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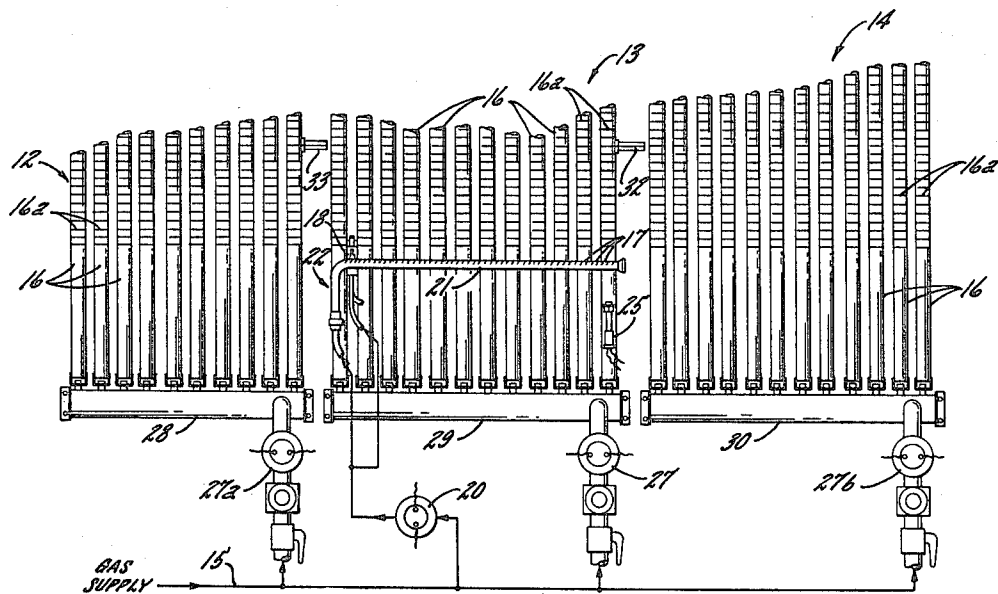
[54] GAS-BOILER IGNITING SYSTEM
5 Claims, 5 Drawing Figs.

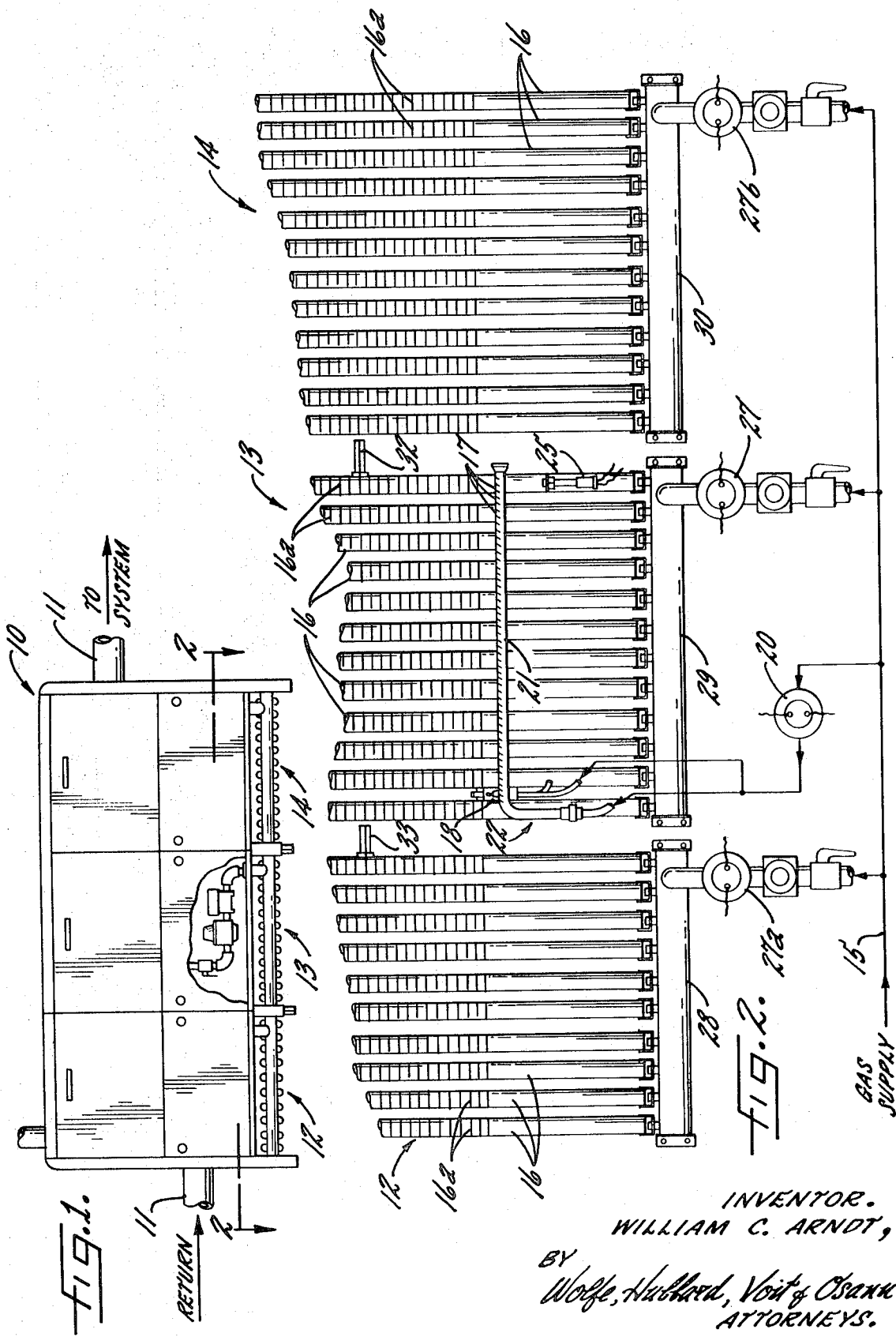
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[51] Int. Cl. F23n 5/20
[50] Field of Search 431/50, 59,
79, 6, 25, 45, 46, 49, 286, 283

