

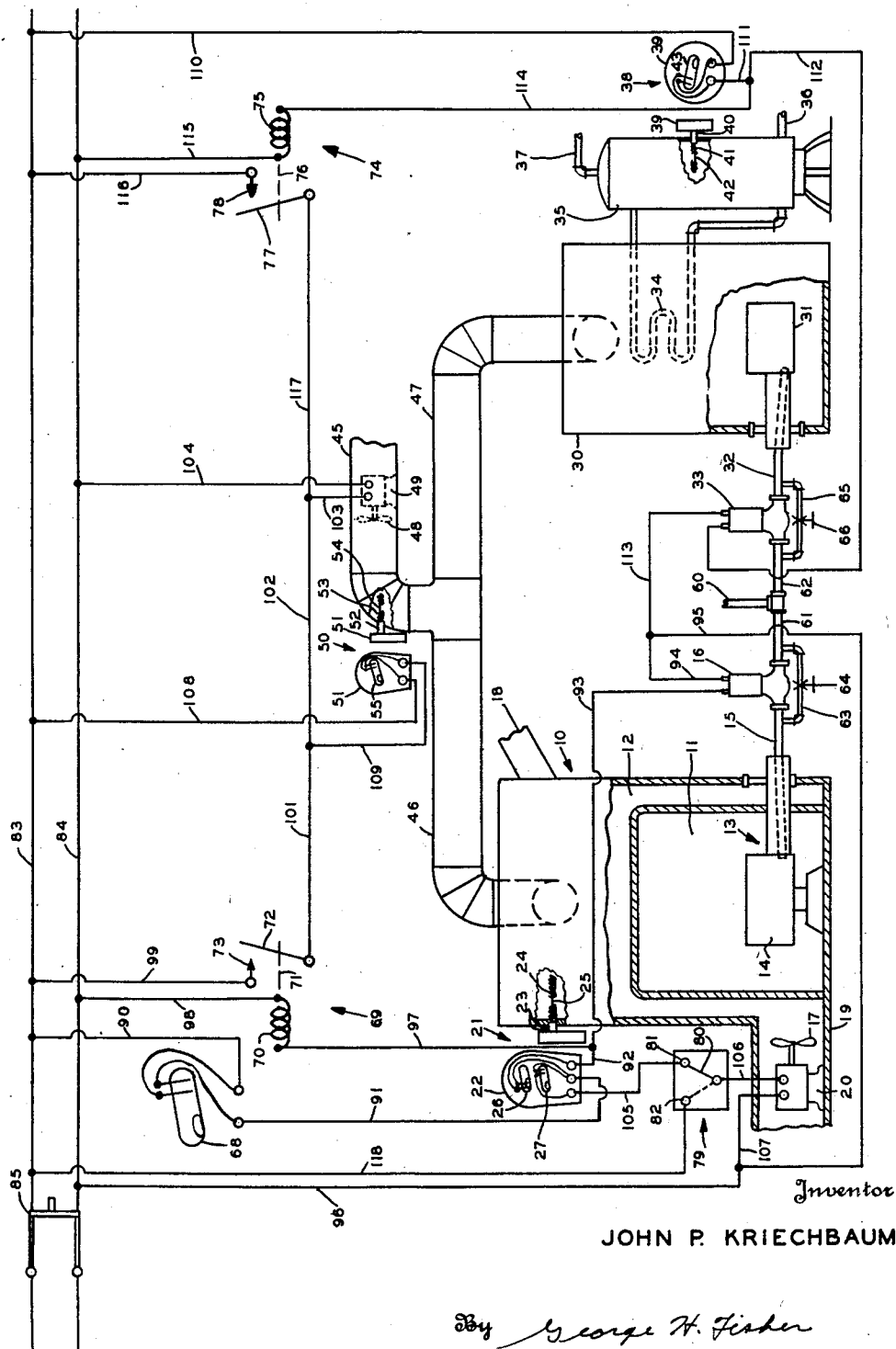
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DUAL OIL BURNER CONTROL SYSTEM

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DUAL OIL BURNER CONTROL SYSTEM

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7 Claims. (Cl. 158—28)

The present invention relates to the art of automatically burning fuels particularly for the heating of homes and the heating of water to be used therein for domestic purposes.

