Sept. 28, 1937. E. J. TE PAS 2,094,284

FLUID FUEL CONTROL SYSTEM

Filed Jan. 12, 1933 4 Sheets-Sheet 1

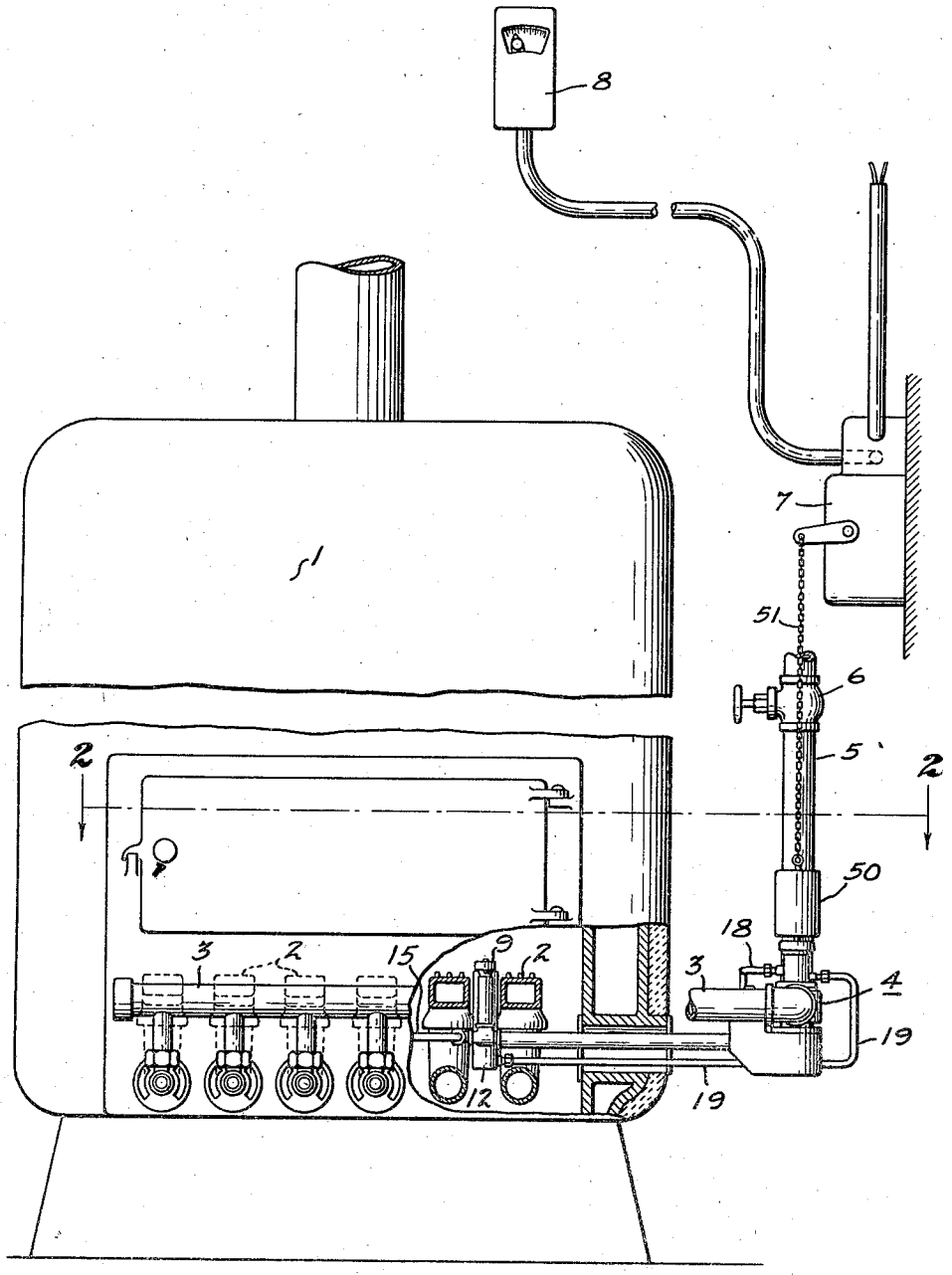

Fig. 1.

