June 23, 1964 W. F. JACKSON ETAL 3,138,194

MULTIPLE BURNER HEATING SYSTEM

Filed Feb. 9, 1962 2 Sheets-Sheet 1

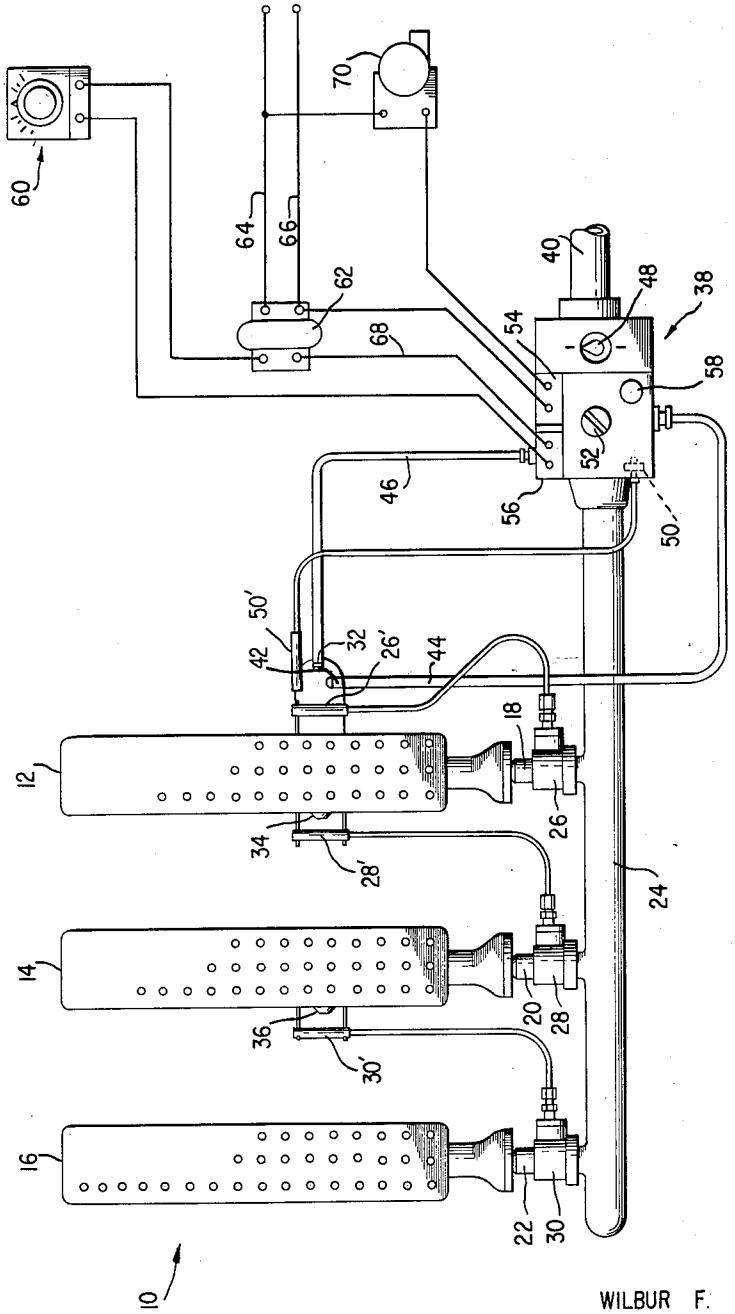



FIG. 1

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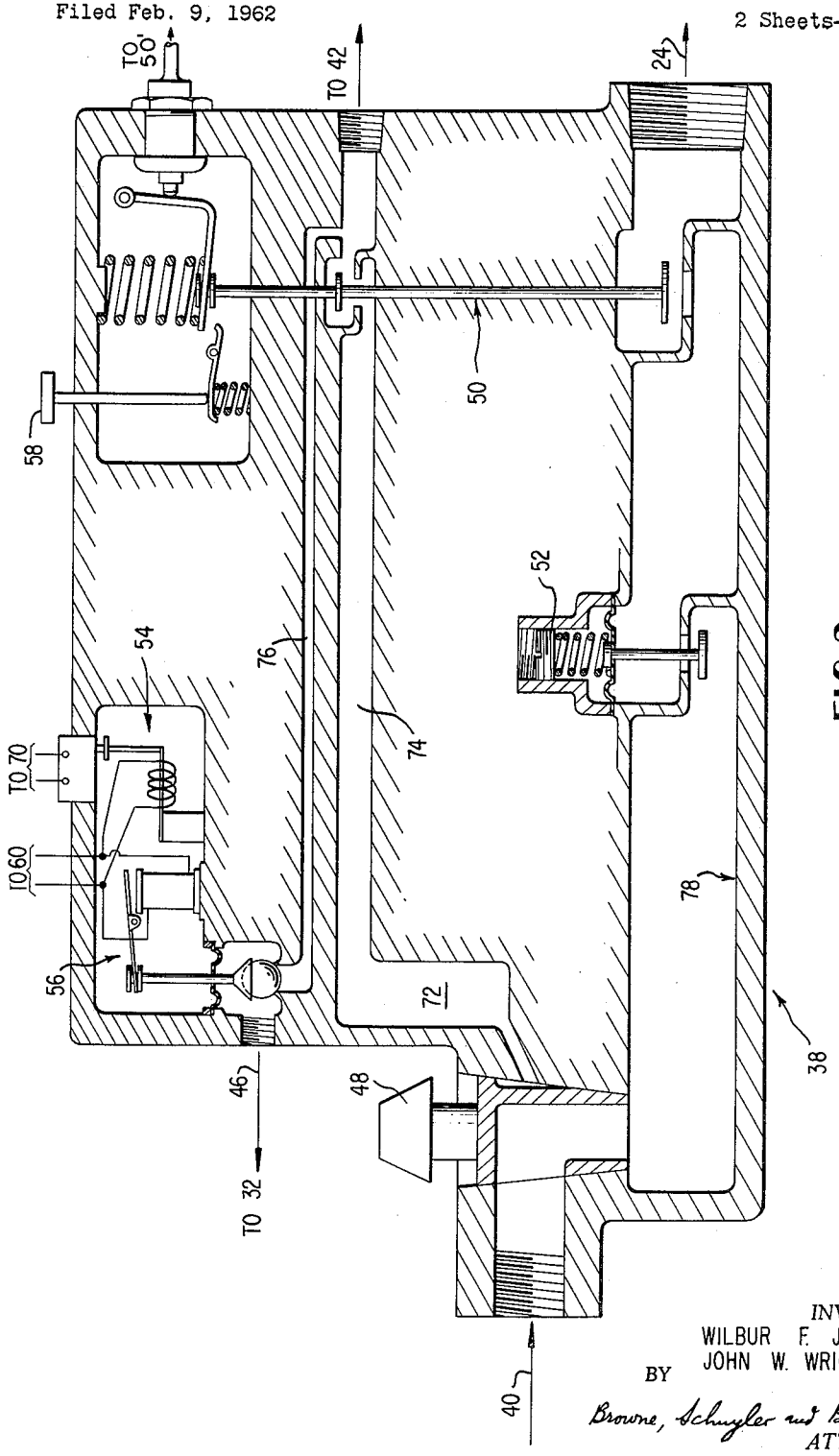



FIG. 2

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3,138,194

# MULTIPLE BURNER HEATING SYSTEM

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4 Claims. (Cl. 158—135)

This invention relates to heating systems having a plurality of burners with a control system for automatically igniting and extinguishing the burners in response to variations in temperature of the space or room being heated.

An object of this invention lies in the provision of a multiple burner system in which the burners are disposed in a series to be sequentially ignited and extinguished in response to temperature variations.

A further object of this invention is to provide a heating system employing fluid fuel in which the fuel supply to the system is shut off upon failure of the fuel to ignite.

The foregoing, and other objects are achieved by the provision of a heating system having a plurality of main burners disposed in a series on a fuel manifold which is connected through a control unit to a source of fuel. Connected to the control unit is a thermostatically actuated ignition pilot which receives fuel from the supply in response to temperature demand and which is positioned adjacent the first burner in the series. Mounted adjacent the ignition pilot is a continuously burning pilot for lighting the ignition pilot when it is receiving fuel. Fuel flow to the pilot burner and main burners is controlled by a thermally responsive valve having a temperature sensing bulb disposed to be heated by the continuously burning pilot flame and which shuts off the fuel supply when the continuously burning pilot is extinguished.