5 One of the objects of the present invention is the provision of means for controlling the supply of fuel to any one of a plurality of burners and simultaneously supplying combustion supporting air to at least those burners which are in operation, together with means rendered operative upon operation of any one of the burners for maintaining the supply of combustion supporting air for a period after cessation of operation of all of said burners.

15 More particularly, the means for maintaining the supply of combustion supporting air to the burners comprises a thermostatic switching mechanism responsive to the temperature of combustion produced by any or all of the burners and which includes a switch which opens upon a fall in temperature whereby the supply of combustion air is maintained until the temperature of combustion falls at least a predetermined amount as a result of cessation of operation of all of said burners.

25 A further object of the invention is the provision of two or more heaters for heating different devices, objects, or mediums and means for controlling the supply of fuel to each of the burners in accordance with changes in the conditions produced or controlled by the burners and simultaneously supplying combustion supporting air thereto together with auxiliary means rendered operative upon operation of any one of the burners for maintaining the supply of combustion supporting air for a period after cessation of operation of all of the burners.

40 A further object of the invention is the provision of two or more heating devices which are all connected to a common stack for the passage of the gases of combustion from the various burners and means responsive to conditions produced by operation of the burners for controlling the supply of fuel and combustion supporting air thereto, together with means responsive to the temperature of the gases of combustion passing through the common stack for the various burners for maintaining the supply of combustion supporting air to at least those burners which are in operation for a period after the cessation of combustion of the last of the burners to be in operation. Specifically, one of the heating devices is utilized to heat a space or dwelling and the other of the heating devices heats a supply of hot water for use in the space or dwelling heated by the

other of the heating devices. Also, preferably, the control system is completely electrical and the means responsive to the temperature of the gases in the common stack is a combustion temperature responsive switch which is operated upon temperature reversals and opens when the temperature of the combustion gases passing through the stack has decreased at least a predetermined amount.

Another object of the invention is the provision of a simple inexpensive control system by means of which the supply of fuel to a heater is varied or stopped or started in accordance with the heating demands but in which the supply of combustion supporting air is initiated when the heater is placed in operation and is prolonged for a period after the supply of fuel is decreased or shut off.

Other objects will be found in the following detailed description, the accompanying drawing and the appended claims.

Referring to the single figure of the drawings, a heating device generally indicated at 10 for heating a space such as a dwelling is herein shown as comprising the usual warm air furnace, but it is to be understood that any other well-known type of heating apparatus could be utilized in its place. The warm air furnace 10 is provided with the usual combustion chamber 11 and an air heating chamber 12. The furnace 10 is herein illustrated as being heated by a liquid fuel burner generally indicated at 13 which comprises a circular combustion pot 14, located within the combustion chamber 11 and adapted to receive a supply of liquid fuel from a pipe 15 which is controlled by an electric valve 16 of any well-known construction.

The furnace 10 is provided with a fan 17 for producing a circulation of air through the air heating chamber 12, out headers 18 and to the room or space to be heated. The fan 17 is herein shown as located in the cold air intake 19 of the furnace 10 and is adapted to be driven by an electric motor 20.

A thermostatic switching mechanism responsive to the temperature of the air in the air heating chamber 12 is generally indicated at 21 and comprises a casing 22, a tubular extension 23 by means of which the switching mechanism is secured to the furnace 10, a helically coiled thermostatic element 24 located within the air heating chamber 12, and a torsion rod 25 by means of which motion of the thermostatic element 24 is transmitted to a pair of switches 26 and 27 located within casing 22. The switch 26 is so ar-

ranged that it is normally closed, as shown in the drawing, and only opens when the temperature of the air in air heating chamber 12 becomes excessive and will hereinafter be referred to as the high limit switch. The switch 27 is so arranged that it opens and remains open whenever the temperature of the air in air heating chamber 12 is at or below some predetermined minimum value say, 150° F. and will hereinafter be referred to as the fan switch. Such switching mechanisms are well-known in the art and need no further detailed explanation.