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FLUID FUEL CONTROL SYSTEM

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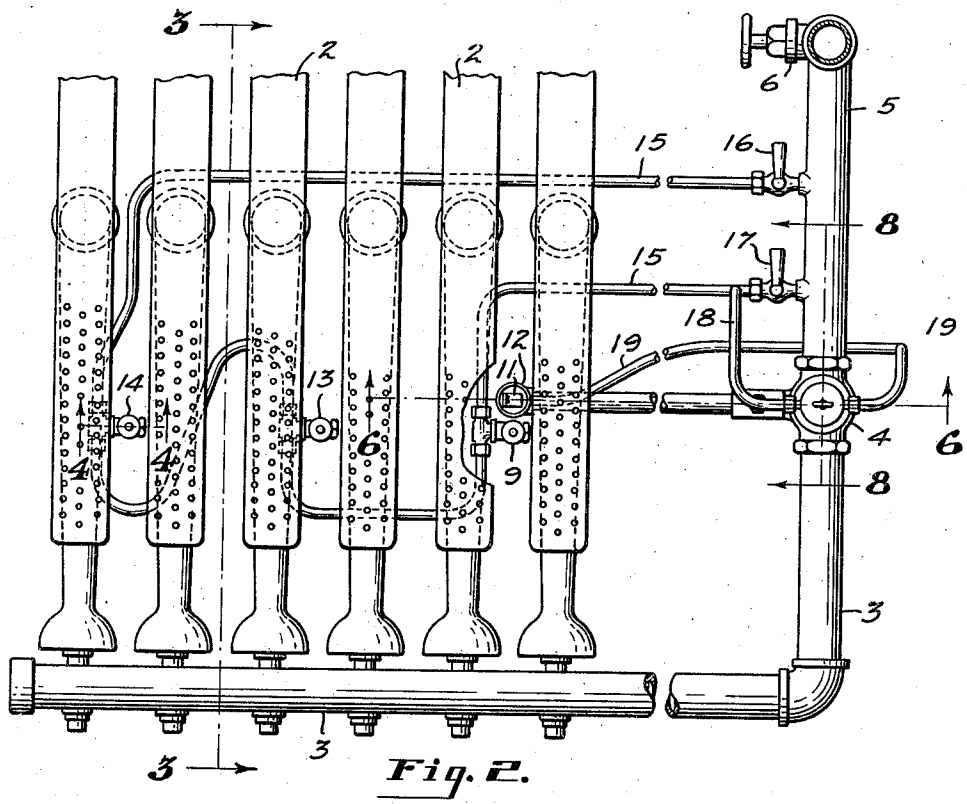

Fig. 2.

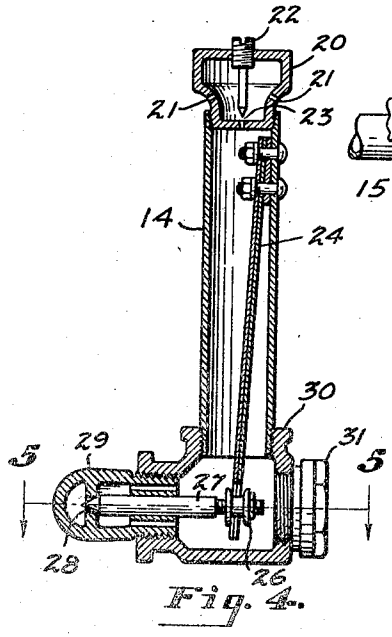

Fig. 4.

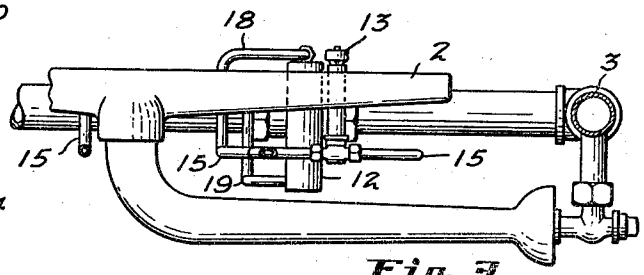

Fig. 3.

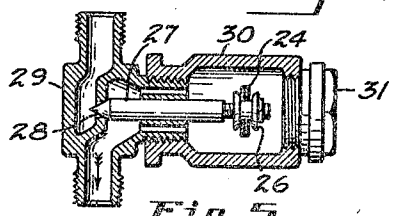

Fig. 5.

