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CONTROL FOR PLURAL RETRACTABLE FUEL BURNERS

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2 Sheets-Sheet 1

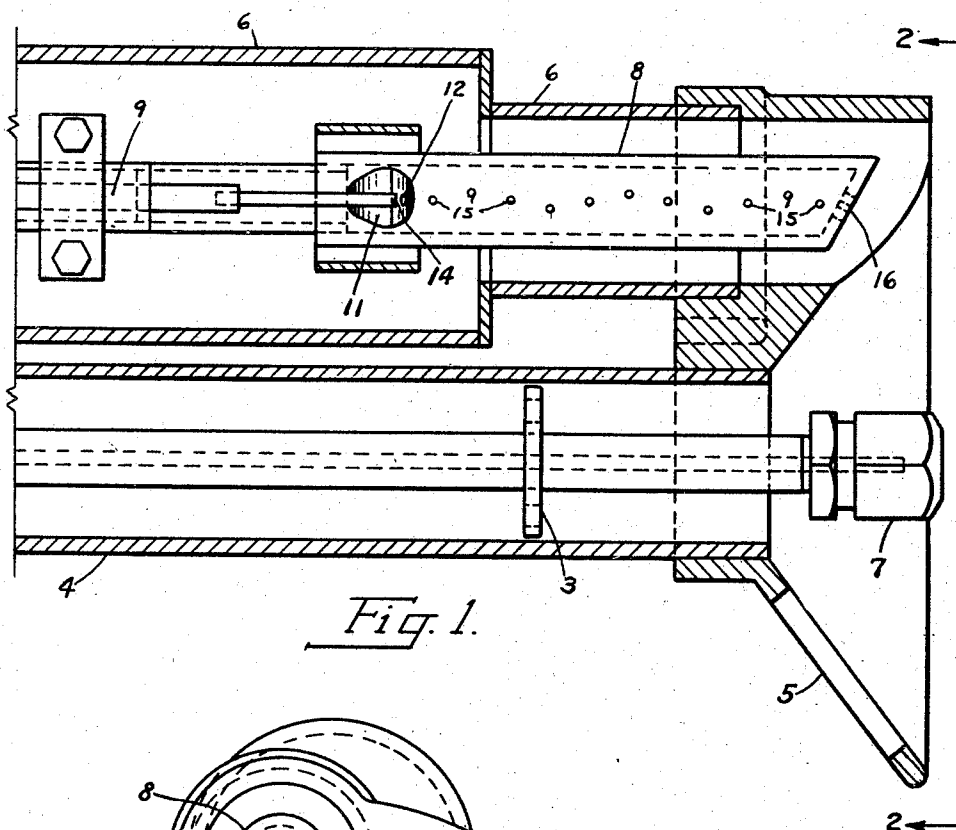


Fig. 1.

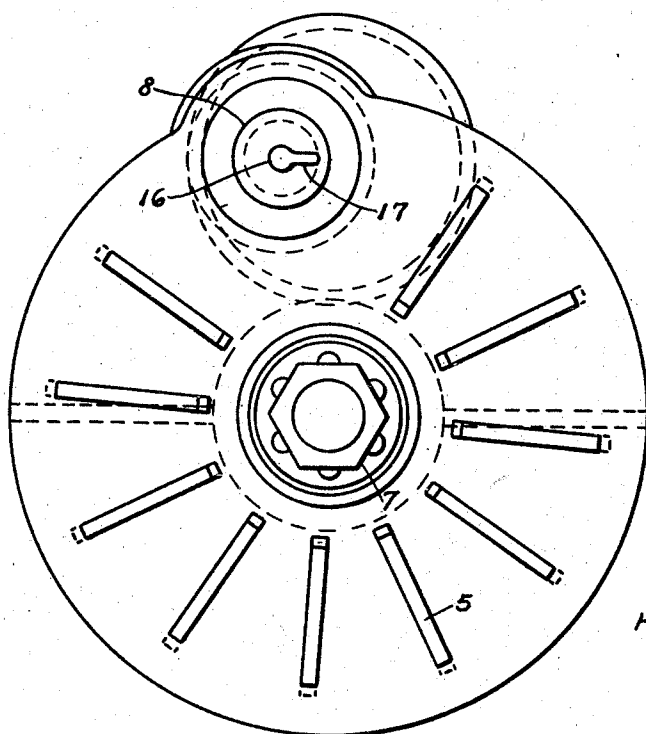


Fig. 2.