A water heater is herein shown as a furnace 30 within which is located a liquid fuel burner having a circular combustion pot 31 adapted to receive a supply of liquid fuel from a pipe 32 which is controlled by an electrically operated valve 33 of any of the usual constructions. Within the heater 30 is located a pipe coil 34, the upper end of which communicates with the upper end of a water storage tank 35 and the lower end of which communicates with the lower end thereof. The water storage tank 35 is provided with an inlet pipe 36 by means of which the tank 35 and pipe coil 34 are provided with a supply of cold water as needed. The storage tank 35 is further provided with a hot water outlet pipe 37 which may be connected to the domestic hot water supply pipes in the usual manner. A thermostatic switch, generally indicated at 38, is quite similar in construction to the switching mechanism 21 in that it comprises a casing 39 having a tubular extension 40 by which the casing 39 is secured to the water tank 35, a helically coiled thermostatic element 41 located within the tank 35 and having one of its ends secured to extension 40, and a torsion rod 42 which extends into and terminates within casing 39 and is secured to the other end of thermostatic element 41. Within the casing 39 and operated by torsion rod 42 is a mercury switch 43 of well-known construction, the mercury switch 43 being so arranged that it closes a circuit when the temperature of the water in the water tank 35 is at or below some predetermined minimum temperature say 160° F.

A common stack 45 is connected to the combustion chamber of the warm air furnace 10 by means of a pipe 46 and is connected to the combustion chamber of the water heater 30 by means of a pipe 47. Associated with the common stack 45 is a draft controlling device herein shown as a draft fan 48 located within the common stack 45 and driven by an electric motor 49. Also associated with the common stack 45 is a thermostatic switching mechanism generally indicated at 50 which comprises a casing 51, a tubular extension 52, a helically coiled thermostatic element 53, and a torsion rod 54. One end of thermostatic element 53 is secured to tubular extension 52 and the other end thereof is secured to torsion rod 54. The torsion rod 54 terminates within casing 51 and is connected to a mercury switch 55 located therein by the usual well-known non-positive transmission means or slip friction connection whereby the mercury switch 55 is operated upon temperature reversals rather than at predetermined temperature values in a manner well-known in the art. The mercury switch 55 is so placed and the usual stop mechanism associated therewith in such manner that the mercury switch 55 closes upon a rise in temperature and opens when the temperature of the gases in the common stack 45 lowers at least a predetermined amount. The switch 55 will be hereinafter referred to as the stack switch.

An oil supply pipe 60 is connected to the inlet of valve 16 by means of a pipe 61 and is likewise connected to the inlet of valve 33 by a pipe 62. Ignition means for the burner 13 is herein shown as comprising a by-pass pipe 63 having a needle valve 64, therein, the by-pass pipe being connected to pipes 61 and 15 so as to shunt valve 16 and the needle valve 64 being so adjusted that there is always a relatively small flow of oil to the combustion pot 14 whereby a small pilot flame is maintained at all times. In a similar manner, a by-pass pipe 65 which is provided with a needle valve 66 connects pipes 62 and 32 whereby a small supply of oil is constantly fed to combustion pot 31 of water heater 30 so as to maintain a small pilot flame at all times. It is to be understood that this oil pilot type of ignition means has been shown herein as merely exemplary of one type of ignition means and that any of the other well-known types of ignition means could be utilized if desired.

The control system includes a room thermostat which is herein diagrammatically indicated as comprising a mercury switch 68 which closed a circuit when the temperature of the room or space to be heated falls to some predetermined minimum, say 70° F. The control mechanism also includes a relay generally indicated at 69 which relay comprises a relay coil 70, an armature 71, a switch arm 72, and a cooperating contact 73. The arrangement is such that upon energization of relay coil 70 the armature 71 is attracted and moves switch arm 72 into engagement with contact 73 and upon deenergization of relay coil 70, armature 71 moves to the position shown in the drawings under the influence of gravity whereby switch arm 72 is moved away from contact 73. A similar relay generally indicated at 74 is also included in the control system and comprises a relay coil 75, an armature 76, a switch arm 77 controlled thereby, and a cooperating contact 78. In this particular embodiment of the invention, the control system is also shown as including a manual switching mechanism 79 which includes a manually operable switch arm 80 which normally engages a contact button 81 but may be moved into engagement with a contact button 82. Power is supplied by line wires 83 and 84 which may include the usual manually operated line switch 85.