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FLUID FUEL CONTROL SYSTEM

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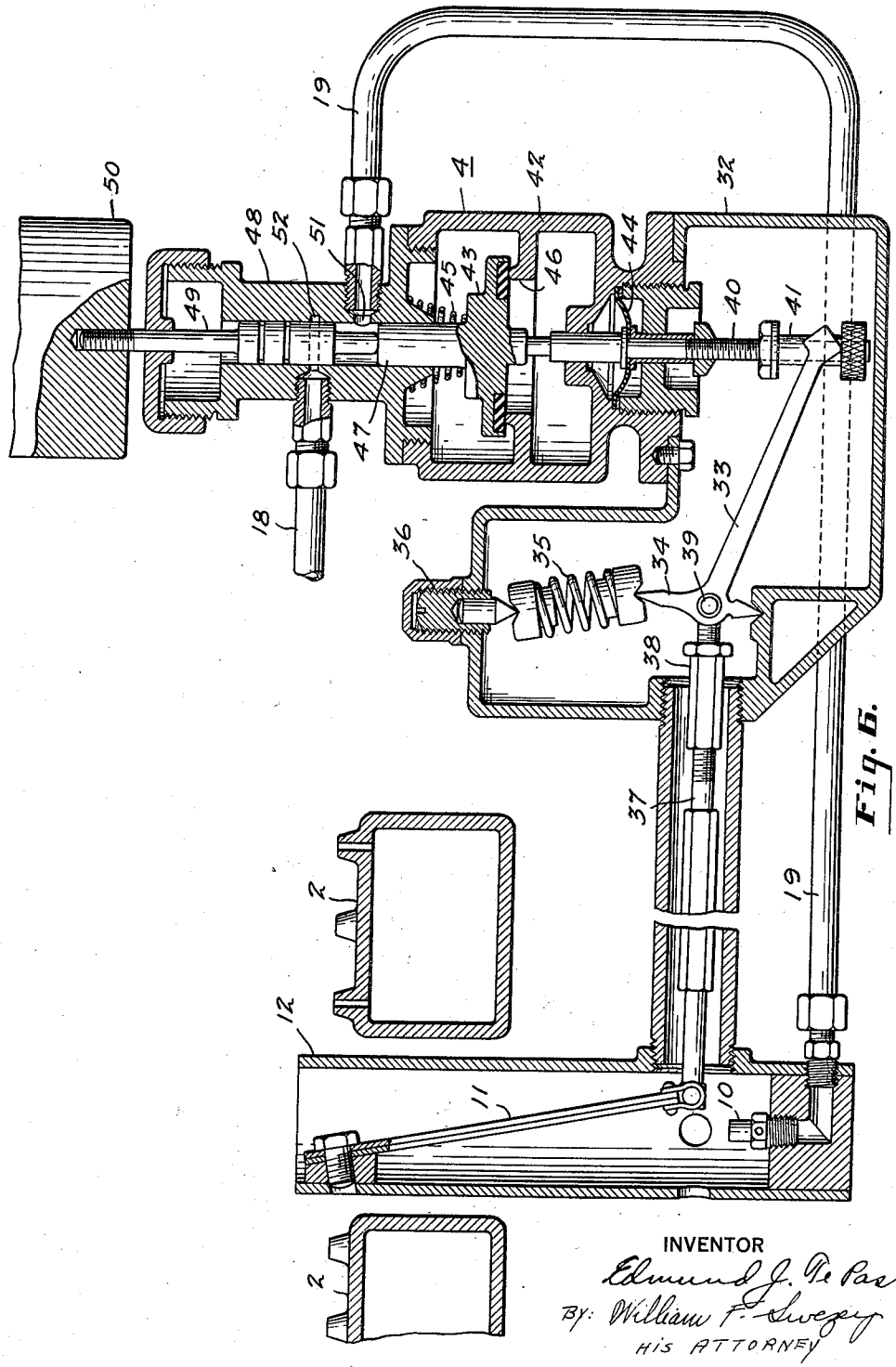

Fig. 6.