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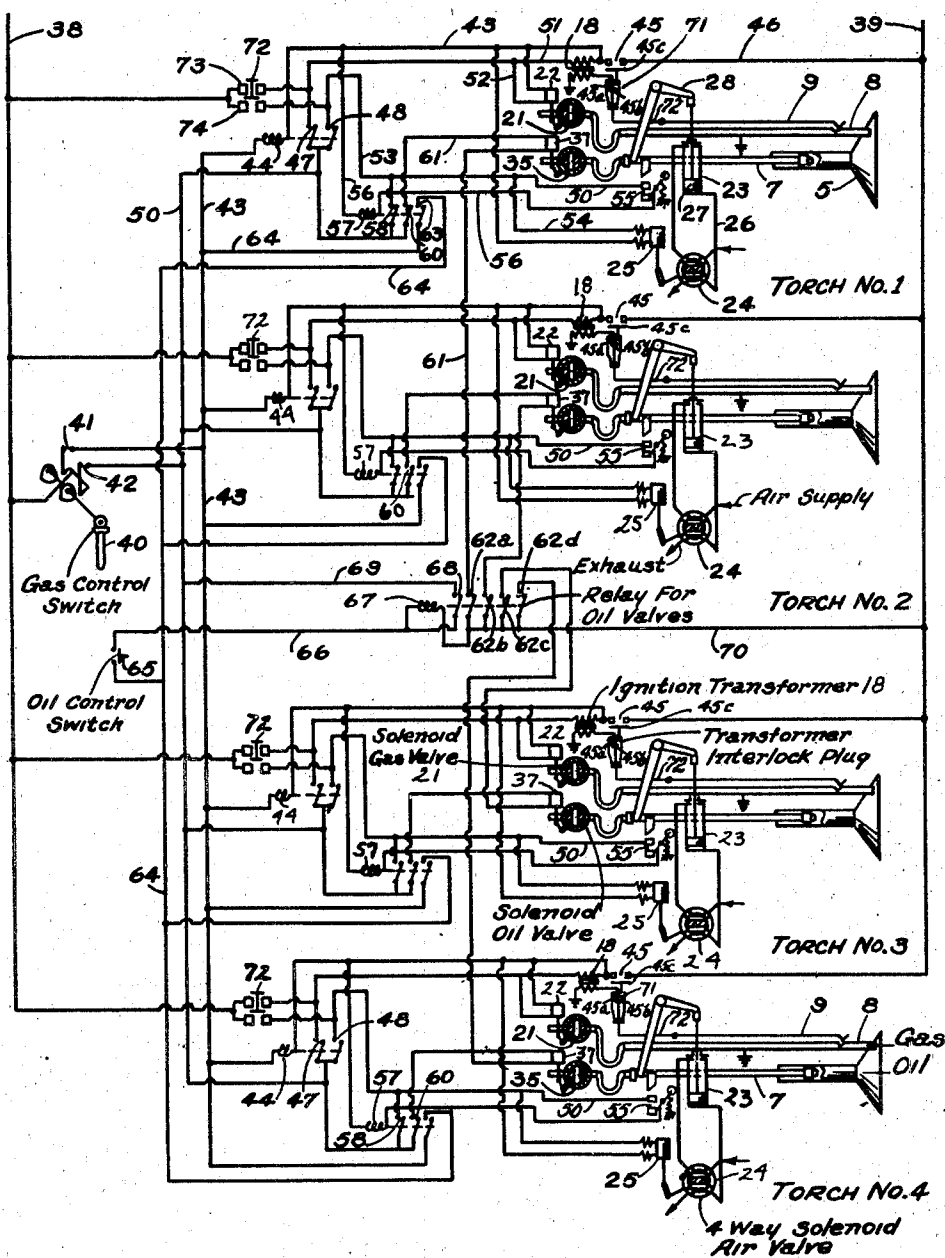
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CONTROL FOR PLURAL RETRACTABLE FUEL BURNERS