Operation

With the parts in the position shown, the space or room temperature is above the desired point inasmuch as room thermostat switch 68 is shown in its open position and the water temperature 35 is at or above the desired point inasmuch as mercury switch 43 is also in open position. Oil valves 16 and 33 are therefore both closed and the furnace 10 and water heater 30 are inoperative except for the hereinbefore mentioned small pilot flame which is herein shown for the purpose of ignition. The temperature of the gases in the stack 45 has dropped since the last operation of either of the heaters with the result that stack switch 55 is in open position. Likewise, the temperature of the air in air heating chamber 12 has dropped considerably since the last operation of the furnace 10 so that high limit switch 26 is closed and fan switch 27 is open. Fan motor 20 and draft motor 49 are both inoperative and relay coils 70 and 75 are deenergized.

The temperature of the room or space to be heated will, after a period, drop below the desired value whereupon room thermostat switch 68

will move to closed circuit position. Movement of room thermostat switch 68 to closed circuit position establishes a circuit for oil valve 16, a circuit for relay coil 70 and conditions a circuit for fan motor 20. The oil valve circuit is as follows: line 83, wire 90, room thermostat switch 68, wire 91, high limit switch 26, wire 92, wire 93, oil valve 16, wire 94, wire 95, and wire 96 to line 84. The energizing circuit for relay 70 is as follows: line 83, wire 90, room thermostat switch 68, wire 91, high limit switch 26, wire 92, wire 97, relay coil 70, and wire 98 to line 84. Energization of relay coil 70 moves switch arm 72 into engagement with contact 73 to establish the following draft motor circuit: line 83, wire 99, contact 73, switch arm 72, wire 101, wire 102, wire 103, draft motor 49, and wire 104 to line 84.

Energization of oil valve 16 opens the same whereupon a full flow of oil is fed from oil supply pipe 60 through pipe 61, oil valve 16, and pipe 15 to combustion pot 14. This full flow of oil is ignited by the small pilot flame already burning in the combustion pot 14 whereupon the furnace 10 is placed in condition to heat the air in air heating chamber 12. Energization of draft motor 49 operates draft fan 48 to create a draft in the common stack 45 whereby a draft through furnace 10 and water heater 30 is created. Initial operation of furnace 10 creates an increase in the temperature of the gases passing through common stack 45 with the result that stack switch 55 quickly moves to closed circuit position to establish a maintaining circuit for draft motor 49 as follows: line 83, wire 108, stack switch 55, wire 109, wire 102, wire 103, draft motor 49 and wire 104 to line 84.

After the furnace 10 has been in operation for a short time, the air in air heating chamber 12 will become heated sufficiently to cause thermostatic element 24 to close fan switch 27 whereupon fan motor 20 is energized by the following circuit: line 83, wire 90, room thermostat switch 68, wire 91, fan switch 27, wire 105, contact button 81, manually operable switch arm 80, wire 106, fan motor 20, wire 107, and wire 96 to line 84. Operation of fan motor 20 drives fan 17 whereupon air is circulated through air heating chamber 12 and headers 18 to the rooms or space to be heated.

As long as the room temperature remains below the desired point, oil valve 16 will remain open unless the temperature of the heated air in the air heating chamber 12 rises above the setting of limit switch 26 whereupon the limit switch 26 will move to open circuit position and deenergize oil valve 16 until such time as the temperature of the air in air chamber 12 decreases to a point below the setting of the limit switch 26. Opening of high limit switch 26 also deenergizes relay coil 70 whereupon the initial energizing circuit for draft motor 49 is opened but the draft motor 49 will continue in operation for at least a short time until the temperature of the stack gases falls sufficiently to open stack switch 55. Likewise, fan motor 20 will continue in operation as long as room thermostat switch 68 is closed unless the temperature of the air in air chamber 12 falls below the setting of the fan switch 27.

When the room temperature has been restored and room thermostat switch 68 opens, oil valve 16, relay coil 70, and fan motor 20 will all be deenergized. As above pointed out however, draft motor 49 will be maintained energized by stack switch 55 for a short period until the temperature

of the gases passing through common stack 45 has dropped at least a predetermined amount. This delayed deenergization of draft motor 49 is provided for the usual purpose of furnishing combustion supporting air to combustion pot 14 for a short period after closure of valve 16 whereby the relatively large amount of oil present in combustion pot 14 at the time oil valve 16 closes is supplied with sufficient combustion supporting air to provide proper smokeless combustion. By the time draft motor 49 is deenergized as the result of opening of stack switch 55, the quantity of oil in combustion pot 14 will have been reduced to the amount of oil permitted to flow through needle valve 64 in by-pass pipe 63. Sufficient air for supporting combustion of this small amount of oil is provided by the natural draft in the system.