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FLUID FUEL CONTROL SYSTEM

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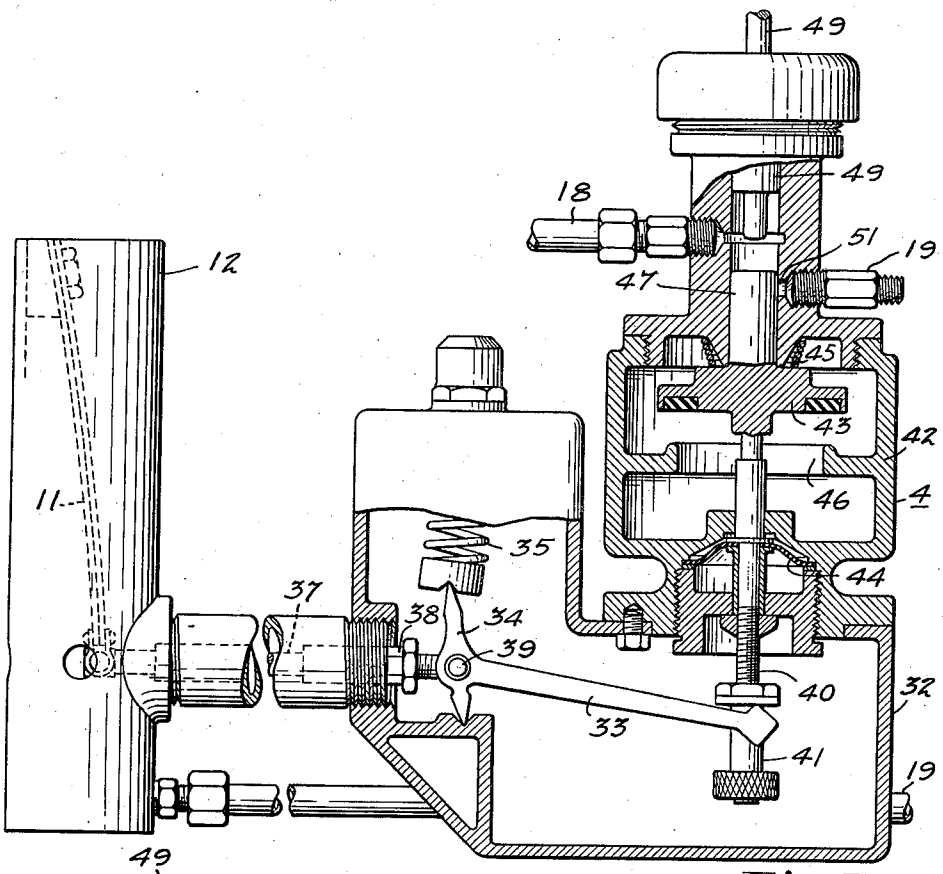

Fig. 7.

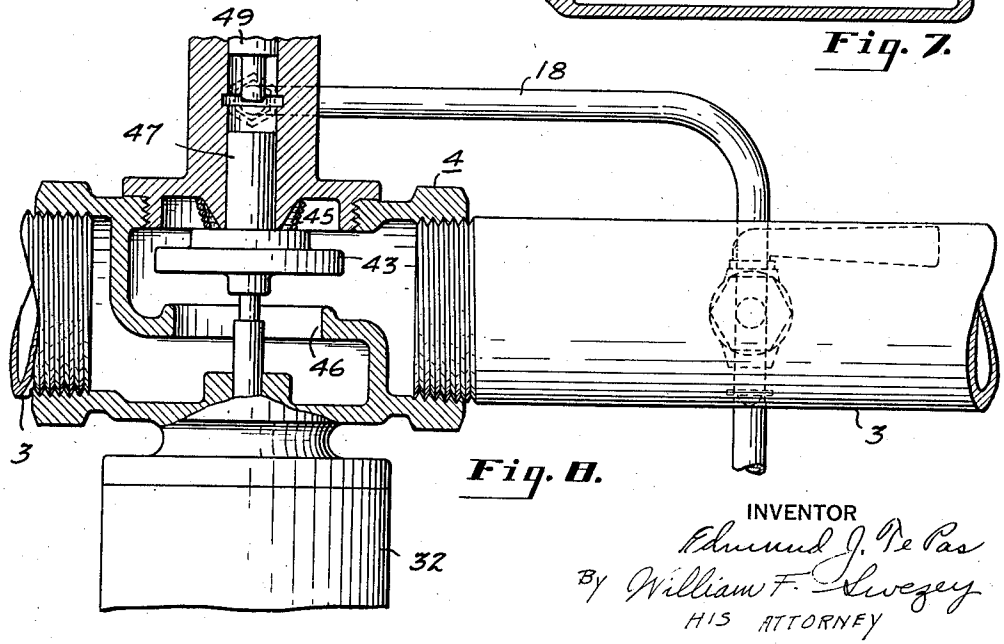

Fig. 8.