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ABSTRACT: An ignition system for a gas-fired boiler is provided in which electrical circuitry is utilized in a novel matter to consecutively initiate and terminate several stages in the ignition of the boiler burners. Fuel is initially supplied to a multiport pilot burner, is ignited, and the existence of the flame across the entire length of the multiport pilot burner is positively assured by an ultraviolet flame-sensing means. Next, the flow of fuel to the main burner is initiated, and after a predetermined time, the fuel flow to the multiport pilot burner is halted, thereby extinguishing the multiport pilot burner flame. The above-discussed sensing means is then used to supervise and insure that main burner flame is present. Fuel supply to the main burner is cut off in response to an indication by the sensing means that main burner flame is not present.





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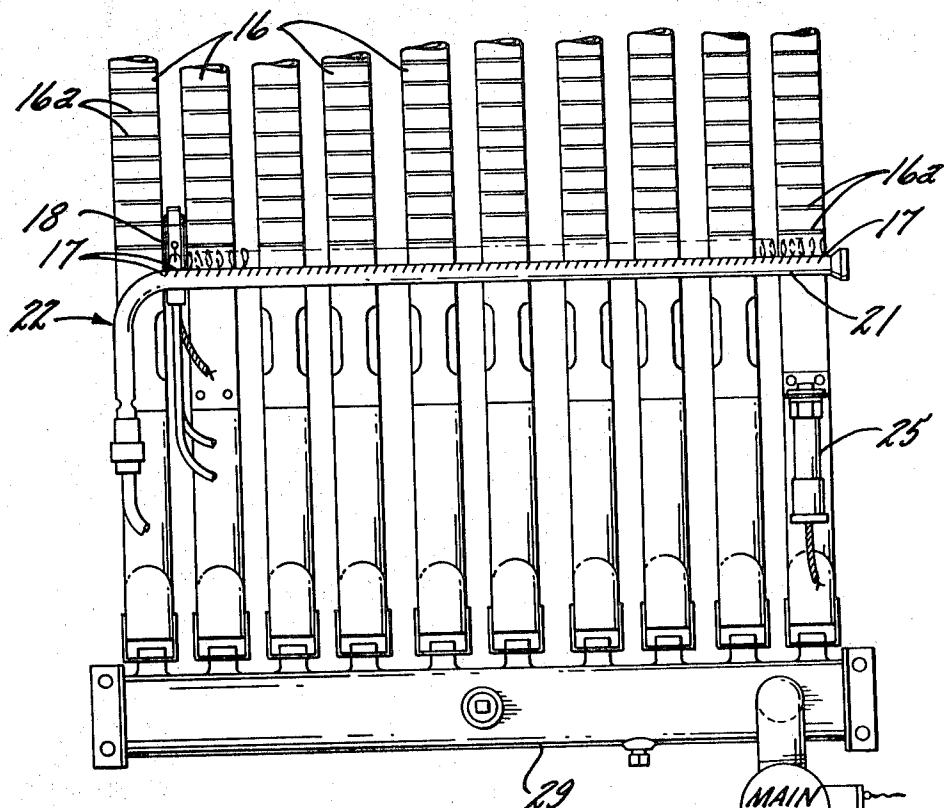


FIG. 3.