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2 Sheets-Sheet 2



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CONTROL FOR PLURAL RETRACTABLE
FUEL BURNERSHarvey C. Mittendorf, East Orange, N. J., assignor
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7 Claims. (Cl. 158—28)

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The invention relates to improved apparatus for controlling the ignition of a multiplicity of fuel burners.

In large furnaces into which fuel is delivered by a multiplicity of burners, it is desirable to provide automatic means for igniting each burner individually, while all are caused to operate from a common or master control. Such apparatus must assure the proper sequence of events for each burner by first causing the ignition means to function when the fuel delivery means is moved into position and thereafter causing the fuel to be delivered into the furnace to be ignited.

An object of the present invention is to provide apparatus for simultaneously lighting all of a plurality of fuel burners for a furnace which is also capable of permitting a defective burner to be cut out of service and physically removed for repairs without disturbing the operation of the other burners. A second object is to enable a repaired burner to be placed back in service through individual operating controls during operation of other burners which had been simultaneously placed in operation. A further object of the invention is to provide control apparatus for retractable fuel burners that assures an ignition spark or pilot flame is functioning and the burner itself in operating position before the supply of fuel is turned on.

Figure 1 is a longitudinal sectional view of the furnace end of a burner and its ignition means;

Figure 2 is an end elevation, viewed on line 2—2 of Fig. 1.

Figure 3 is a schematic view and electrical wiring diagram for the apparatus embodying the invention for controlling the operation of a plurality of burners.

Referring to Figs. 1, 2 and 3, each burner unit 3 comprises a tube 4 ending in a conical casting 5 at its furnace end and an adjacent parallel tube 6 extending at its inner end into an aperture in the cone 5. A fuel supply tube and nozzle 7 projects into tube 4 and may be advanced into firing position as shown, or withdrawn therefrom by means to be described hereafter. A gas supply tube 8 is fixed in tube 6 and an electrode 9 is likewise mounted in fixed position within tube 6 adjacent said gas tube 8. Air for combustion is delivered through the tubes 4 and 6 around the fuel and gas tubes 7, 8. The gas tube 8 is provided with an indentation 11 near its furnace end and in which a small gas port 12 is drilled. The port 12 is so located as to project a jet of gas directly across the path of a spark formed between the end 14 of electrode 9 and the gas tube 8, the electrode end being so placed that the spark formed

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between it and the gas tube will intersect the jet of gas issuing from port 12. A multitude of small holes 15 are provided in gas tube 8 in longitudinal alignment with port 12 and at the end of gas tube 8 is a larger hole 16 directed downwardly toward the center line of tube 7. A slot 17 extends radially from hole 16 toward the line of holes 15. When the gas issuing from port 12 is ignited by the electric sparks from electrode end 14 it in turn progressively ignites the gas jetting through the line of holes 15, through slot 17 and through the main gas jet from hole 16. The end of the gas tube exposed to the furnace heat is made of a heat resisting metal and the electrode is, by this construction, kept at a safe distance from said heat. The electrode is thereby in a fixed location and need not be made retractable as has been the case heretofore when used with a large furnace in which relatively high combustion rates and therefore relatively high temperatures prevail.

