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CONTROL SYSTEM FOR OVENS

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Fig. 1

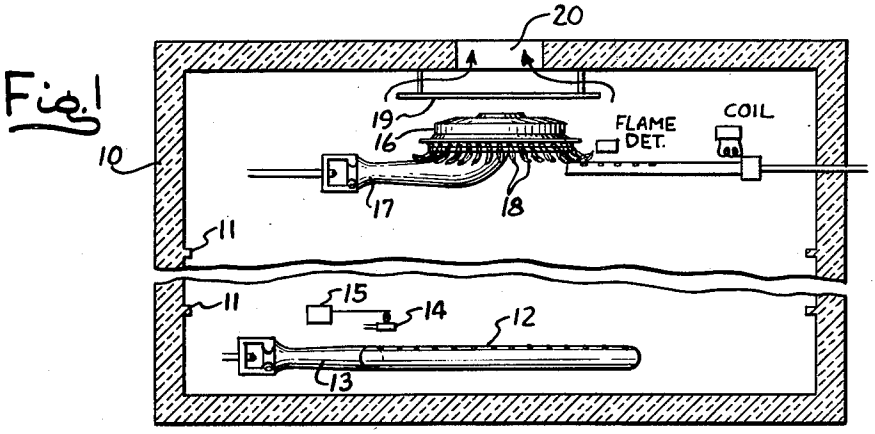
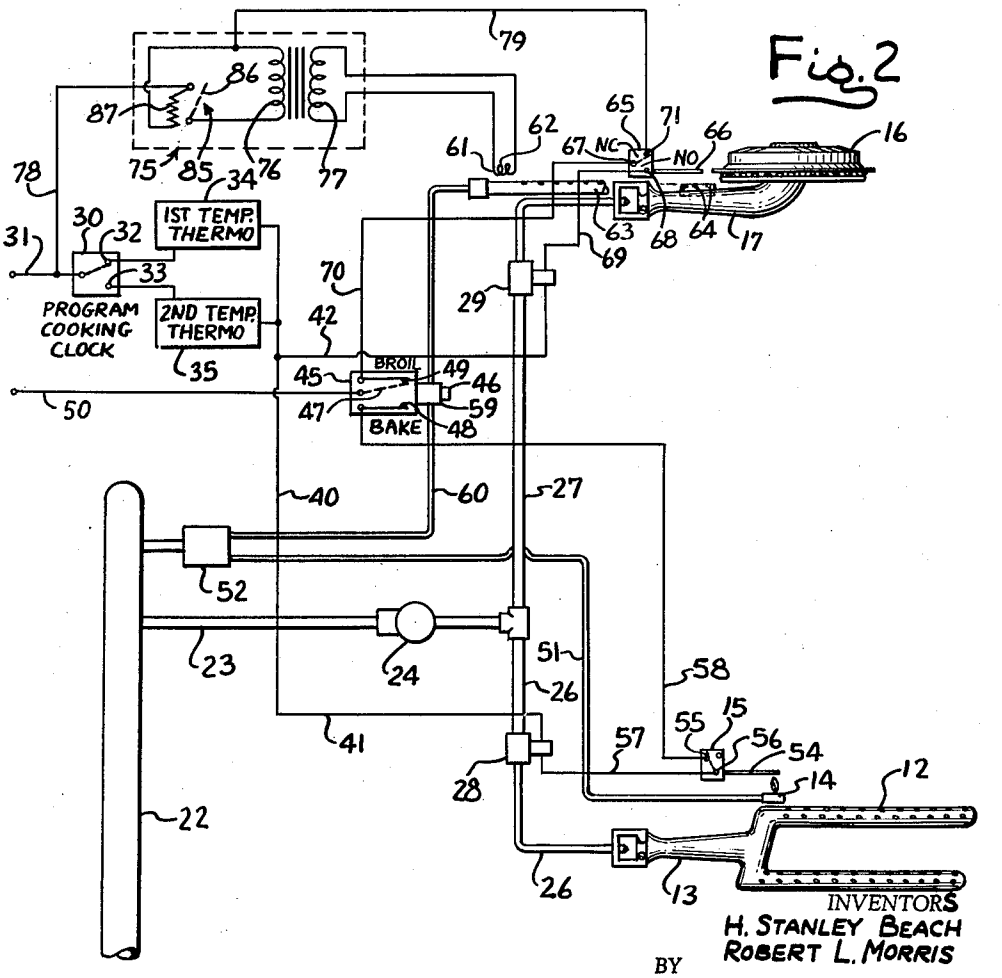


Fig. 2



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CONTROL SYSTEM FOR OVENS

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This invention relates generally to ovens and is more particularly concerned with a control system for igniting the broiler burner in a single cavity gas oven.