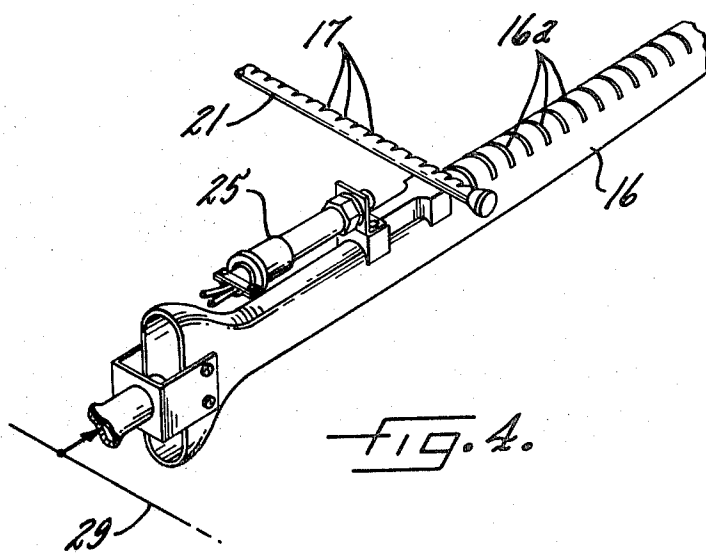
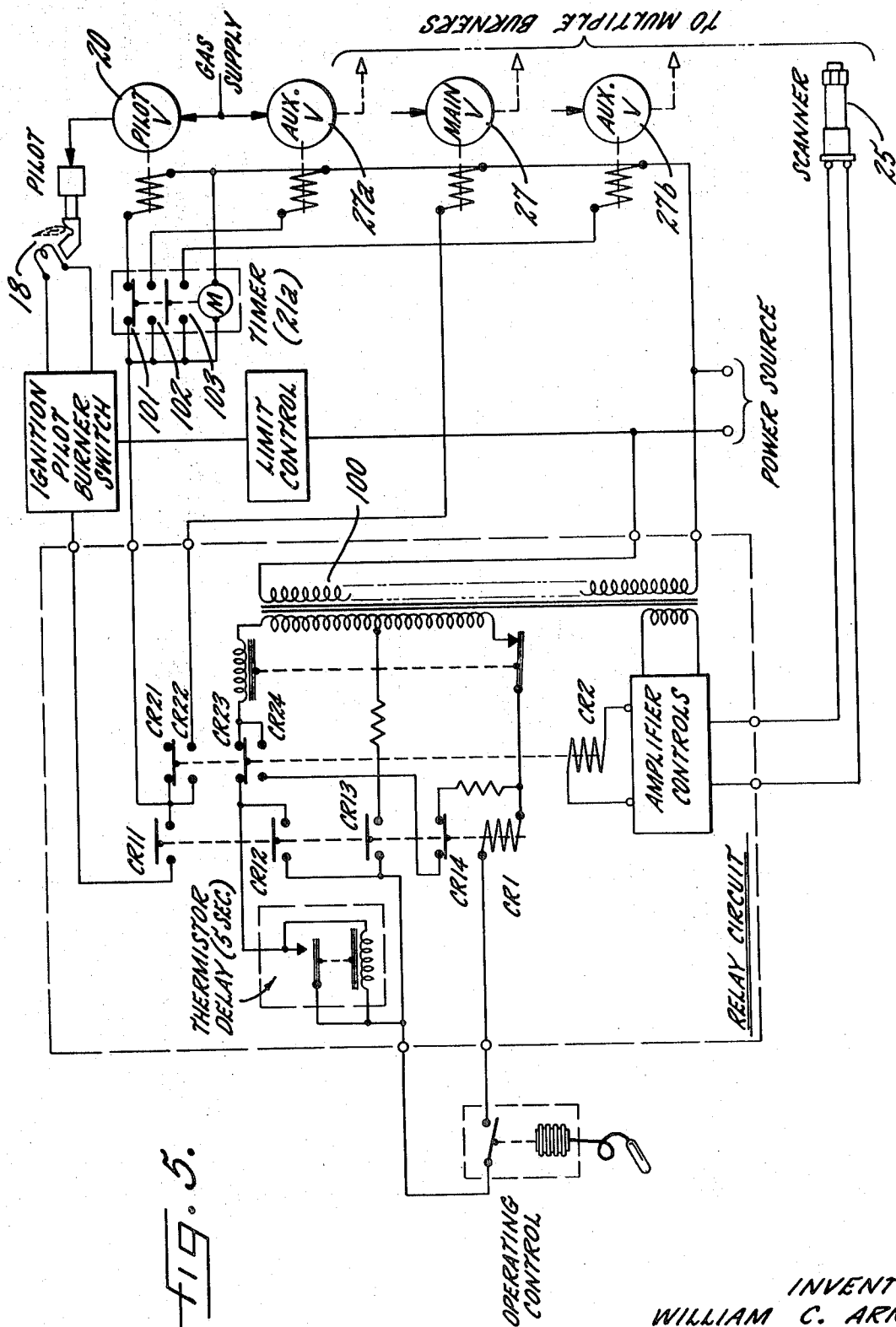