Referring to Fig. 3 the electrodes 9 of each of the four burners shown receive electric current from individual ignition transformers 18 through a wire 72, one terminal of the high voltage coils and gas tubes 8 being grounded as shown. The other terminal of the high voltage coil is connected to a contact terminal 45a engaged between the spring contacts 45b of a withdrawable interlock plug 71 from which the wire 72 leads to electrode 9. Each gas tube 8 is provided with a valve 21 operated by a solenoid 22 which when energized, opens valve 21. The fuel nozzle 7 is advanced and withdrawn through tube 4 by a cylinder 23 and associated double ported valve 24. Valve 24 is operated by a solenoid 25 which when energized turns the valve 90 deg. counter-clockwise thereby admitting fluid under pressure, from a suitable source (not shown) through pipe 26 to the underside of cylinder 23 causing the piston 27 to move bell crank 28 and advance the fuel nozzle 7 toward the furnace. Fuel is supplied to the nozzle 7 through a valve 35 from a source, not shown. Valve 35 is opened upon energization of a solenoid 37.

In Fig. 3 there are shown four burner units such as may be employed in the furnace of a steam generating boiler of high capacity. The figure also illustrates the electrical circuits for controlling and operating the various elements of the burner units, the numerals 38 and 39 indicating a source of electrical energy. Switch 40 is operated so as to connect the power lead 38 to the starting and operating circuits 43, 50 for the burner control apparatus.

Starting relays

Upon engagement of the contacts 41 four starting relays 44, one for each burner, are energized, the circuit 43 extending through the contacts 45 via the bridging piece 45c of interlock plug 71 and through a wire 46 to the other side 39 of the power line. The engagement of the contacts 42 connected the operating circuit 50 to the power lead 38 so that when the contacts 47, 48 of relay 44 engage the ignition transformer 18, and the actuating solenoid for the gas valve is energized through wires 51, 52 respectively, while the solenoid for air valve 24 is energized through wires 53, 54 all leading via wire 46 to power line 39. When gas valve 21 opens the gas becomes ignited because of energization of the electrode 9 and the flame proceeds to the end of gas tube 8 in readiness to light the oil when it is turned on after the nozzle reaches operating position. The air valve 24 is moved into position to admit fluid pressure to the underside of the piston 27 and thereby advance the oil tube and nozzle 7 to its operating position.

The holding relays

When the nozzle 7 reaches operating position, the limit switch 55 is closed resulting in energization through the branch 56 of the holding relay 57. The contacts 58 of this relay establish a holding circuit for it to operating circuit 50 while the contacts 60 prepare a circuit through the wires 61 for the solenoid which operates the oil valve 35. The circuits for all oil valves are open at the contacts 62a, 62b etc. and a further manual operation is required to turn on the supply of oil to all of the burners or such of them as may be functioning properly. The contacts 63 of the holding relays prepare circuits 64 for the master oil control switch which is shown as a push button 65.

Master oil valve relay

Upon operation of the push button 65 current is supplied from starting circuit 43 through the wires 64, 66 to the master relay 67 for the oil valves 35. This relay establishes its own connection through the contact 68 and the wire 69 to the operating circuit 50 and at the same time closes all of the contacts 62a, b, etc. thereby completing the circuits for each of the solenoids that actuate the oil supply valves 35 for each burner.

Disconnecting starting circuit

When all of the burners are functioning properly the switch 40 is moved to disengage the contacts 41 while maintaining the contacts 42 engaged. This results in dropping all of the starting relays 44 and all circuits associated therewith except those which are controlled by the holding relays 57 and the master oil relay 67, both of which derive their current from the operating circuit 50 through their respective holding contacts.

Any one of the burners may be taken off the line while the others continue in operation by withdrawing the related interlock plug 71. This interrupts all of the circuits for the particular burner causing its air valve 24 to move into position to cause retraction of the fuel nozzle 37 whereupon the burner may be adjusted or dismounted for repair. When the burner is again ready for operation an individual manual switch 72 therefor is operated and the bridging of the contacts 73 and 74 thereof results in energizing

the control circuits 51 and 53 which when simultaneously starting all the burners are controlled by the relay contacts 47, 48. In other words each switch functions in place of the related relay 44 and its contacts 47, 48.