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UNITED STATES PATENT OFFICE

2,094,284

FLUID FUEL CONTROL SYSTEM

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Application January 12, 1933, Serial No. 651,308

8 Claims. (Cl. 158—117.1)

This invention relates to fuel control devices for fluid fuel burning appliances and it has for its object the provision of a combined ignition and control system for fluid fuel fired appliances employing a plurality of main heating burners and a plurality of ignition pilots for such burners with fuel control means responsive to the operation of the pilot burners so that in the event of the extinguishment of any one of the pilot burners, the fuel control means is automatically placed in an inoperative and safe condition. A further object of this invention is the provision of a novel thermostatic pilot burner and a new and improved thermostatically and manually operable main burner fuel control valve.

Stated in general terms, my invention comprehends for use in connection with a fluid fuel fired appliance employing a plurality of burners; the use of a plurality of thermostatic pilot burners which pilot burners are supplied with fuel by means of a series fuel connection so that upon the extinguishment of any one of the pilot burners, the fuel supply of such pilot burner and that of the succeeding pilot burners is automatically cut off. The last pilot burner to be supplied with gas in such series is arranged to operate as an igniter for the burner of a thermostatically operated main supply valve, which valve requires the presence of a flame at such pilot burner for its operation so that in the event of extinguishment of any one of the group of pilot burners, it will be impossible to open the main supply valve and supply gas to the main heating burners.

A separate fuel supply line is connected to the pilots so that in the event of their extinguishment, they can be temporarily supplied with gas through such connection regardless of their thermal condition. This connection is provided for starting purposes only. Another feature of my invention is the provision of a thermostatically operated main burner supply valve having provisions for its control by means independent of the thermostatic actuator with further provisions for the control of the fuel supply line of the burner provided for the actuation of such valve.

With these and other objects in view, the invention consists in the novel construction, arrangement and combination of parts, hereinafter described, illustrated in some of its embodiments in the accompanying drawings and particularly pointed out in the appended claims.

In the drawings, Figure 1 is a side elevational view partly in section, of a gas fired boiler employing my improved fuel control; Figure 2 is a sectional view taken on line 2—2, of Figure 1, showing the burner arrangement of the boiler; Figure 3 is a sectional view taken on line 3—3 of Figure 2 showing certain details of the burner arrangement; Figure 4 is an enlarged sectional view taken on line 4—4, Figure 2, of one of the pilot burners; Figure 5 is an enlarged sectional view taken on line 5—5, Figure 4, of the pilot of the pilot burner valve; Figure 6 is an enlarged sectional view taken on line 6—6, Figure 2, of the main burner control valve with the valve shown in closed position; Figure 7 is a sectional view corresponding to Figure 6, showing the main burner fuel control valve in open position; and Figure 8 is an enlarged sectional view taken on line 8—8, Figure 2, showing certain details of the main burner fuel control valve.

For purposes of illustrating my invention, I have applied it to a conventional gas fired house heating boiler 1, having a plurality of main heating burners 2 supplied with gas from a manifold 3 under control of a thermally operated valve 4 which is connected to a fuel supply line 5, having a manually operable control valve 6. The thermally operated valve 4 is automatically controlled by a motor operated device 7 under control of a room thermostat 8.

The valve 4 requires for its operation the presence of a flame at the pilot burner 9. The actuation of the valve 4 is effected by means of the heat supplied by an auxiliary burner 10 which serves to heat a thermostatic element 11 that is located in a tube 12, the aforesaid auxiliary burner being located in the lower part of such tube.

Additional pilot burners 13 and 14 are connected in series in a pilot burner gas supply line 15 communicating with the main fuel supply conduit 5. The inlet side of the pilot supply line is under control of a manually operable valve 16, while the outlet side of the pilot supply line is under control of a manually operable valve 17. The pilot burners 9, 13 and 14 are self-closing burners of the type generally referred to as thermostatic pilot burners. Each is so designed as to cut off the fuel line 15 if it becomes extinguished. These burners are connected in series in the pilot supply conduit 15 so that in the event of the extinguishment of any one of these pilot burners, the gas supply line 15, up to such burners, is automatically cut off and this operation serves to cut off the gas supply of the pilot burners located in the supply line beyond the extinguished burner.

The fuel supply of the auxiliary burner 10 is normally under control of the thermostatic pilots 9, 13 and 14. Normally the fuel passes from line 15 into bypass 18, valve 4, and a conduit 19 to

burner 10. The control of this fuel supply by valve 4 will be described hereinafter.