Customarily, for normal baking in a gas oven it is desirable to have the burner at the bottom of the oven chamber or cavity in order to achieve even distribution of heat by the circulating convection currents. Where it is desirable to use the same oven cavity for broiling purposes it is necessary to have a separate burner at the top of the cavity. In the past, where this has been done, it has been necessary to control the broiler manually and to light it with a match. This is due to the fact that the products of combustion of the lower oven burner will ordinarily extinguish the pilot flame in the upper portion of the broiler, and thus allow pilot gas to accumulate in the oven cavity and create an unsafe condition.

Accordingly, the primary aim of the present invention is to provide a control system for a single cavity gas oven which will automatically light a pilot for igniting the flame on a broiler burner in the top of the cavity when operation of the broiler is selected. It is a more particular object to provide such a control system which precludes the flow of gas to the broiler burner until after a flame has been established adjacent the broiler burner to insure that no gas accumulates in the cavity before the burner lights.

It is another object to provide a control system for a single cavity oven in which the supply of gas to the broiler pilot flame is turned off automatically when the oven burner is selected. It is a related object to provide such a system in which only a single control is required to select either oven or broiler operation and to establish or extinguish the broiler pilot flame according to whether or not the broiler burner is selected.

Another object is to provide a control system of the above type which is safe and dependable in operation and which will automatically turn off the pilot igniter if, after a predetermined period, no flame has been established adjacent the broiler burner. A further object is to provide a broiler pilot which includes a runner tube so that the pilot igniter may be located away from the intense heat of the broiler burner.

It is also an object to provide a control system as characterized above which is inexpensive to manufacture and which is easy to maintain and service after it has been installed within the oven chamber. Other objects and advantages of the invention will become apparent upon reading the following detailed description and upon reference to the drawings in which:

FIGURE 1 is a diagram showing an oven cavity in cross section including a broiler and control arrangement constructed in accordance with the present invention;

FIG. 2 is a schematic diagram of a gas distribution system and electrical control circuit of the present invention.

While the invention will be described in connection with a preferred embodiment, it will be understood that we do not intend to limit the invention to that embodiment; on the contrary, we intend to cover all alternatives, modifications and equivalents as may be included within the spirit and scope of the invention as defined by the appended claims.

Turning now to the drawings, FIGURE 1 diagrammatically illustrates an oven cavity to which the present invention has been applied. The insulated housing indicated

at 10 is provided with the usual shelf supports 11 for mounting shelves (not shown). For ordinary baking a regular oven burner 12 occupies a position at the bottom of the cavity with gas-air mix being supplied through a tube 13. The oven burner is ignited by a standing pilot 14 which controls a flame switch 15.

At the top of the oven cavity a broiler burner 16 is provided which receives gas-air mix through a tube 17. This burner may, for example, be of the type covered in the co-pending application Ser. No. 214,655, filed August 3, 1962, now abandoned, to which reference is made. This type of burner is distinguished by a downwardly angled pattern of flames 18 well suited for broiling purposes. Arranged directly above the burner 16 is a draft plate 19, with the products of combustion being vented through a vent 20.

To supply gas to the burners 12 and 16, the oven is provided with a gas manifold 22. A main gas supply line 23 having a shut-off valve 24 feeds an over burner supply line 26 and a broiler burner supply line 27 which are respectively connected to the burner tubes 13, 17. For controlling the passage of gas to the burners, the supply lines 26, 27 are respectively provided with solenoid-operated valves 28 and 29.

For regulating the operation of the solenoid valves 28, 29 and thus to control the gas supplied to either of the burners 12, 16 and the operating temperature in the oven, an electrical control circuit is provided. A program cooking clock 30 is connected to a "hot" wire 31 of an electrical outlet (not shown). The cooking clock 30 includes the usual timing motor and control knobs and is also provided with two output terminals 32 and 33 connected respectively to a high temperature thermostat 34 and a low temperature thermostat 35 which are connected to a control lead 40. The control lead 40 has branch lines 41 and 42 connected respectively to the two solenoid valves 28, 29.

Selection of either the oven burner 12 or the broiler burner 16 is made by a selector switch 45 which includes an operating knob 46 preferably located on the control panel of the oven. The switch 45 has a switch blade 47 connected to the common terminal 50 of an electrical outlet. Fixed contacts 48 and 49 are connected to the bake solenoid and broiler solenoid so that one of these two solenoids may be selected for operation.

In order to light the oven burner 12, the pilot burner 14 has a continuous or standing flame provided fuel by a pilot supply line 51 connected to the manifold 22 through a filter 52. It will be understood that when gas is admitted to the oven burner 12, the flame from the oven pilot 14 will ignite the burner. To insure that no gas escapes from the oven burner 12 when there is no flame on the pilot 14, the oven flame switch 15 has a sensing element 54 disposed to detect the presence of a flame on the oven pilot. The flame switch 15 has normally open contacts 55 and 56 which close when the sensing element 54 detects a flame, the contacts thereby completing a circuit through wires 57 and 58 forming part of the circuit for actuating the oven solenoid 28. Therefore, if there is not pilot flame, the oven burner 12 will not operate and gas from the oven burner will not accumulate in the oven.

In accordance with the present invention, a control system is provided for automatically supplying gas to, and igniting, a broiler pilot associated with the broiler burner located at the top of the oven cavity when "broiler" operation is selected at the selector switch and for turning off the flow of gas to the pilot when "baking" operation is selected. Accordingly, a broiler pilot control valve 59 is placed in a supply line 60 for selectively communicating gas from the manifold 22 through the filter 52 to a broiler pilot 61. In the preferred embodiment, the

valve 59 is coupled to the same operated knob 46 which controls the selector switch 45 so that gas is delivered to the broiler pilot only when the switch 45 is turned to "broil" to energize the broiler solenoid valve 29. Moreover, an electrical igniter or "glow-coil" 62 is arranged to be energized by the selector switch 45 to ignite the broiler pilot 61 which is coupled to a runner tube 63 disposed adjacent the broiler burner 16. The runner tube 63 has a plurality of gas ports 64 along which the flame from the pilot burner 61 is successively propagated to carry the flame to the broiler burner 16.

It will be appreciated that the broiler pilot 61 does not have a continuous flame such as the standing flame of the oven pilot 14 because the flame on the broiler pilot located in the top of the oven cavity would be extinguished by the products of combustion each time the oven burner 12 is operated. Therefore, the broiler pilot 61 is supplied with gas and ignited each time the broiler burner 16 is used and shut off when the oven burner 12 is selected so that gas escaping from the pilot does not accumulate in the oven and cause an unsafe condition.

Pursuant to another feature of the invention, a broiler flame switch 65 having a sensing element 66 is disposed to detect a flame at the end of the runner tube 63 adjacent the broiler burner 16 so that no gas is admitted to the broiler burner until its ignition is insured. The broiler flame switch 65, similar to the oven flame switch 15, includes normally open contacts 67 and 68 which close when the sensing element 66 detects a flame. The contacts 67, 68 complete a circuit through wires 69 and 70 for energizing the broiler solenoid valve 29. In addition, the broiler flame switch 65 is provided with a contact 71 normally closed with contact 67 for energizing the igniting coil 62.

For energizing the igniting coil 62, a transformer 75 having a primary winding 76 and a secondary winding 77 is coupled with the primary in series to the "hot" input line 31 of the oven and the flame switch contact 71 by wires 78 and 79, respectively. The transformer secondary 77 is connected directly to the igniting coil 62. Since the flame switch contacts 67, 71 are normally closed when there is no flame on the runner tube 63, turning the selector knob 46 to "broil" completes a circuit through the transformer primary 76 and energizes the secondary circuit to the igniting coil 62. As mentioned above, movement of the knob 46 to "broil" also opens the broiler pilot supply valve 59 to allow gas to flow to the broiler pilot 61 where the pilot gas is ignited by the coil 62.

In the preferred embodiment, the elongated runner tube 63 which carries the flame from the broiler pilot 61 to the burner 16 allows the igniting coil 62 to be positioned away from the intense heat of the broiler flame 18. In addition, the sensing element 66 is positioned so that it does not actuate the broiler flame switch 65 until the pilot flame has been propagated at the end of the runner tube 63 adjacent the broiler burner 16 where ignition of the broiler flame is insured. Thus, if for some reason no flame is established at the end of the runner tube 63, the contacts 67, 68 will not close to energize the broiler solenoid valve 29 and gas will not reach the broiler burner 16 to create an unsafe condition.

To prevent the igniting coil 62 from burning out, if the pilot 61 does not light or if the flame switch 65 does not detect a flame on the runner tube 63, a safety shut-off switch 85 is connected in series with the transformer primary winding 76. In the preferred embodiment, the safety switch 85 is an integral warp switch having a bi-metal switch blade 86 adjacent a heating element 87 contained within the transformer 75. The heating element 87 is preferably timed so that it warps the switch blade 86 to open the transformer primary circuit a predetermined interval after the igniting coil 62 is energized. In the present case the safety switch is timed for a three-minute interval. Thus, if the transformer 75 remains energized by the flame switch 65, the safety switch 85 will automatically de-energize the igniting coil 62 three minutes after it has been energized and accordingly will greatly prolong the life of the igniting coil.

Operation of the oven control system may now be described as follows. If the oven is to be used for baking, the control knob 46 is turned to "bake" closing switch blade 47 against contact 48 which energizes the oven solenoid valve 28 provided that there is a flame in the oven pilot 14. Gas now flows to the oven burner 12 where it is ignited by the pilot flame. At this time, the flow of gas through the solenoid valve is regulated by the program cooking clock 30 and the first and second temperature thermostats 34, 35 until the solenoid valve 28 is automatically or manually shut off at the end of the baking period. During the baking period it will be obvious that the heat provided by the pilot 14 and the burner 12 on the sensing element 54 will keep the flame switch contacts 55, 56 closed. It will also be apparent that if there is no pilot flame when the control knob 46 is turned to "bake" the contacts 55, 56 will be open and the solenoid valve 28 will not be energized.

When it is desired to use the oven for broiling, the control knob 46 is turned to "broil" which energizes the transformer primary 76 in a circuit including the selector switch blade 47, contact 49 and normally closed contacts 67, 71 of the broiler flame switch 65. At the same time, the broiler pilot supply valve 59 is opened to admit gas to the broiler pilot 61 where it is ignited by the igniting coil 62 energized by the transformer secondary 77. A portion of gas flowing to the pilot 61 passes through the runner tube 63 and the pilot flame "runs" along the openings 64 toward the broiler burner 16. When a flame is detected at the end of the runner tube 63 by the sensing element 66, contacts 67, 71 are opened to de-energize the transformer 75 and igniting coil 62, and contacts 67, 68 are closed to energize the solenoid 29. Gas is now admitted to the broiler burner 16 and ignited by the flame at the end of the runner tube 63 and the solenoid valve 29 is controlled by the clock 30 and thermostats 34, 35.

One or more broiling sequences may be initiated in succession, since even if the pilot flame goes out, it will be re-ignited as soon as the sensing element detects no flame on the runner tube 63 or broiler burner 16. However, when the control knob 46 is turned away from the "broil" position both the solenoid valve 29 and the pilot control valve 59 are closed thereby insuring that no gas escapes into the top of the oven cavity.

As a built-in safety feature, if the pilot flame does not reach the end of the runner tube 63, contacts 67, 71 will not open and contacts 67, 68 will not close. Thus, the solenoid valve 29 will not open, and after a pre-determined interval the warp switch 85 will open due to the heating of the element 87 and the blade 86 and break the circuit to the transformer primary 76 thereby de-energizing the transformer secondary 77 and igniting coil 62. After the cause of the failure of a flame to reach the end of the runner tube 63 has been determined, the warp switch 85 may be manually re-set and operation resumed.

It will now be appreciated that the present invention provides a control system for automatically igniting both an oven burner 12 and a broiler burner 16 in a single cavity gas oven. Not only does this reduce the size and cost of conventional stove-oven combinations, but it also greatly facilitates the use of single cavity gas ovens in built-in installations. In addition, the control system is safe and dependable and, in the event that some difficulty should raise, it may be easily serviced.

We claim as our invention:

1. In a single cavity gas oven, the combination comprising, a gas manifold, an oven burner located at the bottom of the cavity and a broiler burner located at the top of the cavity, means including first and second solenoid valves for regulating the supply of gas from the

manifold to the respective burners, a pilot supply line coupled to said manifold, a broiler pilot communicating with said supply line, said broiler pilot located adjacent said broiler burner and having an electrical igniting means therefor, first circuit means for said igniting means, selector means having a plurality of operative positions for independently energizing said solenoid valves, other circuit means coupling the selector means in separate series circuits with the respective solenoid valves, said selector means being so constructed and arranged that when it is in one position the first solenoid valve for said oven burner is activated and so that when it is in another position said circuit means for said igniting means is activated, a pilot gas valve interposed in said pilot supply line between the manifold and the broiler pilot and coupled to the selector means for operation therewith so that the flow of gas to said broiler pilot is precluded when said selector is in said one position and so that the flow of gas to said broiler pilot is permitted when said selector is in said other position.

2. The combination defined in claim 1 including switching means interposed between said first circuit means and said other circuit means for said second solenoid valve for said broiler burner, said switching means operable upon actuation thereof for energizing said second solenoid valve and for deenergizing said igniting means after a flame is established on said broiler pilot.

3. The combination defined in claim 2 including means including a standing pilot burner coupled to said manifold for igniting said oven burner when said selector means is in said one position, said pilot gas valve for said broiler pilot being turned off when said selector means is in said one position to thereby prevent the extinction of said broiler pilot by the products of combustion of said oven burner incident to operation of said oven burner.

4. The combination defined in claim 1 including thermostat means connected in series with said oven and broil solenoids for selectively modulating the flow of gas therethrough in accordance with the temperature in said cavity and the temperature selected at said thermostat.

5. The combination defined in claim 1 including a transformer, said igniting means coupled in series with the secondary of said transformer, a limit switch connected in series with the primary of said transformer, said limit switch being timed to open a pre-determined interval after said igniting means is energized.

6. In a single cavity oven, the combination comprising, a gas manifold, an oven burner located at the bottom of the cavity and a broiler burner located at the top of the cavity, means including oven and broiler solenoid valves for regulating the supply of gas from the manifold to the respective burners, a pilot supply line coupled to said manifold, a broiler pilot communicating with said supply line, said broiler pilot located adjacent said broiler burner and having an electrical igniting means therefor, first circuit means for said igniting means, selector means for independently activating the oven solenoid and broiler solenoid and having "bake" and "broil" positions, other circuit means coupling the selector means in separate series circuits with the respective solenoid valves, said selector means being so constructed and arranged that when it is in the "bake" position the oven solenoid is activated and so that when it is in the "broil" position, the circuit means for said igniting means is activated, a flame detector switch associated with said pilot and operable to shift between first and second positions upon being heated by a flame on the pilot, a pilot gas valve in said pilot supply line and coupled to the selector means for operation therewith to allow the flow of gas from the manifold to the pilot when said selector means is in the "broil" position, said flame detector switch closing said circuit for said igniting means when in said first position, and closing said other circuit means for said broil solenoid when in said second position so that when the selector means is turned to the "broil" position gas is supplied to the pilot and the igniter is turned on and so that upon subsequent heating of the flame detector switch by a flame on the pilot the igniter means is turned off and the broil solenoid is turned on for regulating the supply of gas to the broiler burner.

7. The combination defined in claim 6 including a runner tube for said broiler pilot, said runner tube having one end thereof adjacent said broiler burner and the other end thereof remote therefrom, said pilot supply line communicating with said other end of said runner tube, said flame detector switch being located adjacent said one end of said runner tube, and said igniting means being located adjacent said other end of said runner tube remote from said broiler burner and away from the intense heat generated by said broiler burner incident to operation thereof.

References Cited by the Examiner

UNITED STATES PATENTS

2,079,504	5/37	Hobson	236—15
2,395,666	2/46	Kaufmann	158—126
2,823,741	2/58	Thornbery	158—131 X
2,983,314	5/61	Geldhof et al.	158—125
3,033,463	5/62	Doner et al.	236—1

FOREIGN PATENTS

792,930	4/58	Great Britain.

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