In résumé: master control switch 40 is first moved onto contacts 41 and 42 thereby connecting both the starting circuit 43 and operating circuit 50 to the power lead 38. Thereupon switches 47 close, transformers 18 become active and electric sparks occur at electrodes 9. Simultaneously gas valves 21 open, and the gas is ignited by the sparks, and switches 48 cause air valves 24 to open causing pistons 27 to move the fuel tubes 7 toward the furnace. When the fuel tubes 7 are fully advanced, limit switches 55 close and therewith switches 58, 60, 63. The operator may now push master button 65, closing master holding switches 62a, b, etc. therewith opening the fuel valves 35, and the fuel upon reaching nozzles 7 will be ignited by the gas flame. When the fuel from all burners is ignited, the main control switch 40 is moved so as to disconnect the starting circuit 43 from the main lead 38 and maintain connection to the operating circuit 50. Thereupon switches 47, 48 open and the ignition spark and the gas are shut off, while the remaining apparatus continues to function as before since it is all connected into the operating circuit 50.

If, during operation, one of the burners requires inspection, its interlocking plug 71 is withdrawn and disconnects the common return line 46 of the circuits to the related ignition transformer 18, the gas valve 21, the air valve 24, the holding switch 48 and thereby the fuel valve 35. The burner tube 7 withdraws from the furnace and may then be removed and inspected. Upon replacement of the burner tube 7, plug 71 is reinserted and a push button 72 located near the burner is closed which through contacts 73, 74 connects the source of current in a shunt around switches 47, 48 and thereby reinstates the power to the ignition transformer 18, the gas valve 21 and the air valve 24. When the advance of the fuel tube 7 is complete, its limit switch 55 again closes completing the circuit to holding relay 57. This relay closes its contacts 60, completing circuit 61 and solenoid 37 opens oil valve 35 since contacts 62a etc. are held closed by master oil relay 67. Push button switch 72 is held closed until ignition of the fuel is observed whereupon it is released and the previous status of operation again prevails. Push button switch 72 may be connected either to the operating circuit 50, or directly to the main source of current 38. The latter connection has the advantage that an individual burner may be operated for trial while the remaining burners remain idle. Electric indicating lights may be provided across the solenoids 22, 25 and 37 to indicate when these have been energized. To shut down, the main control switch 40 is disconnected from both circuits 43 and 50 and all the apparatus automatically return to their off or starting positions.

The invention may be used to ignite a pulverized fuel burner and the oil burner may be used as a torch for igniting the pulverized fuel.

What I claim is:

1. In a fuel burner system having a plurality of fuel burners each movable to and from operating position and individual means for moving said fuel burners to and from operating position; gas pilot burners mounted adjacent the operat-

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ing position of each fuel burner for lighting the fuel therefrom; electrical ignition means for lighting each gas pilot; valves and operating means therefor to supply gas and fuel respectively to said pilot and fuel burners; control means including a starting switch for simultaneously operating all said gas valves, for energizing all said ignition means and for moving all said fuel burners to their operating position; means also responsive to placement of said switch in starting position and then acting to partly condition said oil valves operating means for actuation; individual means responsive to the movement of each fuel burner to its operating position for completely rendering its fuel valve operating means operable; and means operable thereafter for simultaneously actuating the operating means for the fuel valves for said fuel burners.

2. In a fuel burner system having a plurality of fuel burners each movable to and from operating position and individual means for moving said fuel burners to and from operating position; gas pilot burners mounted adjacent the operating position of each fuel burner for lighting the fuel therefrom; electrical ignition means for lighting each gas pilot; valves and operating means therefor to supply gas and fuel respectively to said pilot and fuel burners; control means including a starting switch for simultaneously operating all said gas valves, for energizing all said ignition means and for moving all said fuel burners to their operating position; means also responsive to placement of said switch in starting position and then acting to partly condition said fuel valves operating means for actuation; individual means responsive to the movement of each fuel burner to its operating position for completely rendering its fuel valve operating means operable; means operable thereafter for simultaneously actuating the operating means for the fuel valves for said fuel burners; and means for discontinuing the operation of the gas pilots and the ignition means therefor of all of said burners while maintaining the burners and fuel supply valves thereof in operative position.

