot burner 17 is provided with a slot adjacent the bimetallic element to provide an auxiliary flame 25 which plays upon the bimetallic element 22 when the pilot burner is ignited. Located adjacent to the upper end of the pilot burner 17 is an igniter 24 which consists of a coil of high resistance wire. Upon energization of this coil, the same is raised to incandescence and serves to ignite any gas issuing from the pilot burner.

A flow of gas to the main burner 10 is controlled by the valve 14. This valve is provided with a valve stem 27 to which is secured a solenoid core 28. The solenoid core 28 cooperates with a solenoid winding 29. The upper end of valve stem 27 is adapted to engage a switch blade 30 which in turn is adapted to engage a fixed contact 31. Upon energization of the solenoid winding 29, the core 28 is moved upwardly to open the valve and to move switch blade 30 into engagement with contact 31. It is to be understood that the arrangement consisting of solenoid winding 29 and core 28 is shown purely for illustrative purposes and that any other electrical actuating means can be used instead.

The valve 19 serves as the pilot burner valve to control the flow of fuel to the pilot burner 17.

This valve is provided with a valve stem 33 which extends through a bimetallic element 34. The stem 33 is provided with a collar 35 at its upper end so that upon inward movement of the bimetallic element 34 the latter engages the collar 35 and moves valve stem 33 upwardly to valve open position. A heater 36 is located adjacent the bimetallic element 34 for the purpose of heating the same to effect such upward movement thereof. The left hand end of the bimetallic element 34 is rigidly secured to a suitable supporting means 37 whereas the right hand end is free to move. The bimetallic element 34 carries contacts 39 and 32 which are adapted to engage with fixed contacts 40 and 41 upon upward movement of element 34. The element 34 is shown in its normal cold position.

The bimetallic element 34 is adapted to cooperate with a bell crank lever 42 which is pivotally mounted at 43. The downwardly extending arm 44 of the bell crank lever is provided with a portion 45 adjacent the lower end which is slightly wider than the upper portion of arm 44. Between the portion 45 and the upper portion of arm 44 is an inclined portion 46 which terminates with a horizontal shoulder 47. Secured to the arm 44 at the lower end thereof is a flexible contact arm 50 which is adapted to engage a fixed contact 54. In the position in which the various parts are shown the contact arm 50 is in engagement with contact 54. Upon the bimetallic element 34 being heated to move upwardly, it will eventually reach the shoulder 47 permitting the arm 44 to move in a clockwise direction until the end of the bimetallic element 34 engages the edge of the arm 44 above the shoulder 47. Because of the narrower width of arm 44 at this point contact arm 50 no longer is in engagement with the contact 54. A spring 48 is secured at one end to the contact arm 44 and at its other end to a fixed support 49. The spring 48 serves to bias arm 44 in a clockwise direction so that upon bimetallic element 34 moving off of the inclined portion 46, arm 44 is abruptly moved in a clockwise direction.

The bell crank lever 42 is further provided with a horizontal arm 51. This horizontal arm is adapted to cooperate with a second bimetallic element 52 which has a pusher member 53 secured thereto. The pusher member 53 bears against arm 51. The end of bimetallic element 52 opposite to that to which pusher member 53 is secured, is secured to a fixed support 55. Located adjacent to bimetallic element 52 is an electrical heating element 56. The element 52 is so disposed that upon being heated, the left hand end thereof is deflected downwardly to move arm 51 in a counter-clockwise direction.

The valve 27 is normally under the control of a condition responsive switch 60 which is shown for purposes of illustration as a room thermostat. This room thermostat comprises a bimetallic element 61 to which is secured a flexible contact arm 62 and a relatively rigid contact arm 63. The bimetallic element 61 is adapted to move contact arms 62 and 63 to the left upon a temperature fall. Contact arm 62 is adapted to engage a fixed contact 64 and contact arm 63 is adapted to engage a contact 65. The spacing between contact arm 63 and contact 65 is slightly greater than that between contact arm 62 and contact 64 so that upon a temperature fall, the engagement of contact arm 62 with contact 64 is effected before the engagement of contact arm 63 with contact 65. As is customary, thermostat