During the normal operation of the appliance, the valve 17 is maintained in a closed position. In the event of extinguishment of any of the pilot burners, the valve 17 can be opened for the purpose of supplying gas to such pilot burner or burners and after such pilot burners have been operated for a length of time sufficient to open their valves, the valve 17 can be closed and the device will then operate by way of the fuel supplied through the valve 16.

The pilot burners 9, 13 and 14 are of the construction illustrated in Figures 4 and 5 and comprise a burner head 20 having a plurality of burner ports 21 under control of an adjusting needle 22 which is operatively associated with a control port 23 formed in the bottom of such burner head. The burner head is supported on a tube 18 in the upper end of which is supported a bimetallic thermostatic bar 24. This bar is forked at its lower end for reception of a spool 26 which is adjustably secured to one end of a movable valve member 27. The valve member 27 is associated with a port 28 provided by the valve casing 29. The casing 29 is received in a fitting 30, which fitting in turn communicates with the tube. A closure cap 31 closes an opening in one side of the fitting 30 provided thereat to permit access to the adjustable spool 26 of the valve.

The bimetallic thermostatic element 24 is arranged so that during the operation of the burner 9, the valve member 27 is held away from its port 28 and in the event of extinguishment of the pilot burner and upon the subsequent cooling of the thermostat, it will warp and shift its lower free end to the left as viewed in Figure 4 shifting the movable valve member 27 in closing relation with its control port 28, thus cutting off the fuel supply of such pilot burner as well as the fuel supply of the pilot burners which are located in the fuel line 15 after, or beyond, such pilot burners.

In Figure 5, the arrows indicate the normal direction of fluid flow through the pilot valves. In the event of extinguishment of any or all of the pilot burners, fuel can be supplied to them by opening the valve 17 to supply fuel backwards in line 15 and igniting the pilot 9. The valve of such burner will be opened in a short length of time by its thermal element, whereupon fuel is supplied to burner 13, so that it may be ignited. Burner 14 may be successively ignited in a similar manner. As soon as all the burners are ignited, valve 17 may be closed and fuel will be supplied in the normal direction in line 15, from valve 16.

Ordinarily, the starting of the appliance is accomplished by merely opening valve 17 and lighting the pilot burner 9. Gas then passes through bypass 18, and conduit 19, to burner 10, which ignites by flashing through tube 12 from pilot 9. This opens main valve 43 to admit gas to the main burner which ignites from pilot burner 9. As the valve of the pilot burner 9 opens, it admits fuel to the burner 13 and such burner is ignited by the main burners which are in operation at this time. Shortly after the ignition of the pilot 13, its valve will open and admit fuel to the burner 14 whereupon this burner is ignited from the adjacent main burners. Valve 17 can then be closed and the device operated under control and in response to the operation of the thermostatic pilot burners 9, 13 and 14.

Referring now to Figures 6, 7 and 8, the main burner control valve comprises a casing 32 provided for the housing of a snap-action mechanism which includes an L-shaped lever 33 having an arm 34 which is engaged by a snap-over spring 35. Adjustment means 36 are provided for regulating the tension of this spring. The snap-action mechanism just described, is connected to the thermostat 11 by means of a rod 37 having an adjustment member 38 pivotally connected at 39 to the L-shaped crank or lever 33. The L-shaped crank at the point remote from its arm 34, is connected to a valve stem 40 by way of an adjustable spool 41. The valve stem 40 extends into a valve body 42 wherein it engages with a valve head 43.

The escape of fuel from the valve body 42 around the valve stem 40 is prevented by means of a flexible diaphragm 44 which is secured centrally about the valve stem and at its periphery to the valve housing 42. A spring 45 is provided to urge the valve member 43 into engagement with its port 46. The upper end of the valve member 46 carries a cylindrical guide member 47 slidably received in the centrally bored member 48. The central bore of the member 48 communicates with the conduits 18 and 19 by way of which fuel is supplied to the auxiliary burner 10. The flow of fuel through the conduits 17 and 18 is under control of a cylindrical valve member 49 which is slidably received in the central bore of the member 48. Thus it is apparent that the elements 48, 47 and 49 constitute valve means for the auxiliary burner 10 and are termed, auxiliary valve means. To the upper end of the valve member 49, there is secured a weight 50, which in turn is connected by means of a chain 51 to the motor operated valve actuator 7 which is under control of the room thermostat 8.