3. In a fuel burner system having a plurality of fuel burners each movable to and from operating position and individual means for moving said fuel burners to and from operating position; gas pilot burners mounted adjacent the operating position of each fuel burner for lighting the fuel therefrom; electrical ignition means for lighting each gas pilot; valves and operating means therefor to supply gas and fuel respectively to said pilot and fuel burners; control means including a starting switch for simultaneously operating all said gas valves, for energizing all said ignition means and for moving all said fuel burners to their operating position; means also responsive to placement of said switch in starting position and then acting to partly condition said fuel valves operating means for actuation; individual means responsive to the movement of each fuel burner to its operating position for completely rendering its fuel valve operating means operable; and means operable thereafter for simultaneously actuating the operating means for the fuel valves for said fuel burners; individual means for causing discontinuance of the supply of fuel to the respective burners and movement of the latter to inoperative position.

4. In a fuel burner system having a plurality of fuel burners each movable to and from operating position and individual means for moving said fuel burners to and from operating position;

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gas pilot burners mounted adjacent the operating position of each fuel burner for lighting the fuel therefrom; electrical ignition means for lighting each gas pilot; valves and operating means therefor to supply gas and fuel respectively to said pilot and fuel burners; control means including a starting switch for simultaneously operating all said gas valves, for energizing all said ignition means and for moving all said fuel burners to their operating position; means also responsive to placement of said switch in starting position and then acting to partly condition said fuel valves operating means for actuation; individual means responsive to the movement of each fuel burner to its operating position for completely rendering its fuel valve operating means operable; means operable thereafter for simultaneously actuating the operating means for the fuel valve for said fuel burners; individual means for causing discontinuance of the supply of fuel to the respective burners and movement of the latter to inoperative position; and individual means for subsequently rendering the individual gas pilot ignition means therefor, burner moving means and fuel supply valve for the individual burners effective to return the related burner to operation.

5. In a fuel burner system having a plurality of fuel burners each movable to and from operating position; individual gas pilot burners adjacent the operating position of each burners for lighting the fuel therefrom; electrical means for igniting each gas pilot; valves for controlling the supply of gas and fuel to said burners; individual means for causing the movement of said fuel burners to and from operating position; an electrical power circuit; electrical means for operating said gas and fuel valves; a starting circuit and an operating circuit associated with said power circuit; a relay for each burner in said starting circuit; circuits including contacts engageable by each relay for connecting to said operating circuit the operating means for its gas valve, the ignition means for the gas pilot therefor and for energizing said means for moving each fuel burner to its operating position; a holding relay for each burner; circuits including contacts engageable by each starting relay for partially connecting the related holding relay to said starting circuit; circuits including limit switches responsive to movement of the individual fuel burners to their operating positions for energizing the related holding relays by completing their connection to said operating circuit; circuits including contacts engageable by each holding relay for creating a holding circuit therefor and for said burner operating means in said operating circuit; circuits including contacts engageable by each holding relay to partially connect to said operating circuit the operating means for the related fuel valve; a master fuel valve relay having holding contacts for connecting it to said operating circuit; circuits including contacts controlled by each holding relay for partially connecting the operating means for the related fuel valve relay to said starting circuit; circuits including master control switch means for connecting said fuel valve relay to said starting circuit through the contacts controlled by any of said holding relays; circuits including individual contacts controlled by said oil valve relay for completing connection of the operating means for each of said fuel valves to said operating circuit; and circuits including a line switch movable to one position for simultaneously

connecting said starting and operating circuits to said power source and movable to another position to subsequently disconnect said starting circuit while maintaining said operating circuit energized thereby discontinuing the energization of starting relays, said ignition means and said gas valve operating means while maintaining energization of the power means for moving said fuel burners to operating positions and the fuel supply valves therefor.