FIG. 4.

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GAS-BOILER IGNITING SYSTEM

BACKGROUND OF THE INVENTION

This invention relates generally to heating equipment and more particularly concerns an automatic system for staging and insuring the ignition of burners in a gas-fired boiler.

Since the widespread acceptance of automatically fired gas boilers and furnaces, a number of systems have been devised to ignite fuel supplied to gas-fired burners. Some difficulties have been experienced with such prior art ignition systems, in that the complete ignition of all the fuel supplied to the burners may not be positively assured. Serious consequences can and have resulted from allowing unignited fuel to escape from a burner undetected. If a sufficient quantity of fuel is allowed to accumulate inside a boiler, the slightest spark or flame can cause a destructive explosion. If unignited fuel is allowed to escape slowly from the boiler or furnace, serious discomforts and even deaths by asphyxiation can and have occurred to occupants of the buildings.

Accordingly, it is the primary object of this invention to provide a simple and reliable method and the requisite apparatus for positively insuring the staged ignition of main burner flame in a gas-fired boiler.

It is a more specific object to provide a method of insuring that the boiler pilot burner is fully ignited before the flow of gas to the main burner is begun.

It is another specific object to provide a method of insuring that the main burner gas flow is halted if the main burner flame is inadvertently extinguished.

A secondary object of the invention is to provide a simple method and rugged and reliable associated apparatus for accomplishing the above objects.

It is another secondary object to provide apparatus for accomplishing the above method which requires but a single flame sensing device for its operation.

Other objects and advantages of the invention will become apparent upon reading the following detailed description and upon reference to the drawings, in which:

FIG. 1 is an elevational view of a typical gas-fired boiler utilizing the novel ignition system,

FIG. 2 is a partial plan view of the burner assemblies and associated apparatus installed in the boiler of FIG. 1,

FIG. 3 is a plan view showing in a greater detail the pilot burner and sensing means associated with one of the main burner assemblies,

FIG. 4 is a perspective view showing in detail the blind end of the pilot burner and the associated main burner tube, having the sensing means mounted thereupon,

FIG. 5 is a schematic illustration of the electrical circuitry utilized in the invention.

While the invention will be described in connection with a preferred embodiment and procedure, it will be understood that I do not intend to limit the invention to that embodiment and procedure. On the contrary, I intend to cover all alternatives, modifications, and equivalents as may be included within the spirit and scope of the invention.

Turning first to FIGS. 1 and 2, there is shown a gas-fired multiple-section boiler 10, wherein the present invention is incorporated, which provides heat to a building automatically upon the demand signal of a conventional thermostat. Water is circulated for heating in the upper portions of the boiler and is then conducted to and from appropriate radiators by pipework 11.

For the purpose of providing the thermostatically demanded heat to the water being circulated through the boiler 10, one or more burner assemblies 12, 13 and 14 are provided in the base of the boiler. Fuel, which may be natural gas, is supplied through schematically shown pipework 15 to a number of main burner tubes 16, each of which is provided with ports 16a, to allow the combustible fuel to escape, ignite, and provide the demanded boiler heat. Upon an appropriate signal from the thermostat, a fuel supply is shut off and the burner flame extinguished.