In the similar manner, the temperature of the water in storage tank 35 will fall below the desired point whereupon mercury switch 43 will be closed to establish energizing circuits for oil valve 33 and relay coil 75. The circuit for oil valve 33 is as follows: line 83, wire 110, switch 43, wire 111, wire 112, oil valve 33, wire 113, wire 95, and wire 96 to line 84. The energizing circuit for relay coil 75 is as follows: line 83, wire 110, switch 43, wire 111, wire 114, relay coil 75, and wire 115 to line 84. Energization of oil valve 33 permits a full flow of oil to combustion pot 31 and energization of relay coil 75 moves switch arm 77 into engagement with contact 78 to establish the following energizing circuit for draft motor 49: line 83, wire 116, contact 78, switch arm 77, wire 117, wire 103, draft motor 49 and wire 104 to line 84. Operation of draft motor 49 produces a draft through common stack 45 and through furnace 10 and water heater 30 as hereinbefore brought out. Combustion of the large flow of oil to combustion pot 31 first serves to raise the temperature of the stack gases whereupon stack switch 55 closes to establish the above mentioned maintaining circuit for draft motor 49. This combustion of oil in combustion pot 31 also heats pipe coil 34 whereby the water in storage tank 35 is heated until the temperature of the same returns to the desired point at which time switch 43 opens to deenergize oil valve 33 and relay coil 75. Deenergization of relay coil 75 interrupts the initial energizing circuit for draft motor 49 but the maintaining circuit therefor will be maintained until the stack gas temperature has dropped at least a predetermined amount to open stack switch 55 whereby combustion supporting air is furnished combustion pot 31 until the excess oil therein has been consumed in the manner previously pointed out in connection with the combustion of the oil in combustion pot 14.

Manually operable switch 79 may be utilized in order to operate fan motor 20 and fan 17 for ventilating purposes by moving manually operable switch arm 80 from contact button 81 and into engagement with contact button 82 to complete an energizing circuit for fan motor 20 as follows: line 83, wire 118, contact button 82, manually operable switch arm 80, wire 106, fan motor 20, wire 107, and wire 96 to line 84.

From the foregoing description, it will be noted that the present invention provides a simple improved control system by means of which the supply of combustion supporting air for a burner may be maintained for a period after the cessation of combustion. It will also be noted that the invention provides a simple control system for a plurality of burners which are herein shown as

thermostatically controlled, it being noted that each burner is controlled in response to changes in different conditions. Specifically, one of the burners is for the purpose of heating a dwelling or space and the other is for the purpose of supplying hot water. The burners are connected to a common stack and the invention utilizes a single draft controlling device, the arrangement being such that when either burner is operated a supply of combustion supporting air is furnished thereto and this supply of combustion supporting air is maintained by means of a single device responsive to the temperature of the gases passing through the common stack for a timed period after closure of the last to close of the valves—to wit, for a timed period after cessation of combustion at the burner last to be shut down.

It is to be understood that any of the usual safety devices may be provided in connection with the two burners for preventing operation thereof in the event the pilot flame fails or combustion fails to be established.

A specific embodiment of the invention has been herein shown and described but it will be appreciated that many changes and modifications can be made by those skilled in the art and I am therefore to be limited only in the purview of the appended claims.

I claim:

1. In combination, a pair of heaters each having a burner and a fuel supplying means therefor, a stack common to said two heaters, an electrical draft producing means operative to produce a draft through said common stack and heaters when energized, an electrically operated fuel supply valve in each of said fuel supplying means, thermostatic means responsive to temperature conditions produced by said heaters, energizing circuits operative to energize said fuel valves to open the same and to energize said draft producing means controlled by said thermostatic means, switching means responsive to the temperature of the gases passing through said common stack and including a switch which closes after combustion is obtained in either of said heaters and opens when the temperature of the gases passing through the common stack falls a predetermined amount after cessation of combustion in both of said heaters, and a circuit operative to maintain operation of said draft producing means controlled only by said switching means.