The bimetallic thermostatic bar 11 is arranged so that when it is heated, it tends to warp to the left as viewed in Figures 6 and 7, thereby actuating the valve with a snap movement to the position shown in Figure 7. Upon extinguishment of the burner 10, the valve parts are snapped from the position shown in Figure 7 to the position they occupy in Figure 6.

The guide member 47 of the valve head 43 operates as a valve to regulate the flow of fuel by way of the port 51 to the burner 10 so that the thermostatic bar 11 will not overheat. Referring to Figure 7, it will be seen that the spring 45 urges the valve member 43 downwardly. Thus, with the valve parts in the position shown in Figure 7, the bimetal 11 has snapped valve 43 open. This opens the main burner supply valve and main burner 2 ignites from pilot 9. However, simultaneously with the opening of main burner 43 the port 51 leading to the auxiliary burner 10 is closed, cutting off said burner 10, so there results a cooling of the thermostat 11, upon the happening of which, the thermostatic bar 11 gradually moves to the right as viewed in Figure 7 until the member 47 uncovers the port 51 communicating with the supply line 19 of the burner 10, whereupon fuel is again supplied to the burner 10. The bimetal 11 will graduate to an intermediate position so as to keep valve 43 open, and to supply fuel to main burner 2; but not opening sufficient to completely shut off port 51 to auxiliary burner 10. In other words, a point of equilibrium is reached wherein port 51 is opened just sufficiently to supply enough fuel to heat bimetal 11 to a point to keep port 51 in such position.

After the boiler has been in operation a sufficient length of time to cause the room thermostat 8 to change its position; such change occurs and it serves to close the electrical circuit of the motor of the device 7, the operation of which causes the dropping of the weight 50, and the downward movement of the plunger 49 whereupon the valve member 43 is shifted to cover its port 46 cutting off the supply of gas to the main burner and valve 49 covers port 52 to cut off fuel to burner 10. The device then stays in this position until the room thermostat 8 again shifts in the other direction to connect the motor device 7 to a source of electrical energy, whereupon the weight 50 is lifted and fuel is supplied to the burner 10 by reason of the plunger 49 uncovering the port 52. If the pilot 9 is operating, the gas supplied to the burner 10 is ignited therefrom, whereupon the thermostat 11 is first heated and then serves to snap the valve parts to the position shown in Figure 7.

However, should any one of pilot burners 14, 13, or 9 be extinguished auxiliary burner 10 will not ignite and the valve 43 will not open to admit fuel to main burner 2.

The motor operated device 7 and the room thermostat 8 are of any suitable design and they are not here illustrated or described in detail as such devices are old and well known in art of controlling heating appliances.

From the foregoing, it will be seen that I have provided an automatic control for fluid fuel fired appliances employing a plurality of main burners and a plurality of ignition pilot burners in which the safe operation of the appliance is assured under any and all conceivable conditions which might result in the extinguishment of any one of the pilot burners.

Furthermore, it is to be understood that the particular forms of apparatus shown and described, and the particular procedure set forth, are presented for purposes of explanation and illustration and that various modifications of said apparatus and procedure can be made without departing from my invention as defined in the appended claims.

Having thus described my invention, what I claim is:

1. In combination, a plurality of main burners, a fuel supply conduit leading to said burners, a plurality of pilots spaced from one another and disposed in ignitible relation with said main burners, said pilots being connected with said fuel supply, a valve in the fuel conduit controlling the supply of fuel to said main burners, thermally responsive means operably connected to said valve, heating means for said thermally responsive means, said heating means being ignitible from one of said pilots, thermostatically controlled valve means connected to each of said pilots and operated by the heat of said pilots to maintain open the pilot fuel supply, each of said thermostatically controlled means affecting the fuel supply to said one pilot and operating to cut off the supply of fuel to said one pilot adjacent said heating means in the event of flame failure at any one of said pilots.

2. In combination, a plurality of burner means, a fuel supply conduit leading to said burner means, two spaced pilots disposed in ignitible relation with different sections of said plural-burner means, connections between said pilots and said fuel supply conduit, thermostatically controlled means in said supply conduit controlling the supply of fuel to said plural-burner means, heat responsive means including a burner positioned in ignitible relation to one of said pilots and actuating said thermostatically controlled means, and thermostatically controlled means connected in the fuel supply to said other pilot operable to shut off the fuel supply to said first pilot upon flame failure at said second pilot.

