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CONTROL UNIT FOR MAIN GAS BURNERS AND PILOT BURNERS

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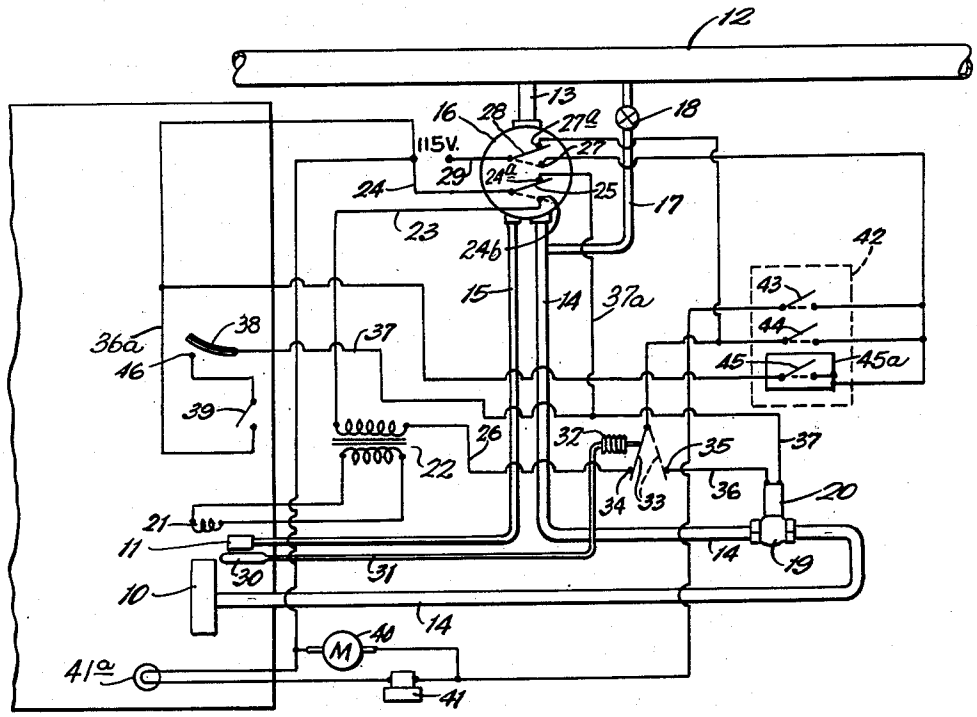

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CONTROL UNIT FOR MAIN GAS BURNERS AND PILOT BURNERS

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This invention relates to an electric control unit for a main gas burner and pilot burner. The gas burners may be employed in driers, heaters, and in a great varity of apparatus in which heat is required for different purposes.

This application constitutes a continuation-in-part of our copending application Serial No. 116,332, filed September 17, 1949.

An object of the invention is to provide an electric control and ignition unit for gas burners and, more particularly, for a gas burner and a pilot burner used in connection therewith. Another object is to provide an electric control and ignition unit for gas burners with means provided for closing the gas supply line to the main burner until the gas pressure has reached a predetermined pressure. Yet another object is to provide a control for the gas supply line to the main burner with means for preventing the flow of gas through the line until the gas pressure in the main manifold is at least about one-half of full pressure or above a definite predetermined pressure. A still further object is to provide electric control apparatus for a gas burner and its pilot valve, the apparatus having a minimum of moving parts while at the same time requiring the pilot burner to supply a predetermined amount of heat before a solenoid control valve in the line leading to the main burner is opened. Yet another object is to provide a control system for gas burners in which there is greater safety against the bleeding or escape of gas without ignition thereof and in which there is substantially no adjustment required after the system is installed. A further object is to provide in apparatus as described equipped with a mercury bulb or other control, a by-pass and means for controlling the by-pass so that while the mercury bulb is cooling, and if the main valve is again reopened while the mercury bulb is cooling, there will be no raw gas bleeding from the main burner.

The control apparatus provides a full safety function with substantially less equipment than heretofore required. Other specific objects and advantages will appear as the specification proceeds.

The invention is shown in an illustrative embodiment by the accompanying drawing, which is a schematic drawing illustrating an embodiment of the invention.