Separate thermally responsive valves control fuel flow to each of the main burners from the manifold, and each of the valves is provided with temperature bulbs which, when heated by a flame, cause the valve to open. The sensing bulb of the first burner of the series of main burners is positioned adjacent the ignition pilot to be heated by the ignition pilot flame. Each of the succeeding burners has its sensing bulb positioned to be heated by the flame of its preceding burner so that when the ignition pilot lights in response to temperature demand, the main burners will ignite in sequences, with a time delay between ignition of adjacent burners dependent upon the response of the sensing bulbs to the application of heat. When the thermostat is satisfied, the ignition pilot is extinguished and the burners are thereafter sequentially extinguished in the order of their ignition.

Other objects and advantages of the invention will become apparent in the following description taken in connection with the accompanying drawings, in which:

FIG. 1 is a diagrammatic view of a multiple burner system embodying the invention; and

FIG. 2 is a schematic view of one arrangement of fuel control elements suitable for use in the embodiment of FIG. 1.

Illustrated diagrammatically in FIGURE 1 is a system having a heater unit 10 consisting of three burners 12, 14 and 16. Burners 12, 14 and 16 are each connected to receive fuel from outlets 18, 20 and 22, respectively, of a fuel manifold 24. Thermally responsive valves 26, 28 and 30 control fuel flow through outlets 18, 20 and 22 respectively.

Valves 26, 28 and 30 are preferably, though not limited to, the type disclosed in our copending application Serial No. 149,030, filed October 31, 1961. The above referred to application discloses a valve which is actuated from



a normally closed position to an open positoin by a mercury filled thermal system. To actuate the valve, a remotely positioned sensing bulb containing mercury is heated until the mercury changes from the liquid to the vapor state whereupon it rapidly expands causing the valve to open with a snap action.

Again, referring to FIG. 1, sensing bulb 26' of valve 26 is positioned adjacent an ignition pilot burner 32, and the corresponding sensing bulbs 28' and 30' of valves 28 and 30 are positioned adjacent carryover ports 34 and 36 of burners 14 and 16, respectively.

With the above described arrangement, when ignition pilot 32 is burning, its flame impinges on bulb 26' causing the expansive material in the sensing bulb to expand and actuate valve 26 to its open position, thereby permitting fuel to flow to burner 12. Fuel escaping at burner 12 is then ignited by the pilot flame. When burner 12 is ignited, the flame from carryover port 34 heats bulb 28' to actuate valve 28, whereupon fuel flows to burner 14 to be ignited by the flame at burner 12. The same sequence of operation occurs to ignite burner 16, with the flame at port 36 acting on bulb 30' to open valve 30, permitting fuel to flow to burner 16 which is ignited by burner 14.

The burners are automatically extinguished in the same sequence. Upon extinction of the ignition pilot flame, bulb 26' cools permitting valve 26 to close, which extinguishes burner 12. Bulb 28' then cools until valve 28 closes to extinguish burner 14, which in turn permits valve 30 to close and extinguish burner 16.

Manifold 24 is connected through a control unit 38 to a main fuel conduit 40. Mounted on a bracket which supports bulb 26' of valve 26, is a continuously burning pilot 42 which communicates with control unit 38 through a fuel conduit 44. Ignition pilot 32 also communicates with control unit 38 by means of a conduit 46. Continuously burning pilot 42 is so positioned that it has no influence on bulb 26'.

Control unit 38, the particular arrangement and details of which form no part of the present invention, is a combination of several components consisting of a manually operated gas cock 48, a thermostatically actuated control valve 50 for controlling fuel flow to the continuously burning pilot 42 and for shutting off the fuel flow to the burners and ignition pilot 32 in case of flame outage at continuous pilot 42, a pressure regulator having a conventional adjustment screw 52 for adjusting fuel pressure from main conduit 40 to manifold 24, an electrically actuated valve 56 for controlling fuel flow to the ignition pilot 32, and a time delay fan switch 54.

Control valve 50 is preferably of the same type as valve 26, 28 and 30, and is provided with a sensing bulb 50', which is positioned adjacent continuously burning pilot 42 to be heated by its flame. Valve 50 may be manually actuated by a reset button 58 in control unit 38 for initially lighting or relighting continuously burning pilot 42.

Gas cock 48 controls flow from main conduit 40 to the pressure regulator and to the pilot burners. Pilot fuel is routed from main conduit 40 through control valve 50 and a pilot gas filter (not shown). When control valve 50 is open, fuel flows to continuously burning pilot 42, manifold 24 and to the electrically actuated ignition pilot valve 56. Should the flame at continuously burning pilot 42 be extinguished, sensing bulb 50' cools to close control valve 50 which shuts off the fuel flow to manifold 24 and pilot burners 32 and 42.