60 is provided with means for adjusting the same. This means is shown as comprising a lever arm 66 which is secured to the bimetallic element 61. The bimetallic element 61 is pivotally mounted at 67 so that upon movement of the lever arm 66, the bimetallic element 61 is rotated about pivot point 67 thereby varying the temperature at which the engagement of contact arms 62 and 63 with contacts 64 and 65 is effected. The lever arm 66 is adapted to cooperate with a scale 70 bearing suitable indicia to indicate the temperature setting of the thermostat. Located adjacent to the thermostat 60 is a switch blade 71 which is adapted to be moved into engagement with a fixed contact 72. The blade 71 is so positioned with respect to contact arm 62 that upon the arm 66 being moved to the extreme left of the scale 70, the contact arm 62 is normally caused to effect engagement of switch blade 71 with contact 72. A spacer 69 is carried by arm 62 to prevent electrical contact between arms 62 and 71.

A step-down transformer is used to supply low voltage power for operation of the system. This transformer comprises a line voltage primary 77 and a low voltage secondary 78. The line voltage primary 77 is connected by wires 79 and 80 to any suitable source of power (not shown).

Operation

The various elements of the system are shown in the position which they occupy when the temperature to which the thermostat 60 responds is above the setting of the thermostat. Moreover, the various elements are shown in the shut-down position wherein the pilot burner is extinguished. Let it be assumed now that the temperature falls to the setting of the thermostat so as to cause first engagement of contact arm 62 with contact 64 and then engagement of contact arm 63 with contact 65. Upon engagement of contact arm 62 with contact 64, the following circuit is established to igniter 24: from the upper terminal of secondary 78 through conductor 82, contact 64, contact arm 62, bimetallic element 61, conductors 83 and 84, contact 54, contact arm 50, conductor 85, igniter 24, and conductors 89 and 90 to the other terminal of secondary 78. The energization of igniter 24 causes the same to heat up so as to be ready to ignite the pilot burner upon opening of the pilot burner valve 19.

At the same time as the energizing circuit is established to igniter 24, a parallel energizing circuit is established to the heating element 36 as follows: from the upper terminal of secondary 78 through conductor 82, contact 64, contact arm 62, bimetallic element 61, conductors 83 and 84, contact 54, contact arm 50, conductor 91, heating element 36 and conductors 92, 93, 94, and 90 to the lower terminal of secondary 78. The energization of heating element 36 causes it to heat the bimetallic element 34 which, upon being heated warps upwardly so that the right hand end thereof moves along the inclined portion 46. The upward movement of bimetallic element 34 raises the valve stem 33 of pilot valve 19 upwardly to open the valve. The opening of the valve permits gas to flow to the pilot burner which is ignited by the igniter 24 which is now hot. The continued heating of bimetallic element 36 causes it to continue to warp until the right hand end thereof passes over the inclined portion 46 on to the shoulder 47. As soon as this happens, the spring 48 is able to move contact arm 44 in a clockwise direction sufficiently to cause disen-

gagement of contact arm 50 from contact 54. When contact arm 50 disengages from contact 54, the energizing circuits to both the igniter 24 and the heating element 36 are interrupted. The bimetallic element is now able to cool off but due to the shoulder 47 is unable to move to its cold position so that the pilot valve 19 is maintained open. The upward movement of the bimetallic element 34 caused the closure of contacts 39 and 40 and contacts 32 and 41. The purpose of these contacts will be apparent from the subsequent description of the operation.

As soon as the auxiliary pilot flame 25 heats the bimetallic element 22 sufficiently, this element engages contact 23. When this happens the various elements are in the position assumed during normal operation of the system. With the elements in this position let it be assumed now that both contact arms 62 and 63 are in engagement with their respective contacts. When such engagement occurs, the following circuit will be established to the valve winding 29. From the upper terminal of secondary 78 through conductor 82, contact 64, contact arms 62 and 63, contact 65, conductors 95 and 96, valve solenoid winding 29, conductor 100, contacts 32 and 41, conductor 97, bimetallic element 22, contact 23 and conductors 98, 94, and 90 to the other terminal of secondary 78.