2. In combination, a pair of heaters each having a burner and a fuel feeding means therefor, a common stack for said two heaters, a draft fan for producing a draft through said common stack, an electric motor for driving said fan, an electrical fuel valve in each of said fuel feeding means which opens when energized and closes when de-energized, a thermostatic switch responsive to a temperature condition produced by one of said heaters and which closes when the value of said condition decreases to a predetermined value, a relay, a circuit for said relay and one of said fuel valves controlled by said thermostatic switch, a second thermostatic switch responsive to a temperature condition produced by the other of said burners and which closes when said temperature falls to a predetermined value, a second relay, an energizing circuit for said second relay and the other of said fuel valves controlled by said second thermostatic switch, parallel energizing circuits for said draft fan motor controlled by said relays, a switch responsive to the temperature of the gases passing through said common stack which closes after combustion is obtained and

which opens when the stack gas temperature falls a predetermined amount after cessation of combustion, and a third circuit for said draft fan motor controlled only by said stack gas temperature responsive switch.

3. In combination; a heater for heating a space and having a burner and a fuel supplying means therefor; a water heater having a burner and a fuel supplying means therefor; a common stack for said two heaters; a draft controlling device in control of the draft through said common stack; a space heater fuel supply valve; a water heater fuel supply valve; a space temperature responsive thermostat; connections between said space temperature responsive thermostat, space heater fuel supply valve, and draft controlling device operative to open said valve and to operate said device when the space temperature falls to a predetermined minimum; a water temperature responsive thermostat; connections between said water temperature responsive thermostat, water heater fuel supply valve, and draft controlling device operative to open said valve and to operate said device when the water temperature falls to a predetermined minimum; and a single device operative to maintain operation of said draft controlling device for a time period after closure of the last to close of said fuel supply valves.

4. In combination; a heater for a space to be heated having a burner and fuel feeding means therefor; a water heater having a burner and fuel feeding means therefor; a common stack for said two heaters; an electrically operated draft producing device which creates a draft through said common stack when energized; an electrically operated fuel valve in each of said fuel feeding means; a space temperature responsive thermostatic switch; circuit connections between said switch, space heater fuel valve, and draft producing device operative to open said valve and energize said device when the space temperature falls to a predetermined minimum; a water temperature responsive thermostatic switch; electrical connections between said water temperature responsive thermostatic switch, water heater fuel valve, and draft producing device operative to open said valve and energize said device when the water temperature falls to a predetermined minimum; a switch responsive to the temperature of the gases passing through said common stack which closes upon a rise in stack gas temperature and opens when said stack gas temperature falls a predetermined amount after cessation of combustion; and a circuit for said device controlled only by said switch.

5. In combination, a plurality of heating devices each including a burner, a plurality of fuel control valves one in control of the flow of fuel to each of said burners, control means operative to selectively open said valves, a single means in control of the draft for all of said burners, connections associated with said control means and valves arranged to operate said draft controlling means to increase the draft to all of said burners upon the opening of any one of said valves by the control means, a single stack for all of said burners, a single device responsive to the temperature of combustion in said stack produced by operation of any of said burners, and connections between said device and draft controlling means arranged to operate the latter to continue the increased draft to all of said burners, until the temperature of combustion in said stack has decreased at least a predetermined amount as a

result of cessation of operation of all of said burners.

5 6. In combination, a plurality of heating devices each including a burner, a separate fuel supply
10 controlling valve controlling the supplying of fuel to each of said burners, a thermostat responsive to a heat condition produced by one of said
15 burners operative to open its fuel supply valve when said heat condition reaches a predetermined minimum, a thermostat responsive to a heat condition produced by another of said burners opera-
20 tive to open its fuel supply valve when said last-mentioned heat condition decreases to a predetermined minimum, means in control of the draft for all of said burners, connections between
said thermostats and draft controlling means operative to increase the draft to all of said burners when fuel is supplied to any one of said burners, a common stack for all of said heating devices, a single device responsive to the temperature of combustion in said stack, and connections

between said device and draft controlling means operative to maintain such increased draft to all of said burners until the temperature of combustion has decreased at least a predetermined amount upon cessation of combustion at all of said burners. 5

7. In combination, a plurality of heating devices each having a burner and a fuel supply therefor, a separate fuel valve in control of the flow of fuel to each of said burners, a single means in control of the draft for all of said burners, control means, 10 means including connections between said control means and valves and said single draft control means operative selectively to open said valves and to operate said draft controlling means upon the opening of any one of said valves, and a single 15 device operative to maintain operation of said draft controlling means for a period after closure of the last to close of said fuel valves.

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