With reference to FIG. 2 gas cock 48 may be positioned for complete "off", pilot gas only, or complete "on" permitting passage of both pilot fuel and main burner fuel. In the schematic illustration of FIG. 2, when gas cock 48 is in the "pilot gas only" position, fuel flows from con-

duit 40 through a filter cavity 72 and pilot passage 74 to a port controlled by control valve 50. When control valve 50 is in the open position, the pilot gas flows through conduit 44 to continuously burning pilot 42, and through a passage 76 to a port controlled by the thermostatically actuated valve 56. When valve 56 opens in response to temperature demand, fuel flows to ignition pilot 32.

Valve 56 is actuated by a conventional thermostat 60 having a switch which closes upon a demand for heat by the thermostat. Thermostat 60 is connected in series with valve 56 and is also connected to a step-down transformer 62 having its primary connected by terminals 64 and 66 to a source of alternating current. Transformer 62 provides a secondary voltage in the 115 volt line of 24 volts through conductors 68 to valve 56. Valve 56 is a conventional electrically actuated valve and may, for example, be a solenoid actuated valve which is closed when the solenoid is de-energized, and which opens to admit fuel to conduit 46 from control unit 38 upon energization of the solenoid. A switch breaker may be employed with the reset button 58 mechanism to open the circuit to valve 56 when reset button 58 is depressed to provide a safe lighting condition for continuously burning pilot 42 regardless of the thermostat setting.

With the system connected as shown, gas cock 48 is turned to the pilot gas "on" position to connect main conduit 40 with control valve 50. Reset button 58 is pressed opening the passage controlled by valve 50 and letting fuel flow to burner 42 which is then ignited. The resultant heating of bulb 50' actuates valve 50 to its open position after which reset button 58 may be released since the flame from continuously burning pilot 42 continuously heats bulb 50'. Valve 50 also controls the flow of gas to the electrically operated valve 56. After ignition of pilot burner 42, gas cock 48 is then turned to the "on" position to supply main burner fuel to manifold 24. When gas cock 48 is turned to the "on" position, conduit 40 is placed in communication with a main fuel passage 78 (FIG. 2) which is also controlled by valve 50, and the pressure regulator. Passage 78 conducts fuel to manifold 24.

When there is a demand for heat by thermostat 60, the thermostat switch closes the circuit and valve 56 opens to permit fuel to flow to ignition pilot 32, which is ignited by the flame of continuously burning pilot 42. Sensing bulb 50' acts to shut off main burner gas, continuously burning pilot 42 gas, and ignition pilot gas in case of flame outage at pilot burner 42.

When the mercury actuated valve of the above referred to co-pending application is employed to control the fuel flow to the burners, actuation of the valves occurs with approximately a ten second time interval. When ignition pilot 32 is lit, bulb 26' is heated for approximately ten seconds before the mercury vaporizes to snap-actuate the valve 26 to its open position. Then, after another ten second interval elapses, valve 28 of burner 14 opens, and so on until all of the burners are ignited. Extinction of the burners occurs with the same time interval between each stage. When heat is removed from the sensing bulbs, approximately ten seconds is required before the mercury cools sufficiently to change back to the liquid state. The stage opening and closing of the valves provides quieter and more efficient ignition and extinction of the burners and gradual heating of the appliance with lower inputs.

Upon ignition of the ignition pilot burner 32, sensing bulb 26' is heated by the flame of pilot burner 32, and after approximately ten seconds delay, valve 26 opens to permit gas to flow to burner 12 which is ignited by the flame from ignition pilot 32. Upon ignition of burner 12, sensing bulb 28' is heated by the flame from carryover port 34 to cause valve 28 to open and admit fuel to burner 14, which is in turn ignited by the flame from carryover port 34. When burner 14 is ignited,



sensing bulb 30' is heated by the flame at carryover port 36 causing valve 30 to open and the fuel at burner 16 is ignited by the flame from carryover port 36. This sequence is followed for each successive burner in the series until all of the burners are ignited.