In the embodiment illustrated in the drawing, apparatus is diagrammatically shown for the controlled heating of a clothes drier or other like apparatus. The main burner is indicated by the

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numeral 10 and a pilot burner is indicated by the numeral 11. The gas is supplied from a manifold or main 12 from which there leads a smaller manifold 13. From the smaller manifold 13 there is a gas supply line 14 leading to the main burner 10 and a smaller gas supply line 15 leading to the pilot burner 11. A valve in the manifold 13 is controlled by the valve knob or regulator 16 which is equipped with a stem leading to the valve (not shown) in the manifold 13.

A by-pass line 17 is equipped with a valve 18 and preferably the valve is opened to a predetermined extent so as to supply just enough gas to the burner 10 as to keep it burning. Thus, if the main valve is closed and the solenoid valve is kept open while the mercury bulb is cooling, the burner 10 is kept alight and should the main valve be turned on again, the gas thus fed will be burned.

The electric control unit preferably consists of a solenoid, a circuit thereof having a normally open switch, a diaphragm device for controlling the switch and operated by a pressure fluid in a bulb located adjacent the pilot burner and being only operable by the heat from this burner, and an ignition coil for the pilot burner and circuits controlled by a switch or switches operated by the opening and closing of the main valve control 16. We also prefer to equip the circuit with a thermostat for maintaining the heat below a predetermined limit or limits, and other safety switches which insure the closing of doors of the drier, etc. Blowers for the movement of air through the drier may also be provided and the motor therefor will lie within one of the circuits described.

In the illustration given, we provide an ignition or glow coil 21 adjacent the pilot burner 11. A transformer 22 is preferably employed for lowering the voltage needed for the glow coil. The transformer, however, may be omitted if the necessary voltage may be supplied by other means. A lead 23 to the transformer is connected to the contact 24^b adapted to be connected with the line 24 by the switch 25 upon the rotation of the valve handle 16. Another lead 26 from the transformer is connected through various lines to a contact 27 adapted to be connected by switch 28 to an incoming line 29. Opposite contact 24^b is the contact 24^a; and opposite contact 27 is the contact 27^a. In the structure shown, the switches 25 and 28 are shown in open position, but when the valve handle 16 is rotated to open the valve the switches are moved to the contacts 24^b and 27 illus-

trated so as to close the circuit of the transformer 22 and thus cause the coil 21 to glow. This ignites the gas flowing from the pilot burner 11.

Adjacent to the pilot burner 11 is a bulb 30 which preferably contains an expansion fluid, such as mercury, and a conduit 31 leads from the bulb to a diaphragm or bellows 32. The bellows 32 normally draws the switch 33 to the position shown in full lines in Fig. 1 and against the contact 34. It will be understood that the natural resiliency of the bellows or springs therein causes the switch 33 to be drawn to the position shown when there is little or no pressure within the bellows. When the heat from the pilot burner exceeds a certain temperature due to a predetermined pressure within the manifold 13, the pressure created by the expansion of the mercury vapor causes the bellows (which is referred to herein as a diaphragm) to move to the right to bring the switch 33 into engagement with the contact 35. This closes the circuit in which the solenoid 20 lies and causes the valve 19 to open so that the gas will now flow through the main line 14 to the gas burner 10.

The circuit of the solenoid 20 includes a lead 36 from the contact 35 to the solenoid and also a lead 37 connected to the contact 24^a of the switch 25 through a branch lead 37^a.

We prefer to interpose in the lead 37 a thermostat 38 which is normally closed but which opens when the temperature within the drier or other device exceeds a predetermined limit. It will be understood that the thermostat, which is illustrated diagrammatically as a bimetallic element, may be any type of thermostat and preferably is of the type which may be adjusted for different temperatures.

If desired, the lead 37 may also be provided with a switch 39 connected to the door of the drier and which will be closed when the drier door is closed.

If a blower is used in the drier, the motor 40 therefor may be connected in the circuit as illustrated, and the ballast 41 may also be as shown in the circuit to limit variations in current in the circuit. An indicator light 41^a may be included in series with the ballast to indicate energization of the motor.