3. In combination, a plurality of burner means, a fuel supply conduit leading to said burner means, two spaced pilots disposed in ignitible relation with different sections of said plural-burner means, connections between said pilots and said fuel supply conduit, thermostatically controlled means in said supply conduit controlling the supply of fuel to said plural-burner means, heating means ignitible from one of said pilots and actuating said thermostatically controlled means, and thermostatically controlled means operable by the flame of said second pilot, a shut-off valve in the fuel connection of said one pilot, operating connections between said valve and said thermostatically controlled means of the second pilot whereby flame failure of said second pilot actuates said valve to shut off the fuel supply to said one pilot.

4. In combination, a plurality of burner means, a fuel supply conduit leading to said burner means, two spaced pilots disposed in ignitible relation with different sections of said plural-burner means, a fuel line connected with said conduit, said pilots being connected in series in said fuel line, a valve in the fuel line for shutting off the flow of fuel to one of said pilots, thermostatically controlled means connected to said valve and operable from the flame of the other of said pilots whereby upon flame failure of said last pilot the valve is actuated to closed position, valve means in the fuel supply conduit for controlling the flow of fuel to the plural-burner means, thermostatically controlled means for operating said last valve means, and heat responsive means for actuating said last thermostatically controlled means, an auxiliary burner for actuating said heat responsive means, said auxiliary burner being ignitibly associated with the pilot controlled by said first valve.

5. In combination, a plurality of burner means, a fuel supply conduit leading to said burner means, two spaced pilots disposed in ignitible relation with different sections of said plural-burner means, a fuel line connected with said conduit, said pilots being connected in series in said fuel line, a valve in the fuel line for shutting off the flow of fuel to one of said pilots, thermostatically controlled means operable from the other of said pilots and connected to said valve, a second valve means in said fuel conduit controlling the flow of fuel to said plural-burner means, thermostatically controlled means for actuating said second valve means, an auxiliary burner operably associated with said last mentioned thermostatically controlled means and disposed in ignitible relation with said first mentioned pilot, said auxiliary burner being connected with the fuel supply conduit, and means for intermittently supplying fuel to said auxiliary burner.

6. In combination, a plurality of burner means, a fuel supply conduit leading to said burner means, two spaced pilots disposed in ignitible relation with different sections of said plural-burner means, each of said pilots being connected to said fuel supply conduit, a valve in said fuel supply conduit controlling the flow of

fuel to said plural-burner means, thermostatically controlled means operating said valve, a valve for shutting off the flow of fuel to one of said pilots, said last valve being normally closed, thermostatically controlled means operably connected to the other of said pilots and to said second valve whereby the flame of said second pilot tends to open said second valve, an auxiliary burner operating said first main thermostatically controlled means, and means for igniting said auxiliary burner from said first pilot whereby the absence of flame at said first pilot renders inoperative said first named thermostatically controlled means.

7. In combination, a plurality of burner means, a fuel supply conduit leading to said burner means, two spaced pilots disposed in ignitible relation with different sections of said plural-burner means, a fuel line connected to said conduit, said pilots being connected in series in said fuel line, a normally closed valve in said fuel line controlling the flow of fuel to one of said pilots, thermostatically controlled means connected to said valve and actuated from the other of said pilots, valve means controlling the flow of fuel through said conduit to said plural-burner means, thermostatically controlled means operably connected to said last valve, an auxiliary burner actuating said second named thermostatically controlled means, said auxiliary burner being disposed in ignitible relation with said first pilot, a fuel supply line connecting said auxiliary burner to said conduit, and a normally closed valve in said last named fuel supply line.

8. In combination, a plurality of main burners, a fuel supply conduit leading to each of said burners, a valve in said conduit having means biasing the same toward closed position, a plurality of auxiliary burner devices, at least two of said burner devices being located in igniting proximity to separate ones of said main burners, a second fuel supply conduit leading successively to said auxiliary burners, thermostatic valve means in said second conduit responsive to the heat of one of said auxiliary burners and operable to hold said valve open when heated, and means including thermally responsive means responsive to the heat of another of said auxiliary burners, and operable to hold said main fuel valve open when heated, said last mentioned auxiliary burner being located on the opposite side of said first mentioned auxiliary burner from the fuel supply whereby the main fuel valve will close upon the extinguishment of either of said last mentioned auxiliary burners.

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