In accordance with the invention, there is provided a multipoint pilot burner 21 bridging the main burner assembly 13 which is initially ignited when the demand for heat is sensed by the thermostat, and electrical circuitry described hereinafter is energized opening a pilot burner valve 20, thus initiating gas flow to the pilot burner. It will be noted that in the present instance, an electrical igniter 18 is positioned adjacent one end 22 of the multipoint pilot burner 21. As gas begins to flow from the ports 17 of the multipoint pilot burner, a flame is initiated by the igniter 18 at the first end 22 of the pilot burner, and is propagated from port to port across the pilot burner 21 to its opposite end, thus providing a standing flame down the entire length thereof.

While the exemplary apparatus has here been shown as including an electrical igniter 18 to initiate the multipoint pilot burner flame, it will be understood, as the ensuing discussion proceeds, that the particular manner of initially igniting the multipoint pilot burner is not critical to the present invention. Thus, the main burner assembly can include an ignition burner that is a continuously burning thermally supervised safety pilot burner interlocked into the primary relay circuit which is well known to those skilled in the art.

In carrying out the present invention there is provided flame sensing means 25 positioned, as shown, in FIGS. 3 and 4, opposite the right-hand end of the multipoint pilot burner 21, which senses the presence of the multipoint pilot burner flame at an adjacent end of the pilot burner. This sensing means consists preferably of an ultraviolet radiation detector, which detects the presence of a flame by the ultraviolet radiation emitted. Devices of this type are well known to those skilled in the art and, for example, are commercially available as the products, Honeywell Ultravision Flame Director, part No. C7027A or Electronics Corporation of America UV-1 or UV-2 scanners.

Thus, when an electrical signal indicating a presence of flame is imparted to the electrical circuitry by the sensing means 25, gas flow is begun in the main burner assembly 13. A valve 27 is electrically opened, thus permitting gas in the pipework 15 to flow to the header 29, and thence to the main burner tube 16 and out the ports 16a. As the gas flows from the ports 16a it is ignited by the multipoint pilot burner flame, and propagates from port to port along burner assembly 13 until the entire burner assembly 13 is lit.

After a predetermined elapsed time, (preferably about 10 seconds) the above-mentioned timing means 21a (FIG. 5) opens which closes the pilot burner valve 20, thereby terminating gas flow to the multipoint pilot burner. Upon termination of fuel flow, the multipoint pilot burner flame is, of course, extinguished.

When the multipoint pilot burner 21 is extinguished, gas valves 27a and 27b are electrically opened through timer 21a thereby permitting gas to flow to headers 28,30 and thence to burner assemblies 12 and 14.

It is a feature of this invention that the presence of main burner flame can be supervised and sensed continuously by the sensing means 25 after the pilot burner flow has been eliminated. For this purpose, the sensing device 25 is mounted as shown in FIG. 4, and is aimed to sense the presence of flame just above both the pilot burner 21 and the main burner tube 16. Therefore, when flame is present on either the pilot or main burner, its presence will be sensed by the sensor 25.

Referring to FIGS. 3 and 4, conjointly, it will be noted further that the ultraviolet flame-sensing means 25 is positioned behind the multipoint pilot burner with the ports 17 thereof disposed on the side opposite from that viewed by the sensing means. Since the ultraviolet sensory means views the flame that can be seen only from the back of the multipoint pilot burner tube, the flame must be of sufficient size to extend beyond the confines of the tube 21 or gas valve 27 is not electrically opened by the appropriate signal from the sensing means and gas is not admitted to burner assembly 13. This is an additional safeguard that prevents operation where, for example, gas pressure is too low or pilot burner ports have become clogged.

In accordance with another aspect of this invention, the electrical circuitry is so arranged that, in the absence of sensed main burner flame (the pilot burner flame having previously been extinguished) gas flow to the main burner will be terminated by electrically closing the main burner gas valve 27. Thus, if for some reason the main burner flame should be blown out, gas flow will stop, and no unburned fuel will be allowed to accumulate in or leak out of the furnace.

In the present illustrative embodiment of the invention, gas flow is initiated in burner sections 12 adjacent to the discussed section 13 in response to a signal from the timing means 21a, the signal being emitted by the timing means at the termination of the predetermined elapsed time period discussed above. As gas flows in the adjacent burner 12 and 14 is established, flame is propagated thereto from the main burner assembly section, preferably by propagating the flame across the bridging nipples 32 and 33.

It will be appreciated that multiport pilot burners and sensors can be placed on adjacent main burner assemblies and that multiple sets of the three main burner assemblies may be provided in large furnaces.