The energization of winding 29 causes upward movement of the solenoid core 28 to cause opening of the valve and engagement of switch blade 30 with contact 31. Upon switch blade 30 engaging contact 31 a holding circuit is established for the winding 29 as follows: from the upper terminal of secondary 78 through conductor 82, contact 64, contact arm 62, bimetallic element 61, conductors 83 and 99, contact 31, switch blade 30, conductor 96, winding 29, conductor 100, contacts 32 and 41, conductor 97, bimetallic element 22, contact 23, and conductors 98, 94, and 90 to the other terminal of secondary 78. It will be noted that this new circuit is independent of contact 65 so that the circuit to the valve winding is not interrupted until contact arm 62 has separated from contact 64. Thus the valve winding 29 is not initially energized until both contacts 64 and 65 have been engaged and it is not de-energized until both of these contacts have been disengaged. In this manner a differential between the energization and deenergization of valve winding 29 is provided so as to eliminate any danger of chattering operation when the thermostat first makes or breaks its contacts.

The energization of valve winding 29 with the resultant opening of valve 14 admits gas to the burner 10 which gas is ignited by the pilot burner 17. Under normal operation of the system, the burner continues in operation until both contacts 64 and 65 have been disengaged to cause closure of valve 14. Such closure does not however affect the operation of the pilot burner which continues in operation so as to be ready to light the main burner upon the next call for heat by the thermostat 60. If at any time the pilot burner is accidentally extinguished, the main valve cannot be opened since bimetal 22 separates from the contact 23.

Let it be assumed now that because of the outside temperature being warm, the householder desires for the system to be shut down. All that it is necessary to do is to move the contact arm 66 to the lowermost position on scale 70. This is more or less a natural operation since this is the conventional way of preventing the burner from

being brought into operation. Upon the arm 66 being so moved, contact arm 62 is moved against the switch blade 71 to force the same into engagement with contact 72. As pointed out previously, the insulating spacer 69 prevents any electrical contact being established between contact arm 62 and switch blade 71. As soon as switch blade 71 is moved into engagement with contact 72 an energizing circuit is established to the heating element 56 as follows: from the upper terminal of secondary 78 through conductors 82 and 101, switch blade 71, contact 72, conductor 102, contacts 40 and 39, conductor 103, heating element 56, and conductors 104, 93, 94, and 90 to the other terminal of secondary winding 78. The establishment of this circuit to heating element 56 causes the same to heat the bimetallic element 52, causing the latter to warp downwardly and rock arm 51 in a counter-clockwise direction. When the arm 51 is so rocked, shoulder 47 is moved out from underneath the bimetallic element 34 permitting the element 34 to spring to its cold position in which it is shown in the drawing. The valve 19 is now completely closed so that the pilot burner is extinguished. When the element 34 moves downwardly to its cold position, contacts 39 and 40 are separated so as to interrupt the energizing circuit to heater 56. This heater now cools off allowing the bimetallic element 52 to cool off and return to the position shown.

As soon as bimetallic element 34 leaves the shoulder 47, contacts 32 and 41 are separated. This interrupts the circuit to the valve winding 29 and prevents reopening of the valve 14 until the system has completely recycled. If it were not for contacts 32 and 41, the valve 14 could be opened immediately after the closure of pilot burner valve 13 and before bimetal 22 separated from contact 23, by movement of adjusting arm 66 to cause reengagement of contact arms 62 and 63 with contacts 64 and 65. This would result in gas being admitted to the main burner with no means to immediately reignite it. With the provision of contacts 32 and 41, this possibility is eliminated.

Upon the householder desiring to put this system into operation again, the adjusting arm 66 need merely be moved to the desired temperature setting and as soon as the thermostat calls for heat the system will be again placed in operation. It is to be noted in this connection that the heating element 36 and igniter 24 are energized when only contact arm 62 engages contact 64 so that by the time that contact arm 63 has engaged contact arm 65 to call for valve operation this system will normally be in condition to permit immediate opening of valve 29. In other words, during a normal slow temperature fall the time between the engagement of contact arm 62 and contact 64 on the one hand, and contact arm 63 and contact 65 on the other hand, is sufficiently long to permit the opening of pilot valve 19, the ignition thereof and the heating of bimetal 22.