If desired, a timer may be provided for breaking the circuit at a predetermined time so as to close off the burners, motors, etc. and the breaking of the various circuits may be after any desired timing intervals. In the illustration given, we have shown diagrammatically a timer 42 which may be actuated by clockwork or by electrically-operated means for closing the switches 43, 44 and 45. In the illustration the timer 42 is of the usual construction and includes a timer motor 45^a in series with the switch 45. Closing of the switch 45 completes the timer motor circuit and the timer then operates in the customary manner to interrupt the operation of the apparatus after a predetermined time interval. Since timers of this type are well known in the art, a further description is believed unnecessary. Since such timing structures are well-known and the operation thereof well understood, it is believed unnecessary to show further details.

Operation

In the operation of the drier illustrated, valve 16 is opened, thereby bringing switch 25 into engagement with contact 24^b and switch 28 into engagement with contact 27. The transformer 22 is thus energized and thereby the glow coil 21 is also energized. Gas flows to the pilot burner 11 and is ignited by glow coil 21. The flames from the pilot burner heat the mercury bulb 30, thereby causing expansion of the mercury contained within the bulb and bringing switch 33 into engagement with contact 35. The solenoid 20 is thus energized so as to open the valve 19. Gas may then flow through the pipe 14 beyond valve 19 to the burner 10. The gas flowing from the burner 10 is ignited by the pilot burner 11.

The by-pass line 17 supplies gas from manifold 12 to line 14 and, as previously pointed out, the valve 16 is so adjusted that a small amount of gas is always allowed to flow through it to the line 14. This amount of gas is sufficient to keep the burner 10 lighted but not enough to furnish heat in any substantial amount. The mercury bulb 30 cools under this operation and eventually the switch 33 is brought back into engagement with contact 34.

Assuming that the clothes drier has not reached its maximum temperature and the thermostat 38 is still in the closed position, and the timer is still in the closed position, and that the main burner is still in full operation, if at this point the housewife should turn off the main switch 16, switch 28 will be brought into engagement with contact 27^a and switch 25 will be brought into engagement with contact 24^a. The mercury bulb, being still in a hot condition, will keep switch 33 in engagement with contact 35, thereby energizing solenoid 20 and thus maintaining the valve open. The flow of gas to lines 14 and to the line of the pilot burner will be shut off when valve 16 is closed but a small amount of gas will continue to flow from manifold 12 through valve 18, line 17, line 14, through solenoid valve 19, and to the main burner 10. Thus this small amount of gas will keep the main burner 10 ignited but, by reason of the absence of heat from the pilot burner, the mercury bulb will cool, eventually bringing switch 33 into engagement with contact 34 and causing the solenoid valve 19 to close. This will shut off the gas to the main burner 10 and return the entire control system to its initial condition.

Should the housewife desire to turn the drier on prior to the cooling of the mercury bulb 30, the gas flowing from manifold 12 through lines 13 and 14 and reaching the main burner will burn there at the full rate. At this time gas will also flow through the valve 16 to pilot line 15 and to the pilot burner 11. The pilot burner 11 will reignite from the main burner 10. The system will then continue to operate as such until either the thermostat 38 has reached its set limit or the timer breaks the circuit.

Under another condition, if the housewife after loading the unit with clothes and allowing it to operate for its maximum period of time, returns later to find the unit shut off and the clothes dry, and for some reason desires to dry an additional load, she need only insert the load and reset the timer. The system will take over automatically to provide full safety from this intermediate starting point. An important feature of the system thus described permits the burning of gas at a greatly reduced bypass rate while the mercury bulb is cooling and before the system cycles to its original position. If at any time the main valve is turned on while the mercury bulb is cooling, there will be no raw gas bleeding from the main burner since any gas to the main burner is ignited by the flame always retained on the main

burner except when the system is in that portion of the cycle to automatically operate through the complete cycle.

Instead of the manual operation described, the timer 42 is effective after the time is set, which is generally a manual operation and also closes switches 43, 44 and 45, for opening the switches 43, 44 and 45 and terminating the operation.