6. In a fuel burner system having a plurality of fuel burners each movable to and from operating position; individual gas pilot burners adjacent the operating position of each burner for lighting the fuel therefrom; electrical means for igniting each gas pilot; valves for controlling the supply of gas and fuel to said burners; individual means for causing the movement of said fuel burners to and from operating position; an electrical power circuit; electrical means for operating said gas and fuel valves; a starting circuit and an operating circuit associated with said power circuit; a relay for each burner in said starting circuit; circuits including contacts engageable by each relay for connecting to said operating circuit the operating means for its gas valve, the ignition means for the gas pilot therefor and for energizing said means for moving each fuel burner to its operating position; a holding relay for each burner; circuits including contacts engageable by each starting relay for partially connecting the related holding relay to said starting circuit; circuits including limit switches responsive to movement of the individual fuel burners to their operating positions for energizing the related holding relay by completing their connection to said operating circuit; circuits including contacts engageable by each holding relay for creating a holding circuit therefor and for said burner operating means in said operating circuit; circuits including contacts engageable by each holding relay to partially connect to said operating circuit the operating means for the related fuel valve; a master fuel valve relay having holding contacts for connecting it to said operating circuit; circuits including contacts controlled by each holding relay for partially connecting the operating means for the related fuel valve relay to said starting circuit; circuits including master control switch means for connecting said fuel valve relay to said starting circuit through the contacts controlled by any of said holding relays; individual contacts controlled by said fuel valve relay for completing connection of the operating means for each of said fuel valves to said operating circuit; and circuits including a line switch movable to one position for simultaneously connecting said starting and operating circuits to said power source and movable to another position to subsequently disconnect said starting circuit while maintaining said operating circuit energized thereby discontinuing the energization of starting relays, said ignition means and said gas valve operating means while maintaining energization of the power means for moving said fuel burners to operating positions and the fuel supply valves therefor; and circuits including individual control switches in said operating circuit operable to disconnect all of the control circuits related to each burner from said operating circuit.

7. In a fuel burner system having a plurality of fuel burners each movable to and from operating position; individual gas pilot burners ad-

jacent the operating position of each burner for lighting the fuel therefrom; electrical means for igniting each gas pilot; valves for controlling the supply of gas and fuel to said burners; individual means for causing the movement of said fuel burners to and from operating position; an electrical power circuit; electrical means for operating said gas and fuel valves; a starting circuit and an operating circuit associated with said power circuit; a relay for each burner in said starting circuit; circuits including contacts engageable by each relay for connecting to said operating circuit the operating means for its gas valve, the ignition means for the gas pilot therefor and for energizing said means for moving each fuel burner to its operating position; a holding relay for each burner; circuits including contacts engageable by each starting relay for partially connecting the related holding relay to said starting circuit; limit switches responsive to movement of the individual fuel burners to their operating positions for energizing the related holding relay by completing their connection to said operating circuit; circuits including contacts engageable by each holding relay for creating a holding circuit therefor and for said burner operating means in said operating circuit; circuits including contacts engageable by each holding relay to partially connect to said operating circuit the operating means for the related fuel valve; a master fuel valve relay having holding contacts for connecting it to said operating circuit; circuits including contacts controlled by each holding relay for partially connecting the operating means for the related fuel valve relay to said starting circuit; master control switch means for connecting said fuel valve relay to said starting circuit through the contacts controlled by any of said holding relays; circuits including individual contacts controlled by said fuel valve relay for completing connection of the operating means for each of said fuel valves to said operating circuit; and circuits including a line switch movable to one position for simultaneously connecting said starting and operating circuits to said power source and movable to another position to subsequently disconnect said starting circuit while maintaining said operating circuit energized thereby discontinuing the energization of starting relays, said ignition means and said gas valve operating means while maintaining energization of the power means for moving said fuel burners to operating positions and the fuel supply valves therefor; individual control switches in said operating circuit operable to disconnect all of the control circuits related to each burner from said operating circuit; and circuits including individual shunt switches for connecting the control circuits for the related fuel burners to said power source to re-energize the ignition means, the operating means for the burner moving means and the gas and fuel valves associated with each burner without re-connecting said starting circuit to the power line.

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