While the apparatus has been shown in somewhat detailed form for purposes of illustration, it is to be understood that the units including the bimetal elements 52 and 34, their respective heaters, and the bell crank 42 would in actual practice be housed in a relatively small casing associated with the pilot valve 19. It is furthermore to be understood that where desired the switch blade 71 and contact 72 may be merely adjacent the thermostat 60 but not associated

with the adjusting mechanism. In this case the switch including switch blade 71 and contact 72 would be a manual switch.

It will be seen that I have provided an extremely simple and effective system for insuring dependable normal operation of a gas burner with means for conveniently shutting down and reigniting the pilot burner when desired. With the present system the householder need never approach the vicinity of a gas burner and at the same time will not need to wait for a service man from the gas company to relight or turn off his pilot burner.

I have shown a specific embodiment of my invention, it is to be understood that this is for purposes of illustration only and that the invention is to be limited only by the scope of the appended claims.

I claim as my invention:

1. In combination, a main burner, a main valve controlling the flow of fuel thereto, a normally constantly burning pilot burner, a pilot burner valve controlling the flow of fuel thereto, means including a remotely located device responsive to a controlling condition for controlling the operation of said main valve, means located remotely from said burners for causing closure of said pilot burner valve, and means operative upon said valve being so closed and upon said condition responsive device calling for burner operation to open said pilot burner valve and cause ignition of said pilot burner.

2. In combination, a main burner, a main valve controlling the flow of fuel thereto, a normally constantly burning pilot burner, a pilot burner valve controlling the flow of fuel thereto, igniting means for said pilot burner, means including a device responsive to a controlling condition for controlling the operation of said main valve, means located adjacent said condition responsive device for causing closure of said pilot burner valve, and means operative upon said valve being so closed and upon said condition responsive device calling for burner operation to open said pilot burner valve, render said ignition means operative to ignite said pilot burner, and later render said ignition means inoperative.

3. In combination, a main burner, a main valve controlling the flow of fuel thereto, a normally constantly burning pilot burner, a pilot burner valve controlling the flow of fuel thereto, means including a remotely located device responsive to a controlling condition for controlling the operation of said main valve, means for maintaining said pilot burner valve open and said main valve under control of said device, means including a control device located remotely from said burners for rendering said previously named means inoperative thereby to cause closure of said pilot burner valve, and means including a control device associated with and movable with said pilot burner valve for causing an immediate closure of said main valve upon closure of said pilot burner valve.

4. In combination, a main burner, a main valve controlling the flow of fuel thereto, a normally constantly burning pilot burner, a pilot burner valve controlling the flow of fuel thereto, means including a remotely located device responsive to a controlling condition for controlling the operation of said main valve, means for maintaining said pilot burner valve open and said main valve under control of said device, and means including a control device located adjacent said condition responsive device for rendering said

previously named means inoperative thereby to cause closure of said pilot burner valve.

5. In combination, a main burner, a main valve controlling the flow of fuel thereto, a normally constantly burning pilot burner, a pilot burner valve controlling the flow of fuel thereto, means including a remotely located device responsive to a controlling condition for controlling the operation of said main valve, means for adjusting the condition setting of said condition responsive means, means for maintaining said pilot burner valve open continuously, and means including a control device associated with said adjusting means for rendering said previously named means inoperative thereby to cause closure of said valve.

6. In combination, a main burner, a main valve controlling the flow of fuel thereto, a normally constantly burning pilot burner, a pilot burner valve controlling the flow of fuel thereto, means including a remotely located device responsive to a controlling condition for controlling the operation of said main valve, a latch for maintaining said pilot burner valve open, electrically operated means for releasing said latch, and means including a control switch located adjacent said condition responsive device for energizing said electrically operated means and releasing said latch.

7. In combination, a main burner, a main valve controlling the flow of fuel thereto, a normally constantly burning pilot burner, a pilot burner valve controlling the flow of fuel thereto, means including a remotely located device responsive to a controlling condition for controlling the operation of said main valve, a latch for maintaining said pilot burner valve open, an electrothermal motor for releasing said latch, and a switch adjacent said condition responsive device for controlling the energization of said electrothermal motor.