All of the results set out before are to a great extent achieved by the control operation of the solenoid 20 by means of the solenoid circuit arrangement. When the valve 16 is opened and the timer 42 set, the switch 28 engages contact 27 and connects one side of the power input through timer switch 44 to the switch 33. After the switch 33 is forced against contact 35 by the expansion bellows 32, as previously described, the solenoid circuit is completed through lead 36, solenoid 20, lead 37, switches 38 (which is normally closed) and 39, and lead 36a, to the other side of the power input. When the temperature exceeds the setting of the thermostatic switch 38 it opens (as shown), breaking the circuit and deenergizing the solenoid. The pilot burner, however, continues to be ignited. The same condition exists when the time for which the timer is set elapses and switches 43, 44 and 45 open. The circuit is broken and the solenoid is deenergized. Again the pilot burner continues to be ignited. When the valve 16 is closed the timer and thermostatic element are bypassed and the solenoid circuit is completed through switch 25, contact 24a, leads 37a and 37, the solenoid 20, lead 36, contact 35, switch 33, and back to the opposite side of the input through the contact 27a and switch 28. The main burner is still ignited, being supplied with fuel through bypass 17, etc., and until the member 30 cools and the bellows 32 withdraw the switch 33 from the contact 35.

It will be understood that the drier apparatus described may be modified in many ways and many electrically-operated devices may be placed within the circuit. For example, a germicidal lamp may be provided and an electric humidity thermostat may be provided if desired. Such devices may be added without modifying the operation of the system above described.

In the foregoing structure the valve control 16 may be arranged for controlling only the flow of gas to the pilot burner, the gas line to the main burner remaining always open except for the solenoid-controlled valve. We prefer, however, to employ the valve for controlling the flow of gas both to the main burner and to the pilot burner conduits.

The structure shown sets out fully an illustrative system and may be modified widely to meet the requirements for different heating, drying, or conditioning devices. The control unit, while shown in expanded form in the illustrations given, is actually a highly compact structure and is readily installed in a conventional drier or heating device and when installed requires only two conventional and simple gas rate adjustments. The moving parts are reduced to a minimum while the structure at the same time provides the utmost in safety control. Unless the pressure in the gas line is above a predetermined point and unless a suitable source of ignition is available, the solenoid valve in the main gas line will not open and gas thus cannot escape or leak.

While in the foregoing specification we have set forth wiring layouts and structure in detail for the purpose of illustrating embodiments of the invention, it will be understood that such details of layout and arrangement may be varied widely by those skilled in the art without departing from the spirit of our invention.

We claim:

1. A control unit adapted to be used with a main gas burner and a pilot gas burner and equipped with a valve controlling the flow of gas to the pilot burner and to the main burner and having a second valve interposed between the first-mentioned valve and the main burner for controlling the flow of gas thereto, comprising a normally open bypass around said first-mentioned valve, an ignition coil adapted to be supported adjacent the pilot burner, a circuit therefore, a solenoid for opening and closing said second valve, a separate circuit for said solenoid, a single pole double throw switch controlling the current flow in both of said circuits, said switch being closed in one of said circuits when open in the other of said circuits, heat-responsive means controlling said switch and including a heat-responsive element adjacent said pilot burner, said means operating to close said ignition coil circuit when said element is below a predetermined temperature and to close said solenoid circuit when above said predetermined temperature, and switch means adapted to be actuated by the operation of said first-mentioned valve to complete the ignition coil circuit when the valve is opened and to complete the solenoid circuit when the valve is closed.

2. The combination of claim 1 in which there is also provided a thermostatically controlled switch in said solenoid circuit for opening said circuit when the temperature to which the thermostat is exposed exceeds a certain point.

3. A control unit adapted to be used with a main gas burner and a pilot gas burner and equipped with a first valve controlling the flow of gas to the burners and a second valve controlling the flow of gas to the main burner, said first valve being equipped with a normally open bypass therearound, comprising an ignition coil adapted to be supported adjacent the pilot burner, a circuit therefore, a solenoid for opening and closing said second valve, a separate circuit for said solenoid, a single pole double throw switch controlling the current flow in both of said circuits, said switch being closed in one of said circuits when open in the other of said circuits, heat-responsive means controlling said switch and including a heat-responsive element adjacent said pilot burner, said means operating to close said ignition coil circuit when said element is below a predetermined temperature and to close said solenoid circuit when above said predetermined temperature, and a double pole double throw switch adapted to be actuated by the operation of said first-mentioned valve to complete the ignition coil circuit when the valve is opened and to complete the solenoid circuit when the valve is closed.

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