In order to more fully understand the operation of the ignition system of the present invention, reference is made to a preferred embodiment of the electrical circuitry, which is illustrated schematically in FIG. 5. In operation, when the operating control is closed by its sensor, such as a common thermostat, the thermostat delay is activated through switch CR23, which is normally closed. A solenoid CR1 opens contact CR14, and closes contact CR13, CR12 and CR11, thus activating the glo-coil which, as described above, is used in igniting the pilot burner flame. The ignition pilot burner switch is, simultaneously with the glo-coil, activated. The normally closed contact 101 in the timer 21a allows the pilot valve to be opened so as to begin gas flow to the pilot burner. Simultaneously, the timer mechanism M begins its measuring of the above-discussed predetermined elapsed time period.

When the pilot burner flame is sensed by the sensing means or scanner 25, the connecting amplifier controls cause actuation of solenoid CR2, which opens contact CR21 and CR23, and closes contacts CR22 and CR24. The closing of CR22 causes the main burner valve 27 to open, and the gas flow to the main burner to commence. The closing of CR24 allows the thermistor delay and the thermostat operating control to be temporarily shunted out of the circuit.

When the timer 21a closes contact 102 and 103, the adjacent main burner gas valves are opened and gas flow thereto is begun. Simultaneously, contact 101 is opened, thereby closing the pilot burner flame and terminating gas flow thereto. Thereafter, if flame in the main burner is lost so that the scanner 25 senses no flame, solenoid CR2 will allow contact CR22 to open, thus closing all gas flow valves. The cycle is completed and the circuit reset when the thermostatic sensor indicates a temperature rise and the operating control contact is once again opened.

I claim:

1. The method of initiating and insuring the presence of flame in a boiler having a plurality of burner assemblies, each

assembly having a plurality of main burners, at least one multiport pilot burner having two ends and extending across a plurality of the burners in an assembly, and flame sensing means, comprising the steps of: initiating pilot burner gas flame, propagating the pilot burner flame from end to end along the length of the pilot burner, sensing pilot burner flame at one end of the pilot burner, initiating main burner gas flow in a main burner assembly in response to the sensed presence of pilot burner flame at said one end, terminating gas flow to the pilot burner and extinguishing the pilot burner flame after a predetermined elapsed time while simultaneously initiating gas flow in adjacent burner assemblies, sensing continually thereafter the presence of main burner flame by said flame sensing means, and terminating gas flow to all main burners in the absence of sensed main burner flame.

2. A method according to claim 1 including the step of sensing ultraviolet radiation emanating from the pilot burner flame at one end of the pilot burner, and further including the step of sensing continually the presence of ultraviolet radiation emanating from a point behind said pilot burner opposite that side of the pilot burner upon which said pilot burner parts are disposed.

3. A method according to claim 1 including the step of igniting said pilot burner flame at an end of said pilot burner opposite said one end where said pilot burner flame is sensed.

4. In a boiler having at least one assembly of a plurality of main burners, each burner having a plurality of burner ports, the combination comprising: at least one pilot burner having a plurality of ports and extending across a plurality of burners in the assembly, means for producing gas flow in the pilot burner for a predetermined time period only, ultraviolet radiation sensing means positioned behind the pilot burner so that the ports of said pilot burner are disposed upon an opposite pilot burner side, for determining the presence of a flame upon the pilot burner and for emitting a signal in a response thereto, so as to sense the presence of flame upon the main burner after termination of the pilot burner flame and further being capable of emitting a signal in response to the sensed presence of main burner flame, means for initiating gas flow in the main burner in response to the sensing means signal so as to cause flame upon the main burner, and means for halting main burner gas flow in the absence of main burner flame.

5. In a gas-fired heater having a main burner assembly including a plurality of multiport main burners, at least one multiport pilot burner extending across a plurality of main burners for igniting main burner gas flow, and at least one ignition means for igniting pilot burner gas flow, the improvement comprising: ultraviolet radiation sensing means positioned behind the pilot burner so that the ports of said pilot burner are disposed upon an opposite pilot burner side for sensing the presence of pilot burner flame and for emitting a main burner gas flow initiating signal in response thereto, the ultraviolet radiation sensing means further sensing the presence of main burner flame after the extinguishment of said pilot burner flame, and means for terminating main gas burner flow in response to the absence of any sensed main burner flame after the extinguishment of the pilot burner flame.

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