8. In combination, a main burner, a main valve controlling the flow of fuel thereto, a normally constantly burning pilot burner, a pilot burner valve controlling the flow of fuel thereto, means including a remotely located device responsive to a controlling condition for controlling the operation of said main valve, a latch for maintaining said pilot burner valve open, electrically operated means for releasing said latch, and a pair of switches in series for controlling the energization of said electrically operated means, one of said switches being located adjacent said condition responsive device and the other of said switches being moved to open position upon release of said latch.

9. In combination, a main burner, a main valve controlling the flow of fuel thereto, a normally constantly burning pilot burner, a pilot burner valve controlling the flow of fuel thereto, means including a remotely located thermostat for controlling the operation of said main valve, means for adjusting the temperature setting of said thermostat, means for holding said pilot burner valve open, and means including a control device associated with said adjusting means operative upon said adjusting means being moved to its lowest setting to render said holding means inoperative and thereby cause closure of said pilot burner valve.

10. In combination, a main burner, a main valve controlling the flow of fuel thereto, a normally constantly burning pilot burner, a pilot burner valve controlling the flow of fuel thereto, means for holding said pilot burner valve open,

igniting means for said pilot burner, means for opening said pilot burner valve, means including a remotely located device responsive to a controlling condition for controlling the operation of said main valve, means including a control device located adjacent said condition responsive device for rendering said pilot valve holding means inoperative thereby to cause closure of said valve, and means rendered operative upon closure of said valve to render said ignition means and said valve opening means operative upon a call for burner operation by said condition responsive device.

11. In combination, a main burner, a main valve controlling the flow of fuel thereto, a normally constantly burning pilot burner, a pilot burner valve controlling the flow of fuel thereto, a mechanical latch for maintaining the pilot burner valve open continuously, means for releasing said latch to cause closure of said pilot burner valve, means including a device responsive to the temperature of the pilot burner flame for causing closure of said main burner valve upon cooling of said temperature responsive device due to extinguishment of said pilot burner, and further means responsive to the position of said pilot burner valve for causing immediate closure of said main burner valve upon closure of said pilot burner valve.

12. In combination, a main burner, a main valve controlling the flow of fuel thereto, a pilot burner, a pilot burner valve controlling the flow of fuel thereto, means including a remotely located device responsive to a condition indicative of the need for operation of said main burner for controlling said main valve, a control member operable between a first position in which it holds said pilot burner valve open and simultaneously causes said main valve to operate under control of said device, and a second position in which it causes closure of both said valves, and means including a switch located adjacent said device for controlling the position of said member.

13. In combination, a main burner, a main valve controlling the flow of fuel thereto, a pilot burner, a pilot burner valve controlling the flow of fuel thereto, means for controlling said main valve including a remotely located device responsive to a condition indicative of the need for operation of said main burner and an electrical

connection between said device and said main valve, a switch in said connection, a control member for operating said pilot burner valve and said switch, said control member being operable between a first position in which it holds said pilot burner valve open and closes said switch to place said main valve under control of said device, and a second position in which it closes said pilot burner valve and opens said switch to cause closure of said main valve, and means including a switch located adjacent said device for controlling the position of said member.

14. In combination, a main burner, a main valve controlling the flow of fuel thereto, a normally constantly burning pilot burner, a pilot burner valve controlling the flow of fuel thereto, means including a remotely located thermostat for controlling the operation of said main valve, means for adjusting the temperature setting of said thermostat, means for holding said pilot burner valve open, means including a control device associated with said adjusting means operative upon said adjusting means being moved to its lowest setting to render said holding means inoperative and thereby cause closure of said pilot burner valve, and means responsive to a call for heat from said thermostat for opening said pilot valve and igniting the fuel flowing from said pilot burner.

15. In combination, a main burner, a main valve controlling the flow of fuel thereto, a normally constantly burning pilot burner, a pilot burner valve controlling the flow of fuel thereto, means including a remotely located thermostat for controlling the operation of said main valve, means for adjusting the temperature setting of said thermostat, means for holding said pilot burner valve open, means including a control device associated with said adjusting means operative upon said adjusting means being moved to its lowest setting to render said holding means inoperative and thereby cause closure of said pilot burner valve, means associated with said pilot valve for preventing opening of the main valve unless the pilot valve is open, and means responsive to a call for heat from said thermostat for opening said pilot valve and igniting the fuel flowing from said pilot burner.

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