Time delay switch 54 is of any well known construction and may, for example, be of the bimetal type with an electrical resistance wire winding for generating heat to close the switch contacts by deflection of the bimetal. Switch 54 is controlled by thermostat 60, and when the thermostat demands heat, current flows to switch 54 from the secondary of transformer 62. When the time delay mechanism causes switch 54 to close, fan motor 70 starts into operation. Switch 54 is so designed that fan motor 70 does not start into operation until sufficient time has elapsed after all of the burners are ignited to prevent movement of cool air by the fan. Switch 54 does not operate to shut off the fan motor until after a suitable time delay from the extinction of the burners so as to dissipate the heat from the extinguished burners.

Upon satisfaction of thermostat 60, the switch opens and valve 56 closes to shut off the flow of fuel to ignition pilot 32. Bulb 26' then cools permitting valve 26 to close extinguishing burner 12. Extinction of burner 12 in turn causes bulb 28' to cool, permitting valve 28 to close and extinguish burner 14. Each of the burners are thus extinguished sequentially until all of the burners in the series are extinguished.

While a specific example of the invention has been illustrated and described, the invention is not limited to the exact construction shown but various alterations are possible within the scope of the invention as defined by the appended claims.

What is claimed is:

1. A heating system comprising;
a supply of fuel,
a series of burners connected to the supply,
a thermostatically responsive ignition pilot disposed adjacent the first burner of the series and connected to receive fuel from the supply in response to temperature demand,
a continuously burning pilot connected to the supply and disposed to ignite the ignition pilot when the ignition pilot is receiving fuel,
a thermally responsive valve for each burner of the series for controlling fuel flow to each of the burners,
a temperature sensing element for each valve of each burner operative when heated to actuate the valve to supply fuel to the burner and operative when cooled to actuate the valve to shut off fuel flow to the burner,
the temperature sensing element of the valve of the first burner of the series being in thermal relationship with the ignition pilot, and the temperature sensing element of the valves of each of the succeeding burners in the series being in the thermal relationship with its preceding burner,
and thermally responsive control means connected to the supply and operatively associated with the continuously burning pilot to shut off the supply of fuel to the series of burners, ignition pilot and continuously burning pilot in response to extinction of the continuously burning pilot.

2. In a heating system;
a series of burners connected to a source of fuel,
a thermally responsive valve for each burner for controlling fuel flow to the burner,
a temperature sensing element for each of said valves operative when heated to actuate the valve to supply fuel to the burner and operative when cooled to actuate the valve to shut off fuel flow to the burner, and
a thermostatically responsive ignition pilot operative in response to temperature demand to actuate the

thermally responsive valve of the first burner of said series,

the thermally responsive valve of each of the succeeding burners in the series being operative in response to ignition of its preceding burner to supply fuel to its burner to be ignited by said preceding burner.

3. In a heating system;

a series of burners connected to a source of fuel,

a thermally responsive valve for each burner for controlling fuel flow to the burner,

a temperature sensing element for the valve of each burner operative when heated to actuate the valve to supply fuel to the burner and operative when cooled to actuate the valve to shut off the fuel flow to the burner,

an ignition pilot adjacent the first burner of the series,

the temperature sensing element of the valve of the first burner being disposed in thermal relationship with the ignition pilot,

the temperature sensing element for each valve of the succeeding burners in the series being disposed in thermo-sensitive relation with its preceding burner,

and means for igniting the ignition pilot in response to temperature demand, each of the burners thereafter igniting in sequence in response to ignition of its preceding burner.

4. In a heating system having a main burner connected with a supply of fuel, the combination comprising;

an ignition pilot disposed adjacent the burner and connected to receive fuel from the supply,

a continuously burning pilot connected to receive fuel from the supply and disposed to ignite the ignition pilot when the ignition pilot is receiving fuel,



a first thermally responsive valve for controlling fuel flow from the supply to the burner, continuously burning pilot, and ignition pilot,

temperature sensing means for said first thermally responsive valve disposed in thermal relationship with the continuously burning pilot, and operative upon extinction of the continuously burning pilot to actuate said first thermally responsive valve to disconnect said burner, continuously burning pilot, and ignition pilot from the supply,

a thermostatically actuated valve between said first thermally responsive valve and the ignition pilot for controlling fuel flow to the ignition pilot in response to temperature demand when said first thermally responsive valve is open,

a second thermally responsive valve between said first thermally responsive valve and the burner for controlling fuel flow to the burner when said first thermally responsive valve is open,

and temperature sensing means for said second thermally responsive valve disposed in thermal relationship with the ignition pilot, and operative upon ignition and extinction of said ignition pilot to respectively admit and shut off fuel flow